A New Proof of Photon Velocity ($V_T = 3.3\,C$) Utilising Ever-True Planck Energy Equation and Kinetic Energy Equation in the Universe 2025 Part B

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As we mentioned in previous articles, photons have constant rest-mass (m_p) and velocity, and their kinetic energy equation can be written as follows:

$$E = \frac{1}{2} m_p V^2$$

In this equation, we calculate the energy value for the photon's velocity being equal to C:

$$E = \frac{1}{2} m_p C^2$$

On the other hand, according to Planck's equation, the energy of electromagnetic waves (including the visible light spectrum) is as follows:

$$E_p = hf$$

If the used velocity (C) were correct, the kinetic energy of the photon would be the same as the energy obtained from Planck's experimental equation. Although we all know that this relationship doesn't hold, for instance let's try it for green light with a frequency of 600 THz:

$$\frac{1}{2} m_p C^2 = \frac{1}{2}(1.64 \times 10^{-36})(3 \times 10^8)^2 = 7.38 \times 10^{-20}\, j$$

$$hf = (6.62 \times 10^{-34}) \times (6 \times 10^{14}) = 3.97 \times 10^{-19}\, j$$

$$\frac{1}{2} m_p C^2 \neq hf$$

Therefore, the velocity C cannot be the true velocity of a photon, and the total velocity must be different.

In Part A, we showed and proved that the velocity of a photon is $V_T = 3.3\,C$ and thus the energy equation becomes:

$$E_T = \frac{1}{2} m_p {V_T}^2 = \frac{1}{2} m_p (3.3C)^2$$

$$E_T \approx 5 m_p C^2 = 8 \times 10^{-19}\, j$$

Furthermore, in previous articles, we demonstrated that electromagnetic waves have both linear

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and rotational motion, and consequently, the total energy of a photon is as follows:

$$E_T = E_L + E_R$$

$$5m_pC^2 = E_L + E_R$$

Although the sum of these two energies is always constant, the ratio of rotational to linear energy is different for waves with different frequencies. We also proved that in green light with a frequency of 600 THz, these two parts are approximately equal:

$$f_G = 600\,THz \Rightarrow E_{L_G} = E_{R_G}$$

$$E_{L_G} = E_{R_G} = \frac{1}{2}E_T = 4 \times 10^{-19}\,j$$

On the other hand, according to Planck's equation, the energy of electromagnetic waves (including the visible light spectrum) is as follows:

$$E_p = hf$$

This energy equation represents the linear contribution of energy; therefore, for green light, we have:

$$E_{L_G} = hf_G = 3.97 \times 10^{-19}\,j$$

Therefore, the defined velocity $V_T = 3.3C$ is correct for photons, and the energy value obtained from the kinetic energy equation will be the same as the energy value from Planck's experimental equation. Although, in previous articles, we showed that Planck's energy equation always represents the linear part of the energy, and if we want to consider the general relationship, the following relations can be written:

$$E_R = \frac{1}{2}m_pr^2\omega^2 = i_RE_T$$

$$E_L = hf = i_LE_T$$

$$E_T = \frac{1}{2}m_pr^2\omega^2 + hf = i_RE_T + i_LE_T$$

For instance, for visible spectrum we have:

$$300\,THz \leq f \leq 900\,THz$$

$$^1/_4 \leq i_L \leq {}^3/_4$$

$$^3/_4 \geq i_R \geq {}^1/_4$$

Given that the energy from Planck's equation and kinetic energy equation are equal, and considering that Planck's experimental equation is always specifically constant and known, the total velocity of photons is indeed 3.3 C.

$$V_T = 3.3\,C$$

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