

# Developing an equation to compute the wavelength ( $\lambda_g$ ) and quantized energy ( $E_g$ ) of elusive graviton

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**Abstract:** Graviton, the carrier of gravitational force, has remained as ever elusive to the physicists till today. But the graviton has a relation with the  $\mathcal{E}_T$ , the quantized energy of thought-carrying particle. This  $\mathcal{E}_T$  can be correlated with the Planck system of units like  $E_P$  (Planck energy),  $m_P$  (Planck mass),  $\lambda_P$  (Planck length) and  $\tau_P$  (Planck time). The same  $\mathcal{E}_T$  can also be correlated with the wavelength ( $\lambda_g$ ) as well as the quantized energy ( $E_g$ ) of the graviton liberated from a body of mass  $m$ .

**Key words:** Cosmic Microwave Background Radiation (CMBR), Universal Mind (UM), Thought-Carrying Particle (TCP), Thought Retaining Particle (TRP), Quantized Energy ( $\mathcal{E}_T$ ) of TCP, Gravitational Force ( $G_F$ ), Thought Force ( $T_F$ ), Planck Mass ( $m_P$ ), Planck Energy ( $E_P$ ), Planck Length ( $\lambda_P$ ), Planck Time ( $\tau_P$ )

## 1. Introduction

The  $\mathcal{E}_T$  is the quantized energy of TCP radiated from the radiant mass of the universe derived through the Stephan-Boltzmann formula as indicated by Gamow [1]. The Planck system of units involving the physical constants like  $h$  (Planck's quantum constant),  $c$  (velocity of light in a vacuum) and  $G$

(Newton's gravitational constant) can be correlated with  $\mathcal{E}_T$ ,  $m_T$  (quantized mass of the same TCP), and the corresponding  $\lambda_T$  (wavelength of the TCP) and  $\tau_T$  (time period of the TCP) as

$$\text{Planck Energy } (E_P) = 2\pi(hc^5 / G)^{1/2} = \mathcal{E}_T(m_P / m_T) \approx 3.09 \times 10^{17} \text{ erg} \quad (1)$$

$$\text{Planck mass } (m_P) = 2\pi(hc / G)^{1/2} = m_T(E_P / \mathcal{E}_T) \approx 3.431 \times 10^{-4} \text{ g} \quad (2)$$

$$\text{Planck length } (\lambda_P) = (hG / c^3)^{1/2} = \lambda_T(\tau_P / \tau_T) \approx 7 \times 10^{-33} \text{ cm} \quad (3)$$

$$\text{Planck time } (\tau_P) = (hG / c^5)^{1/2} = \tau_T(\lambda_P / \lambda_T) \approx 1.349 \times 10^{-45} \text{ sec} \quad (4)$$

Pal *et al* [2] showed that the quantized energy ( $\mathcal{E}_T$ ) of TCP radiated from  $1.16025 \times 10^{53} \text{ g}$ , the calculated radiant mass of the universe through Stephan-Boltzmann formula indicated by Gamow [1] may be expressed as

$$\mathcal{E}_T = \text{quantized energy of the TCP} = \left( \frac{hc}{\lambda_T} \right) = \left( \frac{h^3 c^5 m}{V_{pr}} \right)^{1/4} = 4.95 \times 10^{-16} \text{ erg}, \quad (4a)$$

where  $\lambda_T$  = wavelength in cm of the respective TCP radiated from different sources having different values of mass (m) in g,

$$h = \text{Planck's quantum constant} = 6.63 \times 10^{-27} \text{ erg.sec},$$

$$V_{pr} = \text{present volume of the universe}$$

$$= \left(\frac{4}{3}\right) \pi \left(\frac{c}{H_0}\right)^3 = 1.367 \times 10^{88} \text{ cm}^3,$$

$$H_0 = \text{present value of Hubble's parameter} = 2.023988 \times 10^{-19} \text{ sec}^{-1},$$

$$c = \text{free-space velocity of light} = 3 \times 10^{10} \text{ cm/sec},$$

$$c/H_0 = L \text{ (Hubble length)} = \text{radius of the universe} = R = 1.482 \times 10^{29} \text{ cm}.$$

$$\text{Here } m = \text{radiant mass of the universe} = V_{pr} \cdot \rho_r = 1.16025 \times 10^{53} \text{ g},$$

$\rho_r$  = radiant density as per Stephan-Boltzmann formula indicated by Gamow [1]

$$= 8.5 \times 10^{-36} T^4 \text{ g/cm}^3.$$

Pal *et al* [2] showed that the quantized energy ( $\mathcal{E}_T$ ) of TCP represents universal consciousness.

This universal consciousness exists throughout the universe in the form of universe wide web (uww) covering fields, particles, space-time continuum, dark matter, dark energy, void and all its known and unknown parameters along with all its inhabitants (with or without consciousness). This universal consciousness is to be taken into account, but usually ignored.

## 2. Constituents of a Star System and its Stability and the Relationship with the 'Thought Force' ( $T_F$ )

Pal *et al* [2] showed that TCP and TRP are the ultimate constituents of any matter as well as any mind in the presence of thought force ( $T_F$ ) *in vitro* and thought force ( $T_F$ ) *in vivo*.

Neutron stars are formed out of the deaths of stars several times more massive than the sun. According to Thorne [3], in a stable "white-dwarf" star or a "neutron" star, matter is so dense that its electrons have been squeezed into its protons, converting them into neutrons (*which are conceived here to be constituted ultimately by these postulated TCP and TRP*). The internal pressure developed by the released and highly compressed TCP and TRP can counter-balance the gravitational contraction of the star's mass to maintain the stability. As per Bethe [4], in the 1930s Chandrasekhar pointed out that, in these cases, electrons attain very high energy and approach the velocity (c) of light, which is possible only if an electron is

conceived to be ultimately constituted by these TCP and TRP, which can function like photons.

Bethe [4] mentioned that Helmholtz and Kelvin pointed out that the gravitation is the most prolific source and cause of stellar energy. It is to be understood here simultaneously that the liberation of TCP and TRP through the squeezing of matter plays prominent role to release profuse energy.

It can be shown that

$$G_F = \frac{1}{K} (\mathcal{E}_T / D_i)^2 \quad (5)$$

where  $G_F$  = gravitational force,

$$K = c^4 / G = 12.144 \times 10^{48} \text{ dyne},$$

G = Newton's gravitational constant =  $6.67 \times 10^{-8} \text{ dyne.cm}^2 \cdot \text{g}^{-2}$ ,

$\mathcal{E}_T$  = quantized energy of the TCP radiated from the radiant mass of the universe,

$D_i$  = interacting distance.

$G_F$  (= gravitational force) is thus found to be correlated with  $\mathcal{E}_T$  (= quantized energy of TCP radiated from the radiant mass of the universe). Ultimately this  $\mathcal{E}_T$  represents universal consciousness.

Again, the thought force ( $T_F$ ) that is an expression of the universal consciousness is found to be related with  $G_F$  (gravitational force) by the expression:

$$T_F = (KG_F)^{1/2} \quad (6)$$

where

$$K = c^4 / G \quad (6a)$$

Thorne [3] indicated that the 'force of gravity' generated by the 'pressure' is proportional to the square of the pressure. This statement is found to be true through the following expression:

$$G_F \propto T_F^2 \quad (7)$$

where the generation of pressure is due to the  $T_F$ .

According to the general theory of relativity, gravity is produced not only by mass but also by pressure as indicated by Thorne [3]. In the Einstein law of gravity, the strength of gravity depends not just on mass but also on other forms of energy and on pressure. In this way pressure has two effects: direct (caused by the action of the pressure on surrounding material) and indirect (caused by the gravitation that the pressure creates). Thorne [3] indicated that if a star's internal pressure is very high, it gives rise to gravitational forces that overwhelm the internal pressure and the star collapses.

### 3. Formulation of an Equation for the Wavelength ( $\lambda_g$ ) and the Quantized Energy ( $E_g$ ) of the Graviton Radiated from a Body of Mass $m$

Dutta [5] explained that the Planckian mass  $m_P$  was confined within the volume  $V_P$  of a sphere of diameter  $\lambda_P$  at the Planckian time  $\tau_P$  so that

$$V_P = (4/3)\pi(\lambda_P/2)^3 = 34.642308 \times 10^{-99} \text{ cm}^3 \quad (8)$$

Again

$$V_P = m_P / \rho_P \approx 34.74661 \times 10^{-99} \text{ cm}^3 \quad (8a)$$

where

$$\begin{aligned} \rho_P &= m_P / [(4/3)\pi(\lambda_P/2)^3] \\ &= 2\pi(hc/G)^{1/2} / [(4/3)\pi(hG/4c^3)^{3/2}] \\ &= 12c^5 / G^2 h \\ &= 9.8860393 \times 10^{93} \text{ g/cm}^3 \end{aligned} \quad (9)$$

If  $R_0$  is the radius of this  $V_P$ , then

$$\begin{aligned} V_P &= (4/3)\pi R_0^3 = 34.642308 \times 10^{-99} \text{ cm}^3 \\ &= [(4/3)\pi(\lambda_P/2)^3] \end{aligned} \quad (10)$$

$$R_0 = [8.267 \times 10^{-99}]^{1/3} = 2.022 \times 10^{-33} \text{ cm} \quad (11)$$

This  $R_0$  itself is the wavelength ( $\lambda_g$ ) of the graviton radiated from the Planckian mass  $m_P$ , because the Yukawa-deBroglie graviton hypothesis indicated by Rovelli [6] proposes that the wavelength ( $\lambda_g$ ) of the graviton liberated from a body is equal to the radius of curvature of space caused by the effect of the body's gravitational field.

Expressing Equation (11) in terms of  $m_P$  by utilizing the Equation (2), one can get

$$\begin{aligned} R_0 &= [(8.267 \times 10^{-99})(m_P / m_P)]^{1/3} \\ &= [(8.267 \times 10^{-33} x m_P) / \{m_T(E_P / \mathcal{E}_T)\}]^{1/3} \\ [\dots m_P &= m_T(E_P / \mathcal{E}_T)] \\ &= [(8.267 \times 10^{-99} x \mathcal{E}_T)(m_P) / (m_T E_P)]^{1/3} \\ &= [K_1(m_P)]^{1/3} \end{aligned} \quad (12)$$

where  $K_1$  = dimensional constant

$$\begin{aligned} &= (8.267 \times 10^{-99} x \mathcal{E}_T) / (m_T E_P) \\ &= 2.4066506 \times 10^{-95} \text{ cm}^3 \text{ g}^{-1} \end{aligned} \quad (13)$$

Thus, generalizing the Equation (12) for any body of mass  $m \gg m_P$ , one can get an equation for the wavelength ( $\lambda_g$ ) of the graviton radiated from a body of mass  $m$  given as

$$\lambda_g = [K_1(m)]^{1/3} \quad (14)$$

The corresponding time period  $\tau_g$  of the graviton can be expressed as

$$\tau_g = \lambda_g / c = [(K_1 / c^3)(m)]^{1/3} = [K_2(m)]^{1/3} \quad (15)$$

where  $K_2 = K_1 / c^3$   
= dimensional constant

$$\begin{aligned} &= (8.267 \times 10^{-99} x \mathcal{E}_T) / m_T E_P c^3 \\ &= 8.91352 \times 10^{-127} \text{ sec}^3 \text{ g}^{-1} \end{aligned} \quad (16)$$

The quantized energy ( $E_g$ ) of the said graviton can be expressed as

$$\begin{aligned} E_g &= h / \tau_g = [(h^3 / K_2)(1/m)]^{1/3} \\ &= [(K_3(1/m))]^{1/3} \end{aligned} \quad (17)$$

where  $K_3 = h^3 / K_2$  = dimensional constant =

$$\begin{aligned} &h^3(m_T E_P c^3) / (8.267 \times 10^{-99} x \mathcal{E}_T) \\ &= 32.695752 \times 10^{46} \text{ erg}^3 \text{ g} \end{aligned} \quad (18)$$

It is evident from the Table 1 that the quantized energy ( $E_g$ ) of graviton liberated from the Planckian mass  $m_P$  is  $9.837 \times 10^{16}$  erg with a time period of  $6.74 \times 10^{-44}$  sec. Again, the quantized energy ( $\mathcal{E}_T$ ) of TCP radiated from the radiant mass of the universe is  $4.95 \times 10^{-16}$  erg with a time period of  $1.34 \times 10^{-11}$  sec. It is interesting to note that these two categories of quantized energies are maintaining a more or less inverse relationship in magnitude.

**Table 1:** Respective wavelength ( $\lambda_g$ ), quantized energy ( $E_g$ ), quantized mass ( $m_g$ ) and time period ( $\tau_g$ ) of the graviton radiated from different sources

Object	Mass of the object in g	Wavelength ( $\lambda_g$ ) of the radiated graviton in cm	Quantized energy ( $E_g$ ) of the radiated graviton in erg	Quantized mass ( $m_g$ ) of the radiated graviton in g	Time period ( $\tau_g$ ) of the radiated graviton in sec
Universe	$M_U = 10^{57}$	$2.8872 \times 10^{-13}$	$6.8891 \times 10^{-4}$	$7.65455 \times 10^{-25}$	$9.624 \times 10^{-24}$
Earth	$M_E = 5.96 \times 10^{27}$	$5.235 \times 10^{-23}$	$3.799 \times 10^6$	$4.2214 \times 10^{-15}$	$1.747 \times 10^{-33}$
Planck mass	$m_p = 3.43064 \times 10^{-4}$	$2.022 \times 10^{-33}$	$9.837 \times 10^{16}$	$1.093 \times 10^{-4}$	$6.74 \times 10^{-44}$

## 4. Discussion and Conclusion

### 4.1. Discussion

Pal *et al* [2] developed three different equations expressing the quantized energy ( $\mathcal{E}_T$ ) of TCP. The value of  $\mathcal{E}_T$  in one of the three equations is shown below:

$$\mathcal{E}_T =$$

$$4.384 \times 10^{-16} \text{ erg} \equiv 2.73 \times 10^{-4} \text{ eV} \equiv 2.73 \text{ K} \equiv \text{CMBR}$$

temperature  $\equiv 2.725 \text{ K}$

This conversion of  $\text{erg} \equiv \text{eV} \equiv \text{K}$  is given by Weisskopf [7] as follows:

$$1 \text{ erg} \equiv 0.6241807 \times 10^{12} \text{ eV and } 10^{-4} \text{ eV} \equiv 1 \text{ K}$$

### 4.2. Conclusion

It is interesting to note that the quantized energy ( $E_g$ ) of graviton liberated from the Planckian mass  $m_p$  is  $9.837 \times 10^{16} \text{ erg}$  and the quantized energy ( $\mathcal{E}_T$ ) of TCP radiated from the radiant mass of the universe is  $4.95 \times 10^{-16} \text{ erg}$ . It is found that these two categories of quantized energies maintain a more or less inverse relationship in magnitude. The quantized energy ( $E_g$ ) of liberated graviton may have a relation with the quantized energy ( $\mathcal{E}_T$ ) of TCP. This  $\mathcal{E}_T$  is also related with the Planckian system of units.

We have shown here equations to compute the wavelength ( $\lambda_g$ ) and quantized energy ( $E_g$ ) of graviton radiated from a body of mass  $m$ . These equations can be utilized to compute the wavelength ( $\lambda_g$ ) and quantized

energy ( $E_g$ ) of graviton radiated from different bodies of different masses including Planck mass ( $m_p$ ) showing that these equations can be utilized in the Planckian system of units also and the same is found to play important role in the liberation of graviton for causing the generation of gravity also.

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