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Review Article

On Gravitomagnetic Photon Emission and Variation in Planck Constant

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Abstract

The gravitomagnetic photon emission is the first step to get a new Astronomy, it is derived from the solution of the Schrodinger equation adding the gravitational potential. The variation in Planck constant is the first step to get the Gravity and Quantum Mechanics unification, the variation is derived from the solution of the Schrodinger equation in gravitational systems

Keywords: *Gravitomagnetic Tensor; Gravitational Magnetic Field; Energy Momentum 1-Form; Gravitomagnetic Photon Emission; Maxwell`S Equations; Planck Constant; Planck Constant Variation; Gravity and Quantum Mechanics Unification*

Introduction

Electromagnetic tensor is a 2-form derived from the exterior derivative of a 1-form, similarly Gravitomagnetic tensor [1] can be derived from the exterior derivative of the Energy momentum 1-form and we obtain the similar Maxwell`s equations.

Gravitomagnetic tensor [1] generates the extra force needed to explain the anomalous behavior of pendulums observed during a solar eclipse [2] and dark matter effect.

Solving the Schrodinger equation with the gravitational potential added to the electrical potential we are able to get the gravitomagnetic photon frequency.

Equating the Schrodinger energy value to the total energy in several gravitational systems we get the value of Planck constant in these systems.

Gravitomagnetic Tensor

Electromagnetic form is a 2-form [3].

$$\mathbf{F} = -E_x\mathbf{d}t \wedge \mathbf{d}x - E_y\mathbf{d}t \wedge \mathbf{d}y - E_z\mathbf{d}t \wedge \mathbf{d}z + B_x\mathbf{d}y \wedge \mathbf{d}z + B_y\mathbf{d}z \wedge \mathbf{d}x + B_z\mathbf{d}x \wedge \mathbf{d}y \tag{1}$$

Energy-momentum form is a 1-form [3].

$$\mathbf{p} = -E\mathbf{d}t + p_x\mathbf{d}x + p_y\mathbf{d}y + p_z\mathbf{d}z \tag{2}$$

Gravitomagnetic form is a 2-form

$$\mathbf{G} = \mathbf{dp} = -E_x\mathbf{d}t \wedge \mathbf{d}x - E_y\mathbf{d}t \wedge \mathbf{d}y - E_z\mathbf{d}t \wedge \mathbf{d}z + B_x\mathbf{d}y \wedge \mathbf{d}z + B_y\mathbf{d}z \wedge \mathbf{d}x + B_z\mathbf{d}x \wedge \mathbf{d}y \tag{3}$$

$$G01 = -Ex = px{,}t + E{,}x \tag{4}$$

$$G02 = -Ey = py{,}t + E{,}y \tag{5}$$

$$G03 = -Ez = pz{,}t + E{,}z \tag{6}$$

$$G23 = Bx = pz{,}y - py{,}z \tag{7}$$

$$G31 = By = px{,}z - pz{,}x \tag{8}$$

$$G12 = Bz = py{,}x - px{,}y \tag{9}$$

dG = ddp = 0 [4], we obtain the similar Maxwell`s equations

$$\text{Div } \mathbf{B} = 0 \tag{10}$$

$$\text{Curl } \mathbf{E} = -\mathbf{B}_{,t} \tag{11}$$

* is the Hodge dual [4].

$$^*\mathbf{G} = B_x \mathbf{d}t \wedge \mathbf{d}x + B_y \mathbf{d}t \wedge \mathbf{d}y + B_z \mathbf{d}t \wedge \mathbf{d}z + E_x \mathbf{d}y \wedge \mathbf{d}z + E_y \mathbf{d}z \wedge \mathbf{d}x + E_z \mathbf{d}x \wedge \mathbf{d}y \tag{12}$$

$\mathbf{d}^*\mathbf{G} = 4\pi\, ^*\mathbf{J}$ [4], we obtain the last 2 equations with ρ, the mass density

$$\text{Div } \mathbf{E} = 4\pi\rho \tag{13}$$

$$\text{Curl } \mathbf{B} = \mathbf{E}_{,t} + 4\pi\mathbf{J} \tag{14}$$

where $E^{\rho\sigma}$ is the stress-energy tensor of the FIeld.

$$E^{\rho\sigma} = (4\pi)^{-1}(G^{\rho}_{\nu}G^{\sigma\nu} - \frac{1}{4}g^{\rho\sigma}G_{\mu\nu}G^{\mu\nu}) \tag{15}$$

Gravitomagnetic Photon Emission

An electron is orbiting a nucleus with Z protons, we know the energy levels from the solution of the Schrodinger equation [5], where m_p is the proton mass, m_e is the electron mass, μ is the 2-body reduced mass, e is the electron charge, r is the position of the electron relative to the nucleus, the potential term is due to the Coulomb interaction wherein ϵ_0 is the permittivity of free space and m_N is the mass of the nucleus.

$$\mu = \frac{m_N m_e}{m_N + m_e} \tag{16}$$

$$V(r) = -\frac{Ze^2}{4\pi\epsilon_0 r} = -\frac{k_e}{r} \tag{17}$$

$$E_n = -\frac{\mu Z^2 e^4}{(4\pi\epsilon_0)^2 2\hbar^2 n^2} \tag{18}$$

$$E_n = -\frac{\mu k^2}{2\hbar^2 n^2} \tag{19}$$

with $K = K_e$, now adding the gravitational potential

$$V(r) = -\frac{k_e}{r} - \frac{GZm_p\mu}{r} = -\frac{k_e}{r} - \frac{k_g}{r} = -\frac{(k_e + k_g)}{r} = -\frac{k}{r} \tag{20}$$

And from equation (19)

$$E_n = -\frac{\mu(k_e^2 + 2k_e k_g + k_g^2)}{2\hbar^2 n^2} \tag{21}$$

$$h\nu_g = \frac{\mu(2k_e k_g + k_g^2)}{2\hbar^2}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) \tag{22}$$

For the hydrogen atom, Z = 1, the first term in equation (21) is -13.6 eV, the third term is due to the gravitational interaction and the second term is due to the fact that the electron is closer to the nucleus than it would be without the electromagnetic interaction.

Variation in Planck Constant

We apply equation (21) to the Sun-Earth system, equating equation (21) to the total energy of the gravitational system we get the value of Planck constant in this system, $M_s = 1.9885 \cdot 10^{30}$ kg is the Sun mass, $M_- = 5.97237 \cdot 10^{24}$kg is the Earth mass, a = 149598023000m is the semi-major axis, eccentricity e $_x$ = 0:0167086, $k_g = GM_s\mu$, n = l + 1 and L the angular momentum.

$$\mu = \frac{M_s M_e}{M_s + M_e} \tag{23}$$

$$L^2 = l(l+1)\hbar^2 = GM_s a\mu^2(1-e_x^2) \tag{24}$$

$$n^2\hbar^2 = (l+1)^2\hbar^2 = GM_s a\mu^2, n = e_x^{-2} \tag{25}$$

$$\frac{\mu k_g^2}{2\hbar^2 n^2} = \frac{k_g}{2a} \tag{26}$$

$$h = 4.667814277790492524887853642235 6 \cdot 10^{37} \tag{27}$$

We apply equation (21) to the Sun-Jupiter system, $M_s = 1.9885 \cdot 10^{30}$ kg is the Sun mass, $M_j = 1.8982 \cdot 10^{27}$ kg is the Jupiter mass, $a = 778.57 \cdot 10^9$ m is the semi-major axis, eccentricity $e_x = 0.0489, k_g = GM_s\mu$ and $n = e_x^{-2} = 419$

$$\mu = \frac{M_s M_j}{M_s + M_j} \tag{28}$$

$$\frac{\mu k_g^2}{2\hbar^2 n^2} = \frac{k_g}{2a} \tag{29}$$

$$h = 2.8906347911121939846223770181785 \cdot 10^{41} \tag{30}$$

Conclusions

Gravitomagnetic tensor has been derived from the Energy-momentum and we have obtained the similar Maxwell`s equations, when a charged particle is moving it generates a magnetic field that interacts with charged particles in motion, similarly when a particle is moving it generates a gravitational magnetic field that interacts with other particles in motion.

Gravitomagnetic photon frequency ν_g is obtained by solving the Schrodinger equation including the gravitational potential, the detection of this photon leads to a new Astronomy.

The variation in Planck constant is obtained by solving the Schrodinger equation in several gravitational systems, it is not a constant anymore, it depends on the masses and the distance.

Galaxies in our universe are rotating with such speed that the gravity generated by their observable matter could not possibly hold them together. Gravitomagnetic tensor and the interaction due to the torsion tensor explain dark matter, the shape of galaxies and their distribution in the universe.

Gravitational magnetic force explains other anomalies such as that of the Pioneer spacecraft and its acceleration when moving away from the Sun.

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