I = the moment of inertia of the suspended system about the line of suspension = 423·22 gm.cm[2].

The mean value of 51 determinations of η for dry air at temperatures between 18·9° and 20·9° is

$\eta_{20°} = (1820 \cdot 0 \pm 3 \cdot 0) \times 10^{-7}$ corresponding to
$\eta_{23°} = (1834 \cdot 8 \pm 3 \cdot 0) \times 10^{-7}$.

From this we get

$$e = \left(\frac{1834 \cdot 8}{1822 \cdot 6}\right)^{3/2} \times 4 \cdot 770 \times 10^{-10} = (4 \cdot 818 \pm 0 \cdot 012) \times 10^{-10} \text{ E.S.U.},$$

the uncertainty stated being due only to the viscosity, other sources of error not being considered here.

I am, therefore, of the opinion that the discrepancy between the 'oil drop value' of e and the 'X-ray value' can be explained by the error in η.

A more detailed report will be published elsewhere.

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[1] K. Shiba, *Scient. Pap. Inst. Phys. Chem. Res., Tokyo*, **19**, 97; 1932. 21, 128; 1933.
[2] L. Gilchrist, *Phys. Rev.*, **1**, 124; 1913.
[3] E. L. Harrington, *Phys. Rev.*, **8**, 738; 1916.

Nature of Atmospherics

A SYSTEMATIC study of atmospherics was recently commenced in this laboratory (lat. 11° 25′ N., long. 79° 44′ E.), in view of the importance of the problem in connexion with broadcasting in the tropics. A tuned receiver and a galvanometer of period 1 second were used to record photographically the atmospherics. The results obtained during the months of October and November 1934 (a period during which the atmospheric activity was extremely severe) are of much interest, in connexion with the discrepancies observed between the results for the average duration of atmospherics as recorded by several investigators.

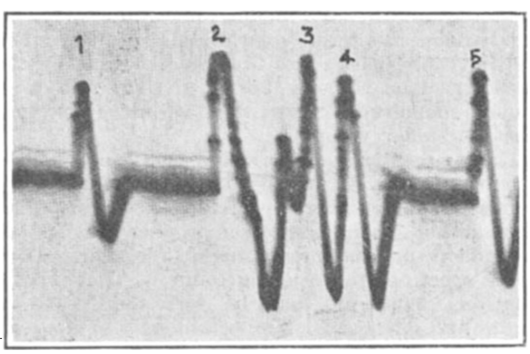

FIG. 1.

In the accompanying illustration (Fig. 1), which is an enlargement of a section of one of the records, certain thickenings are observed along the trace of the galvanometer motion. The number of thickenings or dots, which indicate the number of separate impulses received by the galvanometer in any given interval, can be arranged into groups taking into consideration the rate at which they succeed each other. The curves show that the number of components in groups 1–5 are 4, 12, 8, 10 and 6 respectively. The total duration of each 'atmospheric' is about ½ second. The number of components as indicated by the dots range from 4 to 12. These separate impulses may be due to the separate strokes ranging in number from 1 to 12, constituting a lightning discharge, observed by Schonland and Collens[1].

These individual strokes themselves may be composite, but their nature cannot be recorded or indicated by instruments of periods 0·1–1 sec. The peaks in the records of Munro and Webster[2] may be taken to correspond to the thickenings or the dots in the curves reproduced here.

The dots indicate what may be called the *gross structure* of the atmospheric. In addition to this, there is also evidence of a *fine structure* as revealed by the cathode ray oscillograph records of Watt and Appleton[3]. The durations as observed by them are of the order of milli-seconds, and in many cases the main structure of the atmospheric was supplemented by ripples superposed on the growth and decay slopes. The variations observed during these small intervals may be referred to as the *fine structure* of the components of an atmospheric and are probably due to lightning discharges succeeding each other at intervals of the order of milli-seconds.

The records reproduced here throw light on the discrepancies between the observations of lightning flashes reported by Schonland and Collens, Boys[4] and Halliday[5] on one hand, and Munro and Webster[2] on the other. The former authors record about 10–12 component flashes, whereas the latter have observed up to fifty. Although this difference may be explained according to Munro and Webster[2] on the supposition that a multitude of small flashes occur within the cloud and hence could not be recorded by the camera, there is another explanation which is in agreement with all the observations.

Taking into account the results outlined above, the close agreement between the number of components of an atmospheric as recorded by instruments of relatively long periods (0·1–1 sec.) and the number of lightning flashes recorded by moving lens cameras, and also the complex nature of these components revealed by the work of Watt and Appleton[3], it appears reasonable to suppose that the fifty flashes observed by Munro and Webster are not in the same temporal relation with one another. These can be divided into 10 or 12 groups, each group being separated from the previous one by periods of the order of 0·1 second. Each group may consist of 4 or 5 flashes (occurring either inside the cloud or outside visibly) succeeding each other at intervals of the order of milli-seconds and giving rise to what has been described as the fine structure.

This view is supported by the recent work of Appleton and Chapman[6] on lightning flashes, and is in agreement with the facts revealed by the cathode ray oscillograph and by instruments of much larger periods and with all the observations on lightning flashes recorded so far, as well as with the audible effects produced in a wireless receiver.

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[5] *Phil. Mag.*, **15**, 409; 1933.
[6] NATURE, **134**, 968; 1934.