Poynting theorem and transfer of power between electromagnetism and gravitation

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The deflection of light by gravitation is explained using the Poynting theorem developed for gravitation within the context of ECE theory, in which the field equations of electromagnetism and gravitation have the same structure. Having tested the gravitational Poynting theorem with these experimental data, it is applied to the design of a counter gravitational device in which a circuit may be designed in theory to decrease the Earth's acceleration due to gravity $\boldsymbol{g}$.

Keywords: ECE theory, gravitational Poynting theorem, deflection of light due to gravity, counter gravitational device design.

1. Introduction

The transfer of electromagnetic power (energy per unit time) to other forms of power is well known in classical electrodynamics to be governed by the Poynting theorem. The latter describes the fact that all forms of energy are interconvertible, so electromagnetic energy per unit time may be transformed for example into heat, as is well known to anyone who has used an electrical appliance. The same principle applies to the important problem of transformation of electromagnetic power to gravitational power, or any form of power (defined in physics as any form of energy per unit time). If the fundamentals of this transform can be understood afresh, it may be possible at long last to design practical counter gravitational devices. There is a need for a radically new approach to gravitation because in the obsolete Einsteinian theory of gravitation it was impossible to describe the simple process of transfer of power, so the theory failed completely to provide any practical devices for counter gravitation in aircraft and spacecraft. In fact it failed completely to produce any new physics, it merely degenerated into quixotic and badly tested ideas based on hyper-complexity (the idols or dreams of Plato's cave, the human mind unrestrained by the discipline of nature itself). The obsolete theory was fundamentally incorrect from its very outset, based on an incorrect neglect of spacetime torsion [1–10], and was able only to describe

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small corrections to Newtonian physics in the solar system. Even this small success is very much open to all kinds of doubt [1–10]. As soon as whirlpool galaxies were discovered, their velocity curves showed that the Einsteinian theory was hopelessly wrong. This fact was again brushed aside by propagandists and self-propagators and replaced by the pure fiction of ‘dark matter’. ECE is able to describe whirlpool galaxies through straightforward use of spacetime torsion [1–10], an entirely original approach. The basic errors made by Einstein and his contemporaries have been corrected during the course of development of ECE theory, in which the Cartan spacetime geometry is used [11] properly. Cartan had informed Einstein in the early twenties that the latter's theory incorrectly neglects spacetime torsion, but this error was deliberately hidden by lesser intellects than that of Einstein himself. The result was an unmitigated disaster for physics, in which pseudo-theological edifices of ‘origin’ such as big bang theory and black hole theory were built on totally incorrect geometry. These edifices have collapsed into the quicksand of science history, to be replaced by ECE theory [12]. It is possible to make such claims because of the ability of feedback software to measure objectively and in great detail the professional impact of a theory such as ECE [12]. The impact of ECE theory is unprecedented in science history.

In great contrast to Einstein's failed theory of gravitation, the classical electrodynamics of the nineteenth century produced myriads of practical devices and was based from the outset on empirical discovery of the type made by Faraday. The nineteenth century theory of classical electrodynamics was based on practical devices. Although developed into a powerful unified field theory through use of Cartan geometry [1–10], the ECE field equations of electromagnetism have the same mathematical structure as those of Heaviside. The difference is that the ECE equations are based on spacetime torsion, and the relation between fields and potentials involve the spin connection. Therefore the ECE approach to electrodynamics is able to describe all that the nineteenth century approach can do, but with the addition of a great amount of new physics based rationally on the adoption throughout the subject of the philosophy of relativity. This philosophy predated Einstein by centuries, but Einstein happened to use it in an original way despite his flawed geometry. The use of geometry as a descriptor of nature was commonplace in classical times.

One of the main advantages of ECE theory is that it provides a completely new structure of gravitational theory. This structure is the same as that of the ECE theory of classical electrodynamics and was given in the preceding paper (UFT 168 of this series (www.aias.us)). In Section 2 the interaction of electromagnetism and gravitation is looked at afresh with the use of Poynting theorems for both electromagnetism and gravitation. The gravitational Poynting theorem is a development original to ECE theory. In Section 3 the gravitational Poynting theorem is applied to data from light bending due to gravitation. These types of data are still the only ones that give any experimental evidence that gravitation can affect electromagnetism. There have been claims for counter gravitational devices, but these have always been met with counter claims and embarrassing demonstrations of experimental artifact and of astonishingly poor experimental design. The result is that the subject has been at a standstill for over a hundred years, because there have been no reliable data upon which to base any theory. It is now known that such devices could not have worked if claimed to have been based on an incorrect and obsolete Einsteinian theory of gravitation. So it is checked that the gravitational Poynting theorem is able to describe self-consistently the bending of light by gravity. It is shown that it is able to do so. For technological applications the converse is needed, an electromagnetic circuit must be designed that is able to lessen the pull of gravity as measured through g, the Earth's acceleration due to gravity. The basic thermodynamic principles that any such device must obey are given in Section 3.

2. Applications of the gravitational Poynting theorem

The gravitational Poynting theorem of ECE theory is, for each index *a* (state of polarization):

$$\boldsymbol{g} \cdot \left(\nabla \times \boldsymbol{h} - \frac{\partial \boldsymbol{d}}{\partial t} \right) = \boldsymbol{J}_m \cdot \boldsymbol{g} \tag{1}$$

where $\boldsymbol{g}$ is the acceleration due to gravity, $\boldsymbol{h}$ is the magnetogravitational field strength, $\boldsymbol{d}$ is the gravitational displacement, and $\boldsymbol{J}_m$ is the mass current density defined by the inhomogeneous field equation of ECE gravitation:

$$\nabla \times \boldsymbol{h} - \frac{\partial \boldsymbol{d}}{\partial t} = \boldsymbol{J}_m . \tag{2}$$

Here $\boldsymbol{J}_m$. $\boldsymbol{g}$ has the units of watts per cubic metre, i.e. of gravitational power per unit volume. It is the total work done by the gravitational field on a source within a given volume. The total work done is a conversion of gravitational energy into other forms of energy, all forms of energy being interconvertible in thermodynamics.

The well known electromagnetic Poynting theorem is derived from Cartan geometry in ECE theory, and for each index *a* is:

$$\boldsymbol{E} \cdot \left(\nabla \times \boldsymbol{H} - \frac{\partial \boldsymbol{D}}{\partial t} \right) = \boldsymbol{J} \cdot \boldsymbol{E} \tag{3}$$

where $\boldsymbol{E}$ is the electric field strength, $\boldsymbol{H}$ is the magnetic field strength, $\boldsymbol{D}$ is the electric displacement and $\boldsymbol{J}$ is the electric current density. So $\boldsymbol{J} \cdot \boldsymbol{E}$ also has units of watts per cubic metre and is the total work done by the electromagnetic field on a source within a given volume. This denotes a conversion of electromagnetic energy to other forms of energy, one commonplace example being conversion of electromagnetic power in watts into heat in an electric fire. If the electromagnetic power per unit volume is transformed completely into gravitational power per unit volume then:

$$\boldsymbol{J} \cdot \boldsymbol{E} = \boldsymbol{J}_m \cdot \boldsymbol{g}. \tag{4}$$

Despite its utter simplicity of concept and despite its mathematical simplicity, this equation was never used in the obsolete gravitational theory of the twentieth century because gravitational power per unit volume could not be defined.

Using Eq. (2) gives:

$$\boldsymbol{g} \cdot \left(\nabla \times \boldsymbol{h} - \frac{\partial \boldsymbol{d}}{\partial t} \right) = \boldsymbol{J} \cdot \boldsymbol{E} \tag{5}$$

which can be rewritten as:

$$\frac{\partial U_{grav}}{\partial t} + \nabla \cdot \boldsymbol{S}_{grav} = -\boldsymbol{J} \cdot \boldsymbol{E} \tag{6}$$

where U_{grav} is the gravitational energy density in joules per cubic metre:

$$U_{grav} = \frac{1}{2} \left(\boldsymbol{g} \cdot \boldsymbol{d} + \boldsymbol{b} \cdot \boldsymbol{h} \right) \tag{7}$$

and $\boldsymbol{S}_{grav}$ is the gravitational Poynting vector in watts per square metre (power per unit area):

$$\boldsymbol{S}_{grav} = \left(\boldsymbol{g} \times \boldsymbol{h} \right) \tag{8}$$

Here $\boldsymbol{b}$ is the magnetogravitational flux density defined in UFT 168 (www.aias.us). Equation (6) means that the time rate of change of gravitational energy per unit volume $\left(\partial U_{grav} / \partial t \right)$ plus the gravitational power per unit area flowing out through the boundary surface of the volume $\left(\nabla \cdot \boldsymbol{S}_{grav} \right)$ is equal to the negative of the work done by the electromagnetic field on the sources within the volume. The sources within the volume are represented by the electric current density $\boldsymbol{J}$.

The conservation of total energy can be made clearer by denoting:

$$\int_V \boldsymbol{J} \cdot \boldsymbol{E} \; d^3x = dE_{\text{em}}/dt \tag{9}$$

and:

$$\int_V \frac{\partial U_{grav}}{\partial t} \; d^3x = dE_{\text{grav}}/dt \tag{10}$$

so:

$$\begin{aligned} \frac{d}{dt}\left(E_{\text{grav}} + E_{\text{em}}\right) &= -\int_V \; \nabla \cdot \boldsymbol{S}_{grav} \; d^3x \\ &= -\oint \boldsymbol{n} \cdot \boldsymbol{S}_{grav} dA \end{aligned} \tag{11}$$

using the Stokes Theorem. If there is no flow of gravitational power through the area:

$$\oint \boldsymbol{n} \; \cdot \boldsymbol{S}_{\text{grav}} \; dA = 0 \tag{12}$$

then:

$$\frac{d}{dt}\left(E_{\text{grav}} + E_{\text{em}}\right) = 0 \tag{13}$$

and the total energy (E_{grav} + E_{em}) does not change with time. This is a well known format of the law of conservation of total energy, in this case electromagnetic plus gravitational energies.

In UFT 168 (www.aias.us) the case was considered where, for simplicity of argument:

$$\nabla \times \boldsymbol{h} = \boldsymbol{0}. \tag{14}$$

Using the definition:

$$\boldsymbol{d} = \frac{1}{c^2 k} \boldsymbol{g} \tag{15}$$

where c is the vacuum speed of light and k is the Einstein constant, the following equation is obtained:

$$\boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} = -c^2 k \, \boldsymbol{E} \cdot \mathbf{J}. \tag{16}$$

This equation must be obeyed by any counter gravitational device because it is a fundamental statement of thermodynamics. In the next section these laws will be applied to the bending of light by gravitation.

3. Interaction of free space electromagnetism with gravitation, bending of light by gravity

In free space the electromagnetic field is:

$$\nabla \times \boldsymbol{H} - \frac{\partial \boldsymbol{D}}{\partial t} = \mathbf{0} \tag{17}$$

where

$$\boldsymbol{D} = \epsilon_0 \boldsymbol{E}, \quad \boldsymbol{H} = \frac{1}{\mu_0} \boldsymbol{B}. \tag{18}$$

Here ϵ_0 and μ_0 are the vacuum permittivity and permeability. Therefore the free space Poynting theorem is:

$$\boldsymbol{E} \cdot \left(\nabla \times \boldsymbol{H} - \frac{\partial \boldsymbol{D}}{\partial t} \right) = 0 \tag{19}$$

which is:

$$\frac{\partial U}{\partial t} + \nabla \cdot \boldsymbol{S} = 0 \tag{20}$$

where:

$$U = \frac{1}{2} \left(\boldsymbol{E} \cdot \boldsymbol{D} + \mathsf{B} \cdot \boldsymbol{H} \right) \tag{21}$$

and

$$\boldsymbol{S} = \boldsymbol{E} \times \boldsymbol{H}. \tag{22}$$

Eq. (20) can be written as:

$$\partial_\mu p^\mu = 0 \tag{23}$$

where the four momentum of the free space electromagnetic field is:

$$p^\mu = \left(\frac{E_n}{c}, \, \boldsymbol{p} \right) \tag{24}$$

where:

$$E_n = \int U d^3 x \tag{25}$$

and

$$\boldsymbol{p} = \frac{1}{c^2} \int \boldsymbol{S} \, d^3 x \tag{26}$$

When the electromagnetic field interacts with gravitation Eq. (20) is changed to:

$$\frac{\partial U}{\partial t} + \nabla \cdot \boldsymbol{S} = -\boldsymbol{g} \cdot \boldsymbol{J}_m \tag{27}$$

i.e. :

$$\partial_\mu p^\mu = -\frac{1}{c^2} \int \boldsymbol{g} \cdot \boldsymbol{J}_m \, d^3 x \tag{28}$$

in which the mass current density is defined by the inhomogeneous field equation of gravitation:

$$\nabla \times \boldsymbol{h} - \frac{\partial \boldsymbol{d}}{\partial t} = \boldsymbol{J}_m . \tag{29}$$

In a situation chosen such that:

$$\nabla \times \boldsymbol{h} = 0 \tag{30}$$

a simple result is obtained:

$$\partial_\mu p^\mu = -\frac{1}{k c^4} \int \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} \, d^3 x = 6.634 \times 10^{-9} \int \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} \, d^3 x \tag{31}$$

using:

$$k = 1.86595 \times 10^{-26} \text{ m kg}^{-1} \quad (32)$$

$$c = 2.997925 \times 10^{8} \text{ m s}^{-1}. \quad (33)$$

In vector format, Eq. (31) is:

$$\frac{1}{c}\frac{\partial E_n}{\partial t} + \nabla \cdot \boldsymbol{p} = 6.634 \times 10^{-9} \int \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} \, d^3x \quad (34)$$

or in terms of energy and momentum densities:

$$\frac{1}{c}\frac{\partial U}{\partial t} + \nabla \cdot \boldsymbol{\pi} = 6.634 \times 10^{-9} \, \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} \, d^3x \quad (35)$$

where:

$$E_n = \int U \, d^3x, \quad \boldsymbol{p} = \int \boldsymbol{\pi} \, d^3x \quad (36)$$

If it is assumed that the electromagnetic energy density is changed very little by the interaction with gravitation, then:

$$\frac{\partial U}{\partial t} \sim 0 \quad (37)$$

and:

$$\nabla \cdot \boldsymbol{\pi} = \frac{1}{k c^4} \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} \quad (38)$$

Finally use:

$$\boldsymbol{\pi} = \frac{1}{c^2} \boldsymbol{E} \times \boldsymbol{H} \quad (39)$$

to obtain the general equation that any counter gravitational device must obey under the given approximations:

$$\nabla \cdot \boldsymbol{E} \times \boldsymbol{H} = \frac{1}{c^2} \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} \tag{40}$$

To check that this theory reproduces the main characteristics of bending of light by gravity the following momentum magnitude may be deduced for the light beam interacting with gravitation using the methods and notation of UFT 150 and 155 (www.aias.us):

$$p = m\frac{dr}{dt} = mcb\left(1-\frac{r_0}{r}\right)\left(\frac{1}{b^2}-\left(1-\frac{r_0}{r}\right)\left(\frac{1}{a^2}+\frac{1}{r^2}\right)\right)^{1/2}. \tag{41}$$

Therefore in the radial direction:

$$\frac{\partial p}{\partial r} = \frac{1}{k\,c^4}\int \boldsymbol{g} \cdot \frac{\partial \boldsymbol{g}}{\partial t} d^3x = mcb\frac{d}{dr}\left[\left(1-\frac{r_0}{r}\right)\left(\frac{1}{b^2}-\left(1-\frac{r_0}{r}\right)\left(\frac{1}{a^2}+\frac{1}{r^2}\right)\right)^{1/2}\right] \tag{42}$$

Combining Eqs. (38) and (41) gives the self consistent result:

$$\frac{\partial p}{\partial r} \neq 0.$$

Although the methods used by Einstein to obtain Eq. (41) are incorrect, (see UFT 150 and 155 on www.ais.us) the Eq. (41) may still be used as a purely empirical description of the path of the light and of the velocity and momentum of a photon of assumed mass *m*. A further caveat is that in UFT 158 ff., (www.aias.us), the concept of finite photon mass was found to be wildly self inconsistent in Einstein–deBroglie theory, and replaced with a concept based on covariant mass *R***.** Our present purpose however is to show that the gravitational Poynting theorem is able to give a classical description of the trajectory of light near a large mass such as that of the Sun.

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[12] Site feedback activity for ref. (5), monitored daily for eight years, indicates complete professional acceptance of ECE theory in all sectors, including universities and similar. For example, from Jan. 2004 to Nov. 2010, www.aias.us attracted 708,569 distinct visits, 2,837,065 page views, and 5,749,724 files downloaded (hits). From June 2009 to October 2010 the combined feedback of www.aias.us and www.atomicprecision.com was 406,027 distinct visits and 2,673,173 hits. Complete details are posted quarterly on www.aias.us.