Lerwick). It seems probable that some of these (collected on days with no high wind) will give sodium/potassium ratios approaching those of inland stations.

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PHYSICS

Velocity of Light in a Magnetic Field

ONE consequence of classical electromagnetic theory is that the velocity of light *in vacuo* should be unaffected by superposed magnetic or electric fields ; this conclusion is worth checking experimentally whenever a sufficient advance occurs in precision of observation. As regards the constancy of the velocity of light through a vacuum in the presence of a transverse magnetic field, the most precise observations higherto made are probably those of Banwell and Farr[1]. These investigators showed in 1940 by an interferometric technique with photoelectric recording that in a field of 20,000 oersted the change of velocity, if it existed, was unlikely to be much more than an increase of about 30 cm./sec. ; their probable error was about $18\cdot6$ cm./sec.

Recent developments[2] in the photoelectric detection of small deflexions of a beam of light have made it possible to look for deviations of such a beam when passing through a transverse magnetic field shaped to resemble an optical prism ; this shape of field was first applied by Rabi[3] to improve the accuracy of the Stern–Gerlach technique.

The photoelectric detection system has a root-mean-square error of about $1\cdot4 \times 10^{-11}$ radian for a bandwidth of 1 cycle/sec. ; it has been used to look for deviations of the light beam when a field of about 8,000 oersted is switched on and off for alternate 10-sec. periods. By taking 400 observations, giving a total observing time of about 8,000 sec., the error in comparing the directions of the light beam before and after passage through the prismatic field has been reduced to a root-mean-square value of $5\cdot5 \times 10^{-13}$ radian. The average change in direction actually found was $1\cdot8 \times 10^{-13}$ radian, away from the apex of the prism ; since this was only about one-third of the root-mean-square error, we may conclude that no significant deflexion was observed. For nearly one-half of all the observations, unpolarized white light was used ; in the remainder, the same light was plane polarized, with its electric vector first parallel to the magnetic lines of force, and afterwards at 45° to this direction.

The effective prism angle was about 100° ; the angular root-mean-square uncertainty of $5\cdot5 \times 10^{-13}$ radian therefore corresponds to a root-mean-square uncertainty in the constancy of velocity (or of refractive index of the magnetic field) of about $2\cdot3$ parts in 10^{13}. Should the velocity of light be subject to a simple change by as much as 100 micron/sec. in a transverse field of 8,000 oersted, the change ought to have been detected.

While this negative result may have little consequence, the figures indicate that optical deflexion measurements by photoelectric methods can be comparable in precision with maser experiments[4] and Mossbauer techniques[5].

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'Prize' : a Pre-ionized 'Theta' Pinch

WORK has recently begun here on an experiment designated 'Prize'.

'Prize' is an electromagnetic shock-tube using pre-ionization in the *Z* direction followed by a theta pinch ; its main function is to form a high-temperature plasma in deuterium gas by shock heating[1] without the ubiquitous trapped magnetic field usually associated with theta pinches and described elsewhere[2,3].

In the conventional theta pinch the magnetic field is able to penetrate the cold gas before the initial formation of the current sheet. This trapped magnetic field reduces the temperature of the imploding shocked gas since work is done in compressing it ; the field also gives rise to instabilities on the second half-cycle of the discharge[3]. In earlier experiments at Foulness other methods of eliminating trapped magnetic field were tried including the use of a d.c. bias magnetic field to cancel out the trapped field and also plasma injection using a Kolb type '*T*' tube. In 'Prize' a thin annular cylinder of high-conductivity plasma is formed by a linear pinch before the azimuthal currents in the theta piece set up a longitudinal magnetic field. The magnetic piston set up by the currents in the theta piece then drives the thin annular current sheet towards the axis of the shock tube and, due to the high conductivity of the initial pinch, the diffusion of magnetic field into the plasma is considerably reduced.

Figs. 1 and 2 show the geometry of 'Prize'. The linear *Z* pinch is set up between the annular electrodes at each end of the quartz tube ; the 'backstrap' required to form the initial axial current discharge near the walls of the discharge tube, at the point of minimum inductance, is the thin slotted copper cylinder on the outside of the tube. The cylinder is,

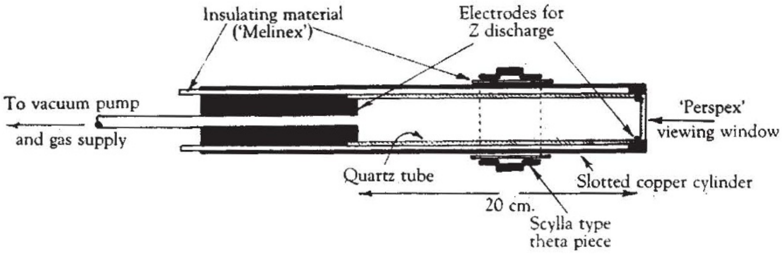

Fig. 1. Cross-section of 'Prize'