ABOUT THE PHOTON PHYSICAL PROPERTIES

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In [1] the formula for the determination of the photon force was received:

$$|F| = \frac{hc}{\lambda^2} \tag{1}$$

The pressure of the photon can be calculated according to the following formula [1]:

$P = \frac{F}{A}$ (2). In [2] the effective area of the collision was defined - $A = \pi\lambda^2$ (3)

By using the Eq. (1) together with Eq. (2) and (3) the following equation can be derived:

$$P = \frac{hc}{\pi\lambda^4} \tag{4}$$

or $$P = \frac{const}{\lambda^4} = \frac{6.323052\ 10^{-26}}{\lambda^4} \quad [\text{Pa}]$$

The thermodynamic analysis has shown that equation like $P_h V_h = kT$ could be used for describing of the photon thermodynamic condition in such form

$$P_p V_p = hf \tag{5}$$

The using of the Eq. (4) and (5) make the calculation of the photon volume possible:

$$V_p = \frac{hf}{P_p} = \frac{hc}{\lambda} \cdot \frac{\pi\lambda^4}{hc} = \pi\lambda^3 \tag{6}$$

This result shows that the photon does not have the form of a sphere. In this case the volume would be: $V = 4/3 \cdot \pi\lambda^3$.

The new equations (5,6) were theoretically proved with a following procedure:

$$\frac{d(PV)_p}{dt} = \frac{dE_p}{dt} \tag{7}$$

The differentiation of Eq. (7) by putting the expression for P and V gives the following, on the APS March Meeting 2004 presented and in [2] proved result:

$$-\frac{d(PV)_p}{dt} = -\frac{dE_p}{dt} = hf^2 = Power \tag{8}$$

Finally, it is possible to calculate the density of the light particle: $V\rho = m = \frac{h}{c\lambda}$ or

$$\rho = \frac{h}{c\lambda V} = \frac{h}{\pi c\lambda^4} = const \cdot \lambda^{-4} = 0.70353\,10^{-42} \cdot \lambda^{-4} \ [\text{kg/m}^3] \tag{9}$$

With the Eq. (4) and (9) the following expression could be presented:

$$P_p = \rho c^2 \tag{10}$$

The multiplying the left and right sides of this formula on V by using the Eq. (5) delivers the famous, well-known Einstein formula: $E = mc^2$

References

1. Determination of the Photon Force and Pressure. S. Reissig, The 35th Meeting of the DAMOP, May 25-29, 2004, Tucson, abstract #D1.102

2. The Photon Power and Stefan-Boltzmann Radiation Law. S. Reissig, Bulletin of the APS, March Meeting 2004, Part I, Montreal, Vol. 49, No.1, p. 255;
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