Letters to the Editor

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Air Waves of Unknown Origin

WITH the object of investigating the passage of waves through the atmosphere to great distances, sets of hot wire microphones are maintained at a number of stations and operated when it is announced that heavy guns are to be fired. Most of the firing which can be utilised for the purpose takes place at Woolwich, but by the courtesy of the Admiralty it is sometimes possible to take advantage of firing by H.M. ships.

During May last, there were three occasions when firing in West Bay near Portland was anticipated and microphones were in operation at the recording stations. On the last occasion, May 29, the firing which was arranged to take place between 10 and 10.30 B.S.T. had been postponed for several hours but this was not known to the operators. No air waves were recorded at any of the stations except Nottingham, but there, in an interval of less than two minutes, from 10.59.35 to 11.1.19 B.S.T. nine distinct air waves were recorded. The spacing of these was rather irregular and there was a decrease in intensity from the first to the last (Fig. 1).

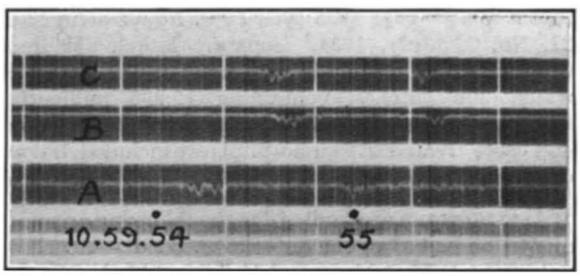

FIG. 1. Microphone records of air waves at Nottingham on May 29, 1934. Receptions 3 and 4. Microphone *B* is 243 m. 35° east of north of *A*; microphone *C* is 311 m. 14° west of north of *A*.

The station at Cefn Mably (Cardiff) was in operation up to 11.0.18. The records at Birmingham and Bristol had stopped at 10.49 and 10.40 respectively.

There are three microphones at Nottingham, so that, from estimates of the intervals between the receptions of waves, the bearing of the source of the waves and the inclination of the trajectory to the horizon can be determined. In this case the bearing of the source was 36° west of south and the angle of descent was 51°. Such a large angle of descent has never been recorded before and therefore the identification of the source is much to be desired.

A line through Nottingham on the correct bearing would pass through Plymouth and near Finisterre. It has been ascertained that there was no naval gun practice near Plymouth. Possibly there was firing near the French coast or blasting at quarries in Cornwall or in Brittany. It is likely that the waves passed over Cefn Mably at a great height. The extraordinary angle of descent of the waves implies that they must have attained a height at which the velocity of sound relative to the ground was about 550 metres per second. This is the velocity of sound in still air at about 1000° A. The alternatives are therefore offered. Was the temperature on May 29 at a certain height of the order 1000° A. (700° C.); was there a wind of the order 200 metres per second (400 miles per hour)? Did very high temperature and very strong wind co-operate?

If we knew where the explosions were produced and the exact times, we could determine approximately the height at which these remarkable conditions prevailed; it is therefore hoped that such information as to the explosions will be obtained. We should be grateful for any assistance.

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Supraconductivity and Fermi-Dirac Statistics

IT is an established fact[1] that the specific heat of some elements in the non-supraconductive state (zinc, silver) does not follow Debye's T^3-law at low temperatures. The deviations seem to be caused by a gas of free electrons, which follow the Fermi-Dirac statistics. So the specific heat of a non-supraconductive elementary substance is:

$$c_n = c\,T^3 + \gamma\,T, \qquad (1)$$

γT being the specific heat of the free electrons according to Sommerfeld[2]. Now it is possible to derive thermodynamically the difference[3] between the specific heat of the supraconductive state (c_s) and c_n:

$$\Delta c = c_s - c_n = \frac{V\,T}{4\pi}\left\{\left(\frac{dH}{dT}\right)^2 + H\,\frac{d^2H}{dT^2}\right\}, \qquad (2)$$

H being the threshold value and V the atomic volume at the temperature considered, or, by assuming the curve of the threshold values to be a parabola[4] ($H = -aT^2 + b$)

$$c_s = \left(c + \frac{3\,a^2\,V}{2\,\pi}\right) T^3 + \left(\gamma - \frac{a\,b\,V}{2\,\pi}\right) T. \qquad (3)$$

Now experiments suggest that in the case of tin and thallium, c_s follows a T^3-law[5]. So the second term of the second member of equation (3) has no appreciable value:

$$\frac{a\,b\,V}{2\,\pi} = \gamma. \qquad (4)$$

This relation can be verified (Table I). In the calculation of γ we assumed the number of the electrons per atom (n) to be equal to their valency. (If n does not equal the valency, the agreement is not so good, but n has only a relatively small influence, as γ is proportional to its cube root.)

TABLE I.

Element	a (gauss/°K²)	b (gauss)	V (cm.³)	$\frac{abV}{2\pi} \times 10^4$ (cal./°K²)	n	$\gamma \times 10^4$ (cal./°K²)
Tl	29·11	163·5	16·9	3·06	3	3·10
Sn	20·35	280·7	14·2	3·08	4	3·03
In	20·86	237·0	15·8	2·96	3	2·97

The agreement is surprising.