An Alternative to Gravitational Waves

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ABSTRACT

In earlier papers by the author [1],[2],[3], an alternate, locally conserved theory of gravitation has been proposed, exploring the possibility that gravitation is a gradient in c, and that that gravitational radiation would be electromagnetic. Since it is an experimental fact that binary pulsars do radiate, a plausible explanation as to how electromagnetic radiation must be possible. It is proposed here that electromagnetic radiation as illustrated in the Larmor radiation and gravitational radiation are actually of the same origin and are a general property of accelerated mass. This paper asserts a proposition that electromagnetic radiation is a more general property of mass dynamics.

Introduction

General Relativity predicts the emission of gravitational waves form objects undergoing gravitational acceleration, and in 1974 Russell Hulse and Joseph Taylor, discovered a binary star system losing energy exactly as predicted, and received the Nobel Prize for their work [4], [5].

Measurements of the cosmic background data from the Planck satellite, the BICEP2, and Keck Array experiments experiment, however have shown no evidence of the distortion of the electromagnetic radiation by way of gravitational waves [6], and a team based at Australia's Curtin University measuring pulsar timing via the Parkes radio telescope, found no distortions indicative of gravitational wave influence [7]. Both these results would be consistent with Gravitational radiation being electromagnetic and not having effect on the transmission of other electromagnetic waves.

Dicke in 1957 [8], as well as others have speculated on the possibility that gravitation has an electromagnetic origin, leading to the result that gravitational radiation could be electromagnetic. Dicke’s theories have generally been discredited, and fallen as a result of the developments in GR.

Mechanism for Electromagnetic Gravitational Waves

For a particle in circular motion around a central force there is a continuous change in the direction of acceleration, and thus an acceleration of acceleration, or jerk. Subjecting a charged particle with radiation properties described by the Larmor formula to acceleration provided by a central force as noted by Feynman [9], shows a reaction force proportional to this jerk in the opposite direction to the velocity.

The Larmor radiation dipole radiation for each of a pair of rotating charges is:

$$P_E = \frac{2}{3}\frac{q^2}{c^3}\dot{v}^2 \qquad (1)$$

In addition to the dipole radiation for rotating opposite charges, there is a quadrupole radiation with a power ratio between the two modes of v^2 / c^2, [10]. The quadrupole contribution is then:

$$P_E = \frac{2}{3}\frac{q^2}{c^3}\dot{v}^2\left(\frac{v^2}{c^2}\right) \qquad (2)$$

This can be added to the Larmor power for the total radiation of a rotating pair of charges.

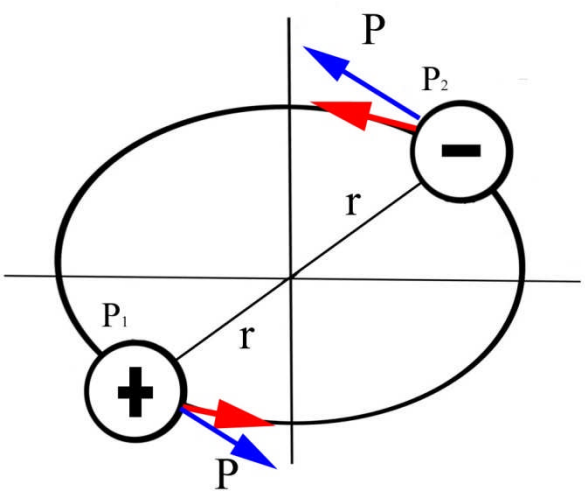
Gravitation mass does not have a negative equivalent, thus there is no dipolar radiation, and the value of the power radiated from the linearized GR equation which only has quadrupole components is [11]:

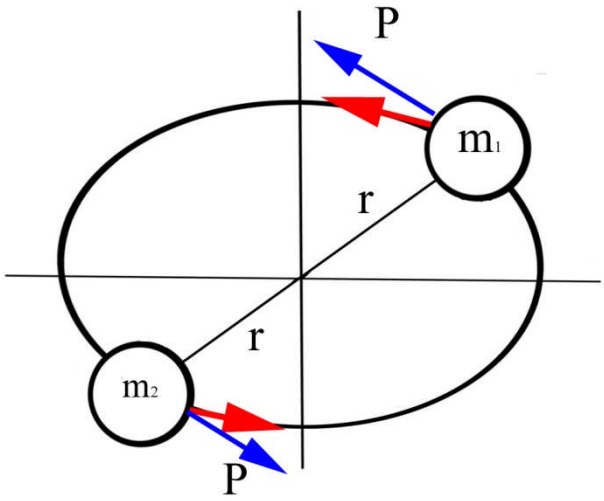
$$P_G = \frac{2}{3}\frac{Gm^2}{c^3}\dot{v}^2\left(\frac{v^2}{c^2}\right) \qquad (3)$$

Keeping to a simple concept, consider two equal masses, or two equal charges placed in a circular orbit with the centrifugal forces balancing the attraction. The power radiated by each is defined by Eq.(1), Eq.(2), and Eq.(3).

The configuration of this is illustrated in Fig. 1.

Fig. 1





$$P_E = \frac{2}{3}\dot{v}^2\frac{q^2}{c^3} + \frac{2}{3}\dot{v}^2\frac{q^2}{c^3}\left(\frac{v^2}{c^2}\right)$$

$$P_G = \frac{2}{3}\frac{Gm^2}{c^3}\dot{v}^2\left(\frac{v^2}{c^2}\right)$$

The force holding one of the charges P_1, in orbit is just the centrifugal force, thus the coupling constant can be replaced with:

The force holding one of the masses M_1 in orbit is just the centrifugal force, thus the coupling constant can be replaced with:

$$f_E = \frac{kq^2}{(2r)^2} = k\,m\frac{v^2}{r} \rightarrow q^2 = mv^2r = Lv \quad (4)$$

$$f_G = \frac{Gmm}{(2r)^2} = m\frac{v^2}{r} \rightarrow = Gmm = mv^2r = Lv \quad (6)$$

And noting for a centrifugal force $\dot{v} = v^2 / r$, results in the power radiated:

And noting for a centrifugal force $\dot{v} = v^2 / r$, results in the power radiated:

$$P_Q = \frac{8}{3}(m\dot{v})v\left(\frac{v^3}{c^3}\right) + \frac{8}{3}(m\dot{v})v\left(\frac{v^5}{c^5}\right) \quad (5)$$

$$P_G = \frac{8}{3}(m\dot{v})v\left(\frac{v^5}{c^5}\right) \quad (7)$$

Or in terms of the third derivative (jerk), this is: (See appendix I for parameter substitutes)

$$P_Q = \frac{8}{3}mr\dddot{v}\left(\frac{v^3}{c^3}\right) + \frac{8}{3}mr\dddot{v}\left(\frac{v^5}{c^5}\right)$$

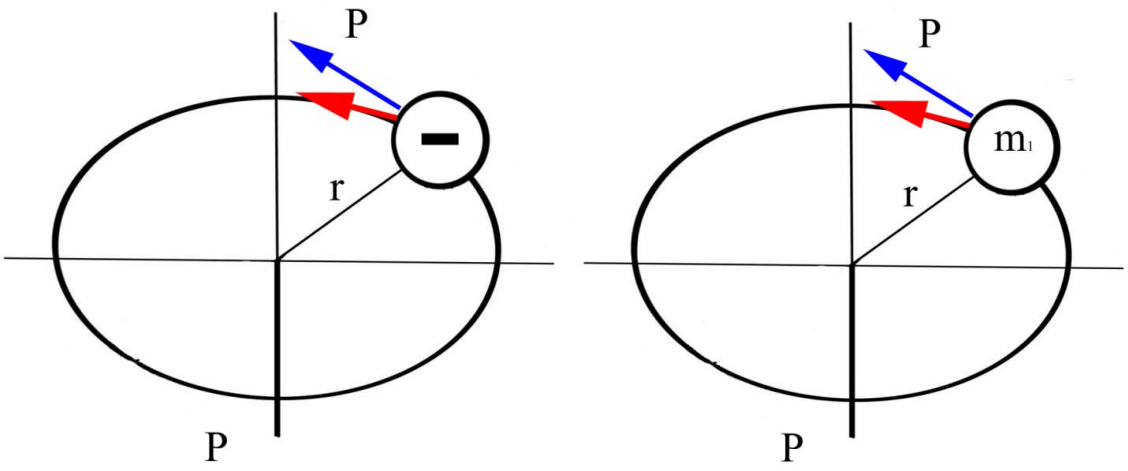
$$P_G = \frac{8}{3}mr\dddot{v}\left(\frac{v^5}{c^5}\right) \quad (8)$$

Note that: the dependence is on mass, jerk, and kinematics of a central force, and not dependent on G or q. The quadrupole power radiated is identical for both charge and gravitation.

Change of Central Force

Presume the replacement of one of the masses and charges in Fig.1 with a string to provide the exact same central force.

Fig. 2



We know for certain in the case of the charge, the Larmor radiation produces the same radiation, and the radiation originates at the mass not from the system:

With the second charge gone, however the electric dipole vanishes for the charge configuration and the radiation for both particles is just the quadrupole radiations which are exactly the same:

$$P_Q = \frac{8}{3} mr\ddot{v}\left(\frac{v^5}{c^5}\right) \qquad P_G = \frac{8}{3} mr\ddot{v}\left(\frac{v^5}{c^5}\right) \qquad (9)$$

The radiation depends completely on the kinematics of mass acceleration and velocity and has no Q or G dependence. The coupling constants participate only in the binding force, not the radiation. Gravitation does not have a negative equivalent, thus there is no dipolar radiation for it, but the quadrupole radiation is exactly the same as the electric dipole.

Note for the mass on a string is just that, a mass on a string, and now has no reference to gravitation. **It is asserted that mass undergoing a change in acceleration radiates the same energy charged or not, and that the radiation is electromagnetic.**

The QFT Basic of Electromagnetic Radiation

From QFT it is known that the interaction of charged particles is the result of the exchange or interaction of a probability cloud of virtual photons surrounding the particles, the cloud being concentric and decreasing probability with distance from the particle [12].

The propinquity of two opposite charged particles, cancels the distant electric vectors surrounding charges, but the virtual photon cloud probabilities are a conserved quantity, and therefore there is no reason to believe the virtual photon probability cloud is annihilated [13]. The total probability and probability amplitude of a cloud of virtual photons is not canceled by the existence, of the probability amplitude of another particle.

This is consistent with the fact that the reaction radiation is proportional to the square of the charge, not the electric vector. When a real particle accelerates, some of its "virtual cloud" is sufficiently accelerated such that $\Delta x \, \Delta p > \hbar$ and so the photons "become" real [14]. All that is required from energy conservation is that a pair of opposite charged particles, undergoing the same acceleration, generates a net radiation, and that the radiation is in phase.

It is conjectured that: Jerk distorts the extended virtual photon cloud surrounding mass, and increases the energy of that mass. The energy is then dissipated by electromagnetic radiation.

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Feynman has pointed out that the out that the radiation reaction force (and therefore the radiated power) is proportional to the third derivative of position, not the uniform acceleration [10], and thus the radiated energy from a particle in a central force is only along the direction of the velocity

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Appendix I

Parameter Substitutions
For equal masses in central attractive orbit

$$P_E = \frac{8}{3}\frac{q^2}{c^3}\dot{v}^2 \rightarrow \frac{8}{3}\frac{mv^2 r}{c^3}\dot{v}^2 \rightarrow \frac{8}{3}\frac{mv^2 r}{c^3}\frac{v^4}{r^2} \rightarrow \frac{8}{3}\frac{mv^2 r}{c^3}\frac{v^4}{r^2} \rightarrow \frac{8}{3}\frac{mv^3 r}{c^3}\frac{v^3}{r^2} \rightarrow \frac{8}{3}mr\ddot{v}\left(\frac{v^3}{c^3}\right)$$

$$P_G = \frac{2}{3}\frac{Gmm}{c^3}\dot{v}^2\left(\frac{v^2}{c^2}\right) \rightarrow \frac{2}{3}\frac{Gmm}{c^3}\frac{v^4}{r^2}\left(\frac{v^2}{c^2}\right) \rightarrow \frac{8}{3}(mr)\frac{v^2 v}{r^2}\left(\frac{v^3}{c^3}\right)\left(\frac{v^2}{c^2}\right) \rightarrow \frac{8}{3}mr\ddot{v}\left(\frac{v^5}{c^5}\right)$$

1 $f_E = \frac{q^2}{(2r)^2} = m\frac{v^2}{r} \rightarrow q^2 = 4mv^2 r$ electric centrifugal force

2 $\dot{v} = \frac{v^2}{r}$ $m\dot{v} = \frac{mv^2}{r}$ centrifugal force

3 $\ddot{v} = \frac{v^3}{r^2}$ central force orbital jerk[24]

4 $f_G = \frac{Gmm}{(2r)^2} = m\frac{v^2}{r} \rightarrow Gmm = 4mv^2 r$ gravitational centrifugal force