movements of individual particles. If the first is true, the same conditions must apply to the transmission of radiant energy, as to the propagation of sound. Sound travels through air with a velocity of 330 miles per second, at 0° cent.

Taking for an example a sound produced by a body vibrating 20,000 times per second and dividing the velocity of sound by this number, we have as the wave length 16.5 mm. Clausius has shown that the mean free path of an oxygen molecule is 5000 times its diameter. Taking $\frac{1}{5 \times 10^7}$ mm. as the diameter, we have 10^4 mm. as the mean free path of an oxygen molecule, and dividing the length of the sound wave calculated above, by this number we have 1665×10^4, or the length of the wave of this extremely high note, is 1665×10^4 times longer than the mean free path of an oxygen molecule, hence it is evident that the propagation of sound is dependent primarily upon the movement of aggregates of molecules.

The elasticity of the ether is assured to be many times greater than that of the most perfect gas. Assuming that it is 1000 times more elastic than oxygen gas, the average distance between the surfaces of the particles must be 1000 times greater than the average distance between the surfaces of the oxygen molecules.

Taking as the mean free path of an oxygen molecule, 10^4 mm., the distance between the particles of ether would be .1 mm. Now the wave length of a certain ray of red light is .000,609 mm., hence the average distance between the particles is 164 times as great as this particular wave length. It follows from this, that the transmission of radiant energy, through such an elastic medium as the ether, cannot be in any way comparable with the propagation of sound through air. If the energy is not transmitted in this manner, then it must be transmitted in the second way, *i. e.*, by the movements of individual particles. But with an ether as elastic as generally assumed, this is impossible, since the average distance between the particles is 164 times as great as the length of a comparatively long undulation, and it would be absurd to say that a vibrating molecule could, by impact with a particle of ether, send the particle 5000 times the diameter of the molecule, and further, that the particle would return from this long journey in time for the next vibration. Even assuming that the particles of ether could move fast enough to accomplish this movement in each vibration, then if the molecules are circular, the particle would have to return in a line that was normal to the surface of the molecule at the point of contact, or it would fly off in another direction after impact with the molecule, and as the particles are so far apart, as compared with the diameters of the molecules, if one particle was driven off there would be no other to take its place. There would also be required a series of particles in a straight line between the body receiving and the body radiating energy.

But it is needless to enlarge upon this method of transmitting radiant energy, for the constant length of undulation and undulatory motion itself, would be impossible in a medium, in which the average distance between the particles was 164 times as long as an undulation.

The only discontinuous medium through which radiant energy *could* be transmitted, would be one in which the average distance between the particles was a small fraction of an undulation. But in a medium of this sort there would be hardly any chance for compression, much less than in oxygen gas, and to assume that ether is less elastic than a gas, is contrary to the theory of discontinuous ether. As a discontinuous ether will not answer the requirements, we must, if we assume *any* ether, assume a continuous one. By means of a continuous ether all the phenomena of light can be explained. One is inclined, however, to apply to a continuous ether the same reasoning as is applied to matter. But as ether is not matter, we cannot with justice attribute to it any of the properties of matter except extension and elasticity, and till we are much farther advanced in our knowledge of the universe, it will be impossible to say anything about ether, except to assume its existence and its continuity. B.

THE COMET.

The comet was seen from this Observatory at 14h. 30m., June 22, 1881. The latitude of the place is 41° 13′; longitude from Washington in time, 53m. 48s. This longitude is approximate, as we have no transit, and being without a correct astronomical clock, are continually annoyed for want of true time. The latitude is somewhat indeterminate, as the declination circle has no Vernier, reading seconds. The telescope (a fine 6 inch Alvan Clark & Sons), is not precisely in the meridian, and we are unable to place it there with accuracy, having no micrometer. With all these hindrances, the adjustment is such that catalogued stars are always in field with power of 60, but in many cases fail to come to the centre or line of collimation. When observation was first made the declination was 43° 10′, then make δ=the declination = 43° 10′, and λ = the latitude of New Windsor = 41° 13′, and take:

log. tan. δ = - - - -	9.972,188
log. tan. λ = - - - -	9.942,478
log. sin. 55° 15′= - - -	9.914,666

which being converted into time = 3h. 41m.; and 6h. — 3h. 41m. = 2h. 19m., A. M., June 23, mean local time in New Windsor, or time of comet's rising, that is, of the nucleus. The tail being several degrees long and direected towards Polaris, was above the horizon some time before.

Had the horizon been water, the nucleus would have come in sight at 2.19, as it was, an interval of 11m. was required to bring it above undulations of the earth. We thought best not to telegraph before seeing the nucleus, but as soon as we positively knew the apparition to be a comet, haste was made to send dispatch. The village is on a branch railroad and telegraph offices are not open nights, so we had to send to the residence of the operator, arouse and engage him to go to the office and send telegram. This took time, and it was not until after 3 A. M. that message was sent. Meanwhile we endeavored to place telescope on nucleus but were unable to, as there was a tree in range, causing another delay until 3.30, when observation was made—the nucleus being an hour above horizon and in apparent

R. A. - - - - - - -	5h. 34m,
δ - - - - - - -	43° 10′

a rough position, as no corrections were made for refraction or parallax.

The telegram read: "Vast comet in northeastern heavens." After mature consideration we regret using so many words, one only—"Comet,"—was all that was necessary, when the acute observer, Swift, would have been on the alert at once. Before sunrise we were favored with 30 minutes good definition, when two envelopes were seen, the nucleus extending a bridge to the external surface of the inner one. Since, the nucleus has changed form, is no longer round, but has prolonged into a beak-shaped mass, and looks like Comet III., 1862, August 29, as drawn by Challis (Chambers' Astronomy, p. 322). The cometary matter is of great tenuity, as it was seen to run over a sixth magnitude star at 10h. June 28, which passed about 15″ from nucleus, yet it was visible through the immense volume of gas.

The comet was seen from many points in the Western States twenty-four hours before noticed at this place, by steamboat hands, street-car drivers, railroad conductors, night-watchmen, policemen and many others whose business required them to be out all night.

NEW WINDSOR, ILL., *July 1st*, 1881. EDGAR L. LARKIN.