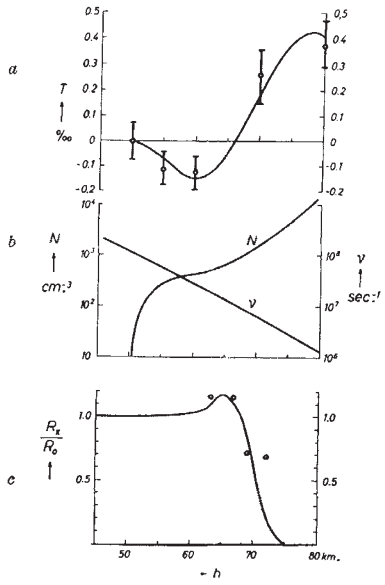

Fig. 3. Results obtained during a disturbed period near Tromsö.

results obtained, by showing some results from a selected period when weak, but still quite stable echoes were observed. In Fig. 3*a* the observed values of cross modulation are shown. The observations were obtained as mean values during the period 2000—2200 M.E.T. on November 26. The ionosonde recordings in Tromsö (20 km. from the observing station), showed no echoes at 2000h., and only faint indications of echoes at 2100h. and 2200h. The strength of the echoes on 2·7 Mc./s. was of the order of 40 db. below the strength obtained during quiet conditions.

In Fig. 3*b* we have shown the electron density profile deduced from the smooth curve of Fig. 3*a*, together with the ν curve. In Fig. 3*c* the measured values of the ratio between the amplitudes of extraordinary and ordinary waves are shown. The smooth curve is deduced from the electron-density profile of Fig. 3*b*. The partial reflexion measurements were made in a short period round 2130 M.E.T.

Fig. 3 showed that consistent results were obtained by the two different methods. Rather low frequencies were used in this first short series of observations both for the disturbing and wanted waves, and it was therefore only possible to make deductions with any certainty about the very low part of the *D* region. New series of observations have been undertaken or planned in which higher frequencies have also been used for the disturbing wave.

In order to be able to convert the observed results into electron density profiles, two assumptions were made, and these will now be briefly discussed.

A value of 3×10^{-3} was assumed for the cooling constant *G*. This value was chosen because it gave the best overall consistency of the cross-modulation results.

Finally a curve was assumed for the collision frequency ν. Our measurements have however provided us with two independent checks of this curve.

(*a*) The measurements of cross-modulation from Tromsö show a transition from negative to positive cross-modulation round 65 km., and the level where this transition should occur is critically dependent on the assumed ν curve.

(*b*) In some cases, no significant differential absorption occurred below the height of the lowest partial reflexions observed, and the measured ratio of the amplitude of the extraordinary and ordinary waves is then determined by ν.

The work reported here has been sponsored in part by the Electronics Research Directorate of the Cambridge Research Center, Air Research and Development Command, U.S. Air Force, through its European Office, under contract *AF* 61(052)-08.

B. BJELLAND
O. HOLT
B. LANDMARK
F. LIED

Norwegian Defence Research Establishment
Kjeller, Norway.
Aug. 4.

[1] Fejer, J. A., *J. Atm. Terr. Phys.*, **7**, 322 (1955).
[2] Gardner, F. F., *ibid.*, **5**, 298 (1954).
[3] Gardner, F. F. and Pawsey, J. L., *ibid.*, **3**, 321 (1953).

A Comparison of Charges on the Electron, Proton and Neutron

WE are gratified that attempts to test the charge-excess hypothesis have begun so soon, but we find the meaning of Hillas and Cranshaw's experiment extremely obscure and we are not able to see that the conclusion claimed follows validly[1].

For example, the ion-trap is well inside the nozzle of the bottle, and any residual charge of the atoms and the gas could readily be compensated by the acquisition of free charges in the nozzle. Although the field produced by any such residual charge would probably itself be insufficient to liberate charges from the material of the nozzle, it would be amply sufficient to drag along charges already liberated. Surface interactions in the nozzle between the fast-moving gas and adsorbed material would very likely lead to production of free charges, and their general presence seems to be confirmed by the drift in potential actually noted. Again, it is not clear what happens to the free charges assumed to be collected by the ion-trap. They would presumably travel to the battery, and this is outside the bottle, the potential of which it is required to measure. The effect of these unbalanced charges is not clear. Furthermore, a potential of the same order as would be expected in the absence of balancing electrons is actually applied to the very box the potential of which it is wished to measure.

The meaning of the observed large ionization current in the air, the fluctuations of the measured current, and the sudden changes of potential, as described, remains quite obscure to us, and it would seem necessary, in view of the minute difference of charge concerned, that much fuller consideration be given to these concomitant effects to establish how they influence the results.

H. BONDI

King's College,
London, W.C.2.

R. A. LYTTLETON

St. John's College,
Cambridge.

[1] Hillas, A. M., and Cranshaw, T. E., *Nature*, **184**, 892 (1959).