Mean of the above series.

=	+
1.44	1.00
2.00	1.01
1.45	1.00
1.71	1.07
1.67	1.19
1.50	1.00
2.00	1.01
Means, 1.68	1.04

$$\text{Per cent. } \frac{1.68 - 1.04}{1.68} = 38.1.$$

Thus with the apparatus working most perfectly, the analyzer succeeded in extinguishing or quenching 38 per cent. of the polarized wave, a percentage too great to be mistaken. Considering the analyzer and polarizer as equally efficient, the real percentage of polarization by polarizer would be 62 per cent., and of the analyzer 62 per cent., as is evident from the fact that 62 per cent. of 62 per cent, is 38 per cent. Thus, either part of the apparatus obliterates over half of the wave attempting transmission, a fraction which would be unmistakably visible in polarized light.

These results establish the following facts for sound waves or for undulations, viz.:

1st. A decided reflection occurs at a surface separating two gases of different density, confirming the views of Henry and Tyndall in this regard.

2d. In repeated reflection from such surfaces the intensity of the final component varies with the relative positions of those surfaces, the same following the laws of polarization in light, from which we conclude that longitudinal undulations can be polarized.

With sound polarized, we complete the list of effects for longitudinal undulations which are known to light, viz.: radiation, shadows, reflection, refraction, diffusion, diffraction, interference and polarization; for the laws are common for like conditions, viz.: for intensity of radiation in ambient space, $\frac{I}{d^2}$; in parallel space, $\frac{I}{d^1}$; in prismatic space, like a tube, $\frac{I}{d^0}$; for shadows, reflection, refraction and interference as well known; for diffusion, as when a steam whistle is sounded, filling the air with its resounding ring; for diffraction, as sound waves diverging rapidly after passing a narrow space between buildings, like light in passing a narrow slit and diverging; and, finally, for polarization, as above. In studying these comparisons we should recollect the vast difference between the properties of undulations in heavy, and ethereal media. Thus the wave length is very great and the velocity of propagation very small in sound as compared with light. This seems sufficient to account for the greater definition of shadows in light; but when a slit or an obstacle is made as narrow for light as for sound, in comparison to wave length, the diffraction divergence is probably about alike; that is, the divergence at a linear slit in light, or between two buildings in sound; or again the shadow of a silk fibre in light and a sound shadow of Bunker Hill monument, for instance, are about alike considering wave length. With these considerations it may be reasonable to expect incomplete or only partial polarization with such apparatus as employed above.

The conclusions to which we are conducted by the foregoing may be summed up as follows:

1st. That vibrations in extended media, produced from the action of a remote single centre of disturbance, can only be longitudinal, even in light.

2d. That vibrations will be to some extent transversal when due to two or more centres of disturbance not in the same line, as when two or more independent coexistent systems of undulations combine into one, or when a simple system is modified by such lateral disturbance as a reflection or a refraction.

3d. That undulations, to be in a condition called polarized, probably consist of vibrations which are transversal, and that no necessity exists for assuming vibrations transversal in front of a polarizer.

NOTE.—As regards longitudinal, oblique, transversal, etc., in the foregoing, the estimate is to be taken by comparing the direction of the line of vibration of a particle with that of propagation of the wave.

My acknowledgements are due to Mr. Clarence H. Wright, who, while a student in my physical laboratory last Spring, rendered valuable aid in the experimental work.

ASTRONOMY.

COMET (*a*) 1881—SWIFT.

The question of the best method of transmitting telegraphic announcements of astronomical discoveries has just been discussed by the leading European societies, and a system has been devised by which this information may be comprised in a message of sixteen words. Thinking that perhaps a better way existed of doing the same work, the Boston Scientific Society has adapted a telegraphic code to the needs of the occasion, and this system has just received a practical test. The announcements lie within the province of the Smithsonian Institution, and it was accordingly decided to transmit by cable the elements and ephemeris. These here given were computed at Dun Echt Observatory, in Scotland, by Drs. Copeland and Lohse, and have been distributed in this country to astronomers by special circulars of the Boston Scientific Society. That set which was computed at Boston, for the Society, by Mr. S. C. Chandler, Jr., has already been cabled to Europe, and distributed by mail, from the Observatory of Lord Crawford, to astronomers in England and the Continent.

The cablegram received at Boston consisted of sixteen words, and the translation is here appended. According to the same code, the announcement of discovery could be comprised in a message of seven words, which would itself contain check words against possible error in transmission.

The elements and ephemeris computed at Dun Echt, on Monday, May 9, were transmitted by cable to Boston in the following message: "Decimosexto erective contextual bewitchery anticly demonstrative courageously sputter arithmancy stomachical auriferous suety bayou synecdochically bissextile eminently." The translation of this message is as follows, viz:

ELEMENTS OF SWIFT'S COMET, 1881 (*a*).

Per. Passage, 1881, May 20.67, Greenwich Mean Time.

	°	′	
Long. Perihelion,	300	2	Eq. 1881.0.
Long. Node,	124	54	
$\omega = \pi - \Omega$,	175	8	
Inclination,	78	48	
Log. $q = 9.7674$.	$q = 5854$.		
Motion direct.			

EPHEMERIS.

Greenwich, midnight.	A.R. h.	m.	s.	DECL. °	′	Brightness.
May 10,	0	38	32	+26	46	1.69
14,		56	48	21	35	
18,	1	17	32	15	54	
22,		40	48	9	55	2.32

Computed by Dr. R. Copeland and J. G. Lohse, from observations made at Dun Echt Observatory. The light at discovery is taken as unity.

By means of control-words in the message, it is absolutely known that the elements are those computed yesterday in Scotland, and it is proposed to cable in the same way the first elements and ephemerides of future comets, obtainable at either terminus, until the code has been most thoroughly tested. J. RITCHIE, JR.