In the writer's Researches on the Physical Constitution and Rigidity of the Heavenly Bodies, 1904–5, he reached the conclusion that the confined solar matter must necessarily be gaseous, though acquiring the property of a highly rigid solid under the enormous pressure and high temperature to which the matter is subjected. In fact it was found by calculation that the layers of the sun's globe have an average rigidity of over 2000 times that of steel, (AN 4104, equation 22, p. 384), while the average rigidity of the matter, accumulated with increasing density in the interior layers, may be 6000 times that of Nickel steel (AN 4104, equation 38, p. 392).

Such a globe must be viewed as bursting internally with pent up explosive energy, yet kept in equilibrium by the accumulating pressure of the surrounding layers: the confined matter is gaseous, yet rigid to the highest degree, and in such confinement must have the property of a solid of enormous rigidity.

Now the rigidity of the aether is variable with the radius vector drawn to the sun's centre, but generally less than that of solids such as glass, which is about 10^{11}. Yet with such high elasticity, due to the enormous molecular velocity 471239 kms, we see that it cannot be rent or cracked, as Lord *Kelvin* once suggested, (Popular Lectures and Addresses, 1.336), by any forces at work in nature. The only artificial forces yet found capable of setting up waves in the aether were the extremely quick explosions of dynamite used by Professor *Francis E. Nipher* of St. Louis.

5. Table of the Physical Constants of the Aether.

The general method employed for determining the physical constants of the aether is based on the process for calculating the mechanical value of a cubic mile of sunlight devised by Lord *Kelvin*, 1854, and first published in the Transactions of the Royal Society of Edinburgh, (cf. »Mechanical Energies of the Solar System«, 1854, and Baltimore Lectures, 1904, p. 261–265). This method was adopted and somewhat improved by *Maxwell*, 1875, in the Article Aether, Ency. Brit. 9th ed. Some further improvements have been introduced by the present writer, especially in those constants of the kinetic theory of the aether, which were never calculated by *Kelvin* or *Maxwell*. These are due entirely to the recent investigations, and are here outlined for the first time.

We adopt the constant of solar radiation recently found by *Bigelow*, namely, 3.98 ca., 1919. (Supplement No. I to the Treatises on the atmospheres of the sun and the earth. Four fundamental formulas for discussing the observations made with various types of pyrheliometers, *F. H. Bigelow*, John Wiley & Sons Inc., New York, 1919, p. 4).

A certain factor in the kinetic theory of the energy of the aether waves coming from the sun was taken by Lord *Kelvin* as between $^1/_2$ and 1, (Baltimore Lectures, p. 263, § 5), and by *Maxwell* as $^1/_2$. Working out the problem somewhat more fully than Lord *Kelvin* has done, thus taking account of the inclinations of all the wave elements in plane, circularly and elliptically polarized light, I find that this factor for the total energy should be a little greater than one half, namely:

$$\mathcal{J} = 1/(^1/_2\pi)\cdot\int_0^{^1/_2\pi}\cos\theta\, d\theta = 2/\pi = 0.63662.$$

Accordingly we thus arrive at the following

Table of Constants of the Aether:

1. Constant of solar radiation, found by *Bigelow* from observations, $R = 3.98$ ca.
2. Assumed ratio of amplitude to wave length $A/\lambda = 1/101.23$, which is nearly the same as was used by *Maxwell*, so that $Ap = 2\pi/101.23 = 1/16.115$.
3. Energy per cubic centimetre at the sun's surface $= (0.63662)\,\varrho\, V^2 (Ap)^2 = 4.41455$ ergs.
4. Greatest tangential stress per sq. cm at the sun's surface $= \varrho\, V^2 (Ap) = 111.1713$ dynes.
5. Coefficient of rigidity of the aether:
   at the sun's surface $= \varrho\, V^2 = 1800$,
   at the earth's surface $219\,\varrho\, V^2 = 394\,200$.
6. Density of the aether at the sun's surface $\varrho = 2\times 10^{-18}$.
7. Density of the aether at the earth's surface $\varrho' = 219\varrho = 438\times 10^{-18}$.
8. Mean velocity of the aetheron, $\bar{r} = 47\,123\,900\,000$ cms.
9. Molecular weight of the aetheron, $(H = 1) = 15.56\times 10^{-12}$.
10. Average length of mean free path, at the sun's surface, $l = 572\,959$ kms.
11. Number of corpuscular collisions per second, at the sun's surface, $C = 0.82246$.
12. Radius of aether corpuscle $= 3.346\times 10^{-12}$, or 1/4005 of the radius of a Hydrogen molecule.

The radius of a molecule of Hydrogen is taken as 1.34×10^{-8}, and the density assumed equal. In computing the molecular weight of the aetheron in 9 above, we disregard the so-called ,Electrical mass' because Professor Sir *J. J. Thomson*, (Electricity and Magnetism, 4th ed., 1909, p. 521), and *Crowther*, (Molecular Physics, 1914, p. 70), and other authorities, admit that this ,Electrical mass' resides in the aethereal medium itself, which we are investigating. This subject will be more fully discussed in a future paper.

It may be noticed that the aether gas, is endowed with enormously high molecular velocities and excessively long range of mean free path, so that the highly elastic aether is very different from the ordinary terrestrial gases. This is forcibly brought out in the following table; yet the similarity with the other gases is also notable, even for such an extreme case as the aether. It is this enormous mean molecular velocity and the long free path which causes the aether to vibrate as an elastic solid for rapidly acting forces, but easily gives way to slow motions. It is worthy of notice that the particles of the aether move out of the way ten thousand times more rapidly than the swiftest planets revolve in their orbits.

The constants for the tables assembled below were drawn originally from *O. E. Meyer*'s Kinetic Theory of Gases, but in the final revision I have adopted the mean of the values cited by *Jeans*, Kinetic Theory of Gases, 2nd ed. 1916.