From these results it is clear that two spectra are obtainable from solid nitrogen, one of which includes the band group N_1, and the other the bands N_2 and N_4. This would go to show that solid nitrogen can exist in two forms A and B, the one, A, emitting the radiation constituting the band N_1, and the other, B, the radiation constituting the band groups N_2 and N_4. Our experiments support the view that the solid nitrogen is initially deposited in the form A, and that under electronic bombardment, and possibly otherwise, it is soon transmuted into the form B, this form B being the one that exhibits the phenomenon of phosphorescence.

4. The band group N_2 as originally observed by Vegard and by McLennan and Shrum, consisted of a single sharply defined narrow band at approximately λ 5230. This band has been found, however, to be more extensive than was originally supposed, for, as shown above, it is now known to consist of at least eight strong and well-defined members. Since no band of anything like this character has ever been shown to be a feature of the spectrum of the aurora, in the neighbourhood of λ 5230, it would appear that Vegard's theory that finely divided solid nitrogen exists in that portion of the upper atmosphere where auroral displays originate is not tenable.

The bands N_1, N_2, and N_4 are shown in Fig. 1, and the bands N_2 in Fig. 2.

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The Physical Laboratories,
University of Toronto, August 20

Polarisation of Wireless Waves.

IT is now generally accepted that many of the phenomena of wireless reception are caused by the interference between two waves, one of which has received reflection or refraction in the upper layers of the atmosphere. Considerable evidence is also now forthcoming of a fact which was suggested in earlier days; namely, that the reflection is not simple but that a vertically polarised incident wave may be returned with polarisation of a much more complex form. On this are based explanations of night variations in bearing, fading, and similar phenomena; and the subject has also been discussed theoretically by Appleton, Hulbert, and Nicholls and Schelling.

These investigators have confined their attention chiefly to wave-lengths of a few hundred metres at most, and there have been doubts as to whether the longer waves were affected in a similar manner. In a previous paper (*Journal I.E.E.*, No. 353, page 587) the present writer has referred to the elaborate but regular intensity variations occurring at medium distances on long waves during the sunset period, and recent experiments have shown that the cycle given by the transmissions from Sainte Assise (UFT) on 14,350 metres at Slough on page 587 is regularly accompanied by a definite cycle of bearing variation differing slightly in intensity from day to day, but always possessing the same general form. Variations of bearing of as much as 35° have been observed at times, showing that the departure from vertical polarisation must have been large.

Measurements were, therefore, made to see if any quantitative deductions could be made from these results.

Although it is theoretically possible to make use of bearing variations for such a purpose, the accuracy of observation is low owing to the non-silent minima which often occur, and it was found preferable to take three measurements of absolute electrical intensity: (*a*) in the plane of propagation; (*b*) in a vertical plane at right angles to this; (*c*) in any convenient intermediate plane from which the results can equally well be deduced.

In some cases it has been found that the intensity (*b*) actually exceeded the intensity (*a*) for short periods.

Now, in the general case of elliptic polarisation these results do not admit of any further solution, but by making the further assumptions: (i.) that second reflections are not present; (ii.) that the downcoming wave remains plane polarised but that the plane of polarisation is rotated, it is possible to deduce figures for this angle of rotation and for the coefficient of reflection.

Observations taken at Slough and Exeter under these conditions show that during the sunset period a rapid rise in the coefficient of reflection occurs and also a rotation of the plane of polarisation of at least 90°, most of which persists throughout the night. It remains to be verified whether assumptions (i.) and (ii.) are justifiable, though there is evidence in their favour; but the two chief facts which emerge from the tests are independent of them. These are:

I. Long waves as well as short may be elaborately polarised by refraction in the upper atmosphere during the night.

This effect is also present, though in a less degree, during daylight in the winter, and occasionally even during daylight in the summer.

II. The effect persists during the hours of darkness, remaining fairly steady after the sunset period is over; and consequently it cannot be caused by the mere temporary displacement of the reflecting surface from its normal horizontal position owing to the ionic recombination which occurs at sunset; but must be an essential feature of the mode of refraction.

Further experiments on this point are in progress, but as the solution requires the construction of a vector triangle the conditions have to be very carefully chosen in order to avoid indeterminate figures due to the limitations of the geometrical process. The experiments referred to above were carried out for the Radio Research Board of the Dept. of Scientific and Industrial Research.

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National Physical Laboratory,
Teddington,
August 31, 1926.

Plastic Deformation of Single Metallic Crystals.

NATURE has published two letters from Mr. S. J. Wright and Dr. Goucher respectively (June 26 and July 31) in reply to ours of May 22 on the wedge formed when a single crystal of a metal is broken in tension. We desire in reply to stress most strongly the fact that our analysis of such a wedge is concerned with the final position of an atom after movement and has no reference to the path or the mechanism by which it arrived there. This concerns directly both of the communications.

Mr. Wright's insistence on the fact that the wedges examined by him were bounded by curved surfaces, means no more than that the ultimate displacement of the atoms of his test-pieces was greater in some localities than in others and has no bearing whatever on the validity of our treatment. His remarks *re* hard spheres are similarly wide of the mark, since we have not made assumptions of any kind as to the mechanical properties of the atom in its response to the stress.