Letters to the Editor.

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The Mass Spectra of Zirconium and some other Elements.

AFTER repeated failures I have now succeeded in observing the mass rays of zirconium. Their detection is only possible under very favourable conditions with the most sensitive schumannised plates. Zirconium gives mass lines 90, 92, 94 and a doubtful one at (96), with relative intensities, very roughly, 10, 2, 4, (1) respectively. The masses of the first three can be determined with unusually high accuracy, owing to the incidental presence among them of a faint doublet 93, 95 due to CBr. There is no appearance of asymmetry in the spacing, so that the masses of the isotopes of zirconium must be very closely integral with those of bromine; that is to say, less than whole numbers by about one-tenth of a unit. The atomic weight may therefore be roughly estimated as 91·4 or 91·2, according to whether the mass number 96 is included as an isotope or not.

Successful mass spectra have been obtained with cerium (at. wt. 140·25), which indicate that it consists of a strong component 140 and a weak companion 142. Further experiments with neodymium (at. wt. 144·27) establish its principal isotopes as 142, 144, 146, with a possible (145).

Continuous work with anode mixtures not containing iodide has reduced the intensity of the iodine line sufficiently to warrant a further search for light isotopes of barium. Its principal line 138 has been obtained of great intensity, but there is no trace whatever of any mass number less than 136. There is some evidence of a faint component at 136, and, since the great intensity of the 138 line makes resolution impossible, 137 may also be present. It seems quite certain, however, that, even if both exist, they can only do so in quantity quite inadequate to account for the low value of the atomic weight (137·37) at present in use.

Incidentally, during this work I have obtained mass spectra of silicon under conditions affording satisfactory confirmation of the presence of Si^{30}, previously in some doubt. Its line is a little less intense than that of Si^{29}, in excellent agreement with Mulliken's observations on band spectra (NATURE, March 22 and April 5, pp. 423, 489).

It will be noticed that the above results are on the whole in fair agreement with the predictions made by A. S. Russell. F. W. ASTON.

Cavendish Laboratory, Cambridge,
August 8.

The Zeeman Effect in Strong Magnetic Fields.

IN a recent paper (Proc. Roy. Soc. A, vol. 105, p. 691, 1924), one of us has given an account of a method for the production of intense magnetic fields, with the limitation, however, that the field only lasts for a time of the order of 1/100th sec. We are now investigating the Zeeman effect in these intense fields. These fields allow the use of a quartz spectrograph in place of the usual large concave grating or interferometer, etc.

For the source of light, we have been using a spark produced in a special way from a large high tension condenser battery, and the intensity is sufficient for one spark to produce a spectrum photograph, while most of the emission lines remain quite sharp. The spark takes place in a coil of 5 mm. internal diameter in which the field is produced, and the spark and the current in the coil are timed to occur together.

We have so far investigated mainly the "longitudinal" Zeeman effect (observation in the direction of the lines of force) in fields of about 130,000 gauss as being technically easier than the "transverse" effect. The accompanying photograph (Fig. 1), enlarged from the original six times, shows one of the results. The lines are the first members of the principal series of doublets of ionised calcium (Ca II) and of the sharp series of doublets of aluminium. It is feared, however, that the latter may not show clearly in the reproduction, though they are quite obvious in the original. The magnetic separation is about 3 Å.U.

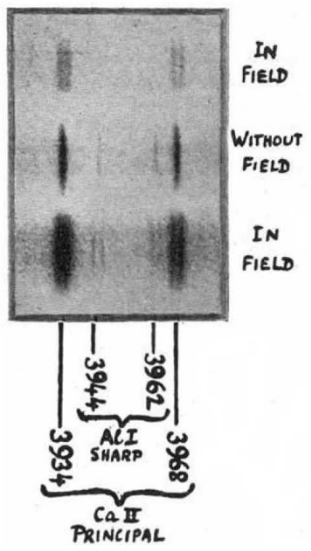

FIG. 1.

Generally speaking, the results so far obtained on lines of various elements indicate that the magnetic splitting is, except for the larger scale, identical with that obtained in ordinary cases. We have, however, observed some interesting cases of the Paschen-Back effect, partial and complete. We may mention in particular the case of the Be group 2650, given by Paschen-Götze as the p, p' group of Be, and as consisting of six extremely close lines. We have found that this group taken as a whole shows the normal Zeeman effect.

We have observed some interesting cases of lines appearing strongly in the spectrum taken in the field which do not appear in the comparison spectrum, and other cases of lines disappearing in the field. A further effect observed is that the lines produced in the field are shifted towards the red by varying amounts. It is possible that this is a kind of pressure effect, due to the production of the spark in the field, and to investigate the matter further, and for other reasons, we hope shortly to deal with absorption spectra. We have also a project for the production of still higher fields (probably up to 250,000 gauss) by cooling the coil with liquid air in order to be able to use more turns in a coil of given resistance.

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July 20.

Biology and Sociology.

I SHOULD like to direct attention to a point connected with the above topic which Dr. Malinowski does not mention in his article in NATURE, July 19.

What is of importance is not the transference of ready-made biological theories to the field of sociology, but rather that the problems of cultural evolution should be approached from the same detached and objective point of view as that of the biologist. Natural selection, for example, can be strictly said to operate