»Under these premises, the velocity of the wave was found to be $\frac{1}{3}\sqrt{5}$ (or 0.745) into the mean velocity of the particles. In most gases the velocity of sound is slightly less than this. This is referable to the movements of rotation developed at the encounters of the molecules (which calculably would delay the wave to a certain extent). In vapour of mercury, according to the determinations of *Kundt* and *Warburg*, the velocity of sound is exactly $\frac{1}{3}\sqrt{5}$ into the molecular velocity«.

According to these announcements, the corpuscles of the aether, viewed as a monatomic gas, should have a mean molecular velocity of $3/\sqrt{5}\cdot V = 1.34\,V$, where $V = 3\times 10^{10}$ cms, the velocity of light. A conclusion of such great importance, which received the approval of the luminous mind of *Maxwell*, is entitled to profound attention. Thus I have had it before me for some five years, but only undertook the mathematical verification and physical test of this *Preston-Maxwell* theorem quite recently; and, as my results differ slightly from those of *Preston* and *Maxwell*, I will give the process of test and verification employed.

In order to confirm this theory I have compared the observed velocity of sound for the four leading gases which are best determined, with their mean molecular velocities, and find the following indications of experiment, without regard to the *Preston-Maxwell* theory. In the experimental data there remains a little uncertainty. For the older values of $\bar{v}$ and k_2 the table yields for the corrected ratio a mean of 1.64, which is 0.07 above the theoretical value of 1.57. The newer data, preferred by *Jeans*, Dynamical Theory of Gases, 2nd edition 1916, p. 9–131, give a mean value of 1.57, though the discordance between the results for the individual gases is somewhat increased.

Gas	Mean molecular velocity $\bar{v}$		Observed velocity of sound in gas at 0° C V	Ratio $\bar{v}/V$ without correct.		Correction factor for $\sqrt{(k_1/k_2)}$ *)		Corrected ratio $\bar{v}/V$	
	older values	newer values		older values	newer values	older values	newer values	older values	newer values
Air	498 m	459 m	332.0 m	1.50	1.38	1.09	1.09	1.63	1.51
Hydrogen	1859	1694	1265.0	1.47	1.34	1.09	1.09	1.60	1.46
CO	497	493	337.1	1.50	1.46	1.10	1.09	1.65	1.59
CO_2	396	393	259.4	1.52	1.51	1.10	1.13	1.67	1.71
Mean value for a monatomic gas:								1.64	1.57

*) $k_1 = 1.66$ for a monatomic gas; $k_2 = 1.40$ for a biatomic gas like the air or hydrogen; $k_2 = 1.36$ for CO and CO_2 in the older values. But in the newer values air, hydrogen and CO have $k_2 = 1.40$, and CO_2 has $k_2 = 1.30$, from the data given by *Jeans*.

It thus appears from the most reliable data available that the ratio should be larger than *Maxwell* indicated by about 17%. His processes of calculation are not known, but a theoretical ground for the above result may be deduced as follows. Consider the particles of a monatomic gas to move with the velocity $\bar{v}$, as in the reference circle, in simple harmonic motion, while the wave advances across the diameter of the circle with the velocity V. Then it is evident that the two motions are in the ratio of π to 2, which gives 1.5707963, in exact agreement with the above value as corrected for a monatomic gas.

This theoretical and practical conclusion is confirmed also by the profound researches of *Airy* on Tides and Waves, Encyclopedia Metropolitana, 1845. In Plate I, fig. 27, we find a very exact representation of the motions of the elements which go to make up the form of a wave in water. As the wave advances these elements describe small circles about a mean position, while the forward and backward motion incident to the passing of the wave is over two diameters of the elementary circles, giving the obvious ratio $2\pi/4 = 1.57$, as before. It was from the study of *Airy*'s researches that I became doubtful of the numerical accuracy of *Maxwell*'s result, and was led to subject the theory to a practical as well as a theoretical test.

If therefore light be observed to have a velocity of 300000 kms per second, the particles of the aether will have an average molecular velocity of 471239 kms per second. This is a very important result, and it confirms the general theory outlined by *Preston* and *Maxwell*, though the details of their processes are altered.

4. Exact Calculation shows the elastic power of the aether to be 689321600000 times greater than that of our air in proportion to its density: Thus it cannot be disrupted by any known force, and only the quick action of dynamite will generate waves in it.

In the »Electrodynamic Wave Theory of Phys. Forc.«, I, 1917, the writer has referred the chief forces of nature to wave action, and explained the mode of wave action for gravitation, magnetism, electrodynamic action, etc. As the aether was taken to be corpuscular, yet known to behave like an elastic solid, owing to the enormous velocity of the particles, the elasticity was recognized to be adequate to produce the postulated dynamical effects, but it is highly desirable to have this working hypothesis for so important a constant verified by exact calculation.

In the passage above cited from the Optics, 1721, p. 325, *Newton* gave the first outlines of a correct theory of the elasticity of the aether. It was subsequently rediscussed by Sir *John Herschel*, in the well known address on light, (Familiar Lectures on Scientific Subjects, London, 1867, p. 282); yet owing to the importance of an understanding of the elasticity of the medium for the Electrod. Wave-Theory of Phys. Forc., I have reexamined the whole subject. The present results establish beyond doubt the almost infinite power of expansion and contraction always operating in the aether for generating the stupendous physical forces observed throughout nature.

It is therefore certain that wave action in such an elastic medium is adequate to account for all the varied