as simply a symbol for $4\pi[VD] = [VJ]$, that magnetism may with advantage be eliminated from all fundamental physical discussions, and that it may be possible to express the forces associated with protons and electrons at rest and in uniform and accelerated motion by a single comprehensive formula, thus eliminating both the curl- and flux-cutting equations. Such a change would be a great help towards clarifying fundamental problems, but it will take some time to formulate and assimilate, and in the meantime the flux-cutting equations and the simple physical concepts to which they lead should greatly facilitate the teaching and application of the Maxwellian theory.

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Radio Fadeouts, Auroras and Magnetic Storms

FROM observations made in the South Island of New Zealand we may add to the data already published in NATURE on the connexion between the radio fadeouts, auroras and magnetic storms of the two periods January 20–22 and January 24–26, 1937.

As reported from Canberra[1], the first of these periods of activity began with solar activity and poor reflection of wireless waves from the ionosphere. The wireless observations in New Zealand do not correspond exactly with those of Canberra. On beginning observations of the reflection of waves from the F_2 region at 2100 G.M.T. on January 20 no reflected wave could be observed and this fadeout lasted until 2305 hours, after which time weak echoes were obtained.

Magnetic conditions were moderately stormy during January 20 and 21 and an aurora was observed over New Zealand with its maximum phase at 0945 hours G.M.T., January 21. This faded out at 1100 hours. The magnetic storminess culminated in a major storm beginning at 0240 G.M.T., January 22 and during the entire night an intense auroral display occurred in the southern hemisphere with its maximum phase at 1045 G.M.T., January 22, when it was seen in Canberra.

The interval from 2100 hours January 20, when the radio fadeout was first observed, until 0240 hours January 22, when the magnetic storm began, is about 30 hours.

The intense aurora which accompanied the storm probably began during daylight, since complex echoes from the ionosphere which accompany such activity were observed.

On January 24 the Christchurch observations of the radio fadeout corresponded exactly to those made at Canberra. An interesting feature of the following period not already reported is that a good auroral display began in the southern hemisphere about the time of commencement of the magnetic storm at 1150 G.M.T., January 25. Through cloudiness it was not seen until 1315 G.M.T., but from the stage of development at that time it had probably started earlier.

This was in all probability the beginning of a period of world-wide auroral activity. The southern aurora mentioned above was followed by the intense aurora in the northern hemisphere[2] from 1800 G.M.T., January 25, until about 0230 G.M.T., January 26. This in turn was followed by another southern aurora observed in the evening from about 0900 h. G.M.T., January 26. It seems reasonable to assume that an intense daylight aurora may have been in progress in the southern hemisphere at the same time as that observed in the northern hemisphere, for during the whole period of ionospheric observations in Christchurch from 2100 hours, January 25, until 0530 hours, January 26, no echoes could be received from the ionosphere. The magnetic storm was in progress during most of this period.

The above auroral observations show that the estimated time interval of 39[1] hours from the solar eruption (at 0250 G.M.T., January 24) to the commencement of the aurora is too large, but that this interval should be about the same as that to the commencement of the magnetic storm, i.e., approximately 33 hours.

Ionospheric conditions in Christchurch appear to be similar to those observed at Tromsø by Appleton[3] during a magnetic storm and auroral display. It is found, for example, that 'no echo' periods often occur in the morning following a night of magnetic and auroral activity. The fadeout at 2100 G.M.T., January 20, may be of this type although no auroral or magnetic activity is known to have preceded it. Radio fadeouts coinciding in time with solar eruptions are observed as well as the periods of 'no echo' mentioned above. It would appear, therefore, that in high latitudes a radio fadeout may be due to ultraviolet radiation emitted during an eruption or may also be due to ionization by the particle radiation causing the auroras.

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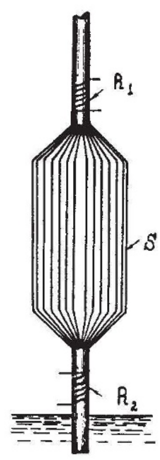
[1] NATURE, **141**, 746 (1938).
[2] NATURE, **141**, 232 (1938).
[3] *Phil. Trans. Roy. Soc.*, A, **236**, 191 (1937).

Further Experiments on Liquid Helium II

IN a previous note[1], we reported our investigation of the formation of a thin film of liquid helium II on the walls of a tube which is in contact with it. A very rough estimation of the thickness of the film was made from the amount of heat necessary for its destruction; it was found to be of the order 10^{-5} cm. The object of the further research was a direct determination of the thickness of the film.



The apparatus for the measurements is shown in the accompanying diagram. Here S is a cylinder of a great area, on the upper and lower part of which are soldered two tubes 4 mm. in diameter. A resistance thermometer R_1 of phosphor bronze wire 0·051 mm. thick is wound on the upper tube; a heating coil R_2 of constantan wire 0·1 mm. thick is wound on the lower tube. The lower part of the apparatus is immersed in liquid helium so that the heating coil is above the level of the liquid. In the presence of a