Theoretical Evaluation of Planck's Constant

Prof. K.V.K. Nehru, Ph.D.

The analysis of physical quantities into their space-time components, made possible by the application of the Reciprocal System, throws fresh illumination on the nature and significance of these quantities. Larson demonstrates that the result of applying the discrete unit postulate to the dimensions of physical quantities results in the principle that the dimensions of the numerator of the space-time expression of any real physical quantity cannot be greater than those of the denominator. Quoting Larson:[1]

> The most notable of the quantities excluded by this dimensional principle is "action." This is the product of energy, t/s, and time t, and in space-time terms it is t^2/s Thus it is not admissible as a real physical quantity… The equation connecting the energy of radiation with the frequency is:
>
> $E = hv$
>
> where *h* is Planck's constant… expressed in terms of action.
>
> It is clear, however, from the explanation of the nature of the photon of radiation… that the so-called "frequency" is actually a speed. It can be expressed as a frequency only because the space that is involved is always a unit magnitude. In reality, the space dimension belongs with the frequency, not with the Planck's constant. When it is thus transferred,… the equation for energy of radiation is [in space-time terms]

$$\frac{t}{s} = \frac{t^2}{s^2} \times \frac{s}{t} \qquad (1)$$

In *The Structure of the Physical Universe* Larson derives the value of Planck's constant on this basis, making use of the gravitational constant. In this paper I attempt to do the same, but without bringing the gravitational constant into the picture, with the hope of showing the factors involved more clearly.

We will adopt the suffix *c* to denote a quantity expressed in conventional units, no suffix to denote the quantity expressed in the natural units, and suffix *n* to denote the magnitude of the natural unit of a quantity expressed in terms of conventional units.

Remembering that, on the natural unit basis, any unit of a physical quantity is also the unit of the corresponding inverse quantity; every unit of energy is both a unit of t/s and a unit of s/t, each in its proper context.[2] From Equation (1), the quantitative relationship between E natural units of energy and u natural units of speed can be expressed as:

$$E = (1/1)\ u$$

since the numerical magnitude of the t^2/s^2 term is $(1/1)^2$ in natural units. The speed u is given by the quotient of S natural units of space and T natural units of time. Therefore,

$$E = S/T$$

1 Larson, Dewey B., *Nothing But Motion*, North Pacific Publishers: Portland, OR, 1979, p. 152.

2 *Ibid.*, p. 169 (see lines 6-4 from bottom).

Now we will introduce the conventional units into the equation, but will do so only in the case of those quantities which we want expressed in the conventional units finally. Since $E = E_c / E_n$ and $T = T_c / T_n$, we have:

$$E_c = (E_n T_n) \frac{S}{T_c} \tag{2}$$

However, from what has been quoted earlier, we note that the numerical magnitude S in Equation (2) is 1, since the vibration is confined to one natural unit of space. The lack of recognition of the true status of the frequency term as a speed term and expressing every quantity in terms of conventional units (i.e., including 1 cm in place of S) therefore has the effect of overstating the numerical value on the right-hand side by a factor of 1 cm/S_n. As such, the right-hand side must be multiplied by the reciprocal of this factor. Thus,

$$E_c(in\ ergs) = \left(E_n T_n \frac{S_n}{1\,cm} \right) \frac{1}{T_c}(in\ sec) \tag{3}$$

Or, replacing 1/T by v, the frequency in Hertz,

$$E_C = \left(E_n T_n \frac{S_n}{1\,cm} \right) v \tag{4}$$

from which we have Planck's constant as:

$$h = E_n T_n \frac{S_n}{1\,cm} \tag{5}$$

There are two additional factors to be considered before we can arrive at the numerical magnitude of *h*. Firstly, since the photon vibration is limited to the time-region while measurements appertain to the outside region, this value of *h* is to be reduced by the interregional ratio R. Hence,

$$h = \frac{(E_n T_n S_n)}{(R \times 1\,cm)} \tag{6}$$

The second factor is concerned with the effect of the secondary mass component s. As long as mass is expressed in the dynamical unit of gram, it becomes necessary to take account of the discrepancy between the units of primary mass and inertial mass. Thus, when adopting the gram-unit, the mass term is to be multiplied by a factor of 1+s, where 1 is the primary mass and s the secondary mass.[3] In the present case, since energy is t/s while mass is t^3/s^3, the multiplying factor is $(1+s)^{1/3}$. Thus,

$$h = \left[\frac{(E_n T_n S_n)}{(R \times 1\,cm)} \right] [1+s]^{1/3} \tag{7}$$

3 *Ibid.*, p. 170.

Adopting the values from *Nothing But Motion*[4,5,6],

$E_n = 1.49175\times10^{-3}$ erg

$T_n = 1.520655\times10^{-16}$ sec

$S_n = 4.558816\times10^{-6}$ cm

$R_n = 156.4444$ (Reference 5),

and for the secondary mass calculation, from Reference 6,

m, magnetic mass = 0.00639205,

we have the value of Planck's constant as:

$$h = 6.6243162\times10^{-27}\,erg\text{-}sec \tag{8}$$

But it must be noted that m, the magnetic mass, is not the only component of the secondary mass s. This is because in the particles with unit net displacement (like, for example, M ½-½-0), there is always an initial unit of electric mass, of magnitude 0.0005787. Thus 1+s becomes 1.00697075. Substituting this in Equation (7) gives:

$$h = 6.6255857\times10^{-27}\,erg\text{-}sec \tag{9}$$

This is in close agreement with the experimental value of 6.6256×10^{-27} erg-sec (within an error of 2.16×10^{-4} percent).

4 *Ibid.*, p. 160.
5 *Ibid.*, p. 162.
6 *Ibid.*, p. 164.