in an ethyl alcohol – water vapour mixture at 0° C. and 76 cm. mercury pressure amounts to about 90 ion pairs/cm., a number which is somewhat higher than the value of 79 ion pairs/cm. for alcohol vapour found by Curran and Reid and determined by the method of placing two counters in a spectrograph.

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Directional Correlation between Successive Internal-Conversion Electrons from Tantalum-181*

HAFNIUM-181 decays with a 48 day half-life to a 20-microsecond metastable state[1] of tantalum-181. From this, two γ-rays are emitted in cascade, with internal conversion coefficients $N_e/(N_e + N_\gamma)$ approximately 0·6 and 0·06 [2]. We wish to report some measurements on the directional-correlation between these successive conversion electrons.

2 mgm. of finely divided hafnia, irradiated with slow neutrons in the Harwell pile to give hafnium-181, was used as a source. Self-absorption in the source of the softer conversion electrons was appreciable. Four Geiger–Müller counters with 2·3-mgm./cm.^{2} windows were placed around the source, each 6 cm. away from it. They were arranged as two pairs to measure the instantaneous coincidence-rates C for two angles at the same time. Angles of 90° and 180° have been used, with an angular resolution of $\pm$ 8°. Each counter fed very short pulses (0·3 microsecond) into its coincidence unit, so that delayed coincidences were practically eliminated and the correction for random coincidences was small. The anisotropy was found to be

$$\frac{C\,(180°) - C\,(90°)}{C\,(90°)} = -0{\cdot}32 \pm 0{\cdot}08.$$

Check experiments on secondary electrons from unconverted γ-rays showed that effects from these were small.

Extensions of such experiments are being considered, as well as the theoretical implications regarding the multipolarity of the transitions involved and spins of the corresponding nuclear states.

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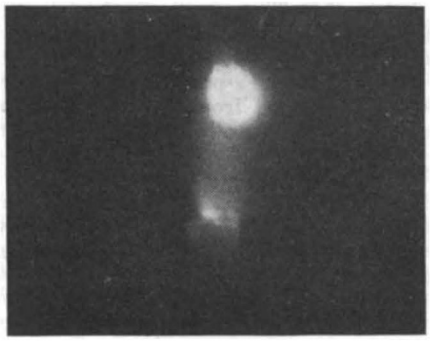
A New Phenomenon in the High-Pressure Mercury Vapour Discharge

THE mechanism of the positive column of the high-pressure mercury vapour discharge appears to be now well understood[1]. It has been a basic assumption in all the theoretical work—and this has been borne out by general experience of the behaviour of the discharge—that the positive column is substantially uniform in all properties along the whole of the distance between the electrodes, at least to within less than a millimetre from the discharge terminations. It is true that there are some exceptions: the column often tends to contract near the electrodes, and in long vertical burning tubes this effect is more marked at the lower end. This contraction is not difficult to understand, and its accentuation at the lower electrode is due to the higher density there compared with that at the upper end of the tube. It is true also that very close to the cathode small intense bright spots may often be seen[2], but it has always seemed likely that this was associated with a purely surface effect on the electrode; and there has been no evidence to suggest that in the high-pressure condition any appreciable degree of axial non-uniformity could be produced.

For some time we have been making observations on discharges in mercury vapour at pressures of the order of 5 atmospheres, and with arc-lengths of the order of 10–20 mm., which are somewhat surprising in view of this long-accepted background.



Bright region in the neighbourhood of the cathode of a high-pressure mercury-vapour discharge showing intense barium spectrum

If a small amount of a relatively easily ionized vapour, such as sodium or barium, is evaporated into the positive column of such a discharge, at high loadings (of the order of 1 kW. per cm. of arc), a large intense region may be produced extending from the cathode over a substantial part of the distance between the electrodes. The accompanying photograph—which was taken through a Wratten 25 filter with a *P*1200 plate—shows the bright region produced in the neighbourhood of the cathode of a D.C. discharge, by the addition of a small quantity of barium vapour to the high-pressure mercury vapour. This bright area has fairly clearly defined edges and radiates an intense Ba spectrum with—less strongly—that of Ba^+. Its luminance is some 40,000 Sb., which is about twice that of the remainder of the arc. The phenomenon in its present form seems to be mainly associated with the cathode function, since it appears at this electrode whatever the position of burning of the arc.

Another property which the photograph incidentally shows is that the intense region can be preferentially deflected in a magnetic field.

There are indications that similar phenomena occur in the rare gases at high pressures.

The fact that quite small quantities of an easily ionizable substance are able profoundly to affect the properties of the positive column is not very unexpected; but that a cathode phenomenon of this magnitude can be so produced is of considerable