

The mean values of  $a_1^2/a_2^2$  obtained for this pair of lines for indium and gallium, namely 2.35 and 1.55 respectively, may be compared with the value 2.58 obtained by Prof. Vonwiller<sup>1</sup> for the corresponding pair for thallium.

In conclusion, I wish to thank Prof. Vonwiller, who suggested the work, for his continued help and advice.

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<sup>1</sup> *Phys. Rev.*, 35, 7, 802; 1930.

### Absorption Bands of Iodine Vapour at High Temperatures

I HAVE investigated the absorption of iodine vapour in a tube of 26 cm. length at temperatures above 800° C. over the region 2900–5000 Å. and have observed the appearance of a continuous absorption band with a sharp limit at 3425 Å. on the long wave side. With increasing temperature the intensity of this band increases and at 900° C. a new absorption band appears with the long wave limit at 3252 Å. At about 1050° C. both bands extending from 3425 Å. to 3000 Å. change in appearance, showing on the continuous background many close bands. These are extremely diffuse and it was impossible to decide whether they are genuine band heads or due to fluctuations of intensity in the continuous spectrum.

The table below gives the temperature  $t$  and the vapour pressure  $p$  at which each kind of spectrum appears.

| Limit of band. | Broad continuous band appears at |                | Narrow bands appear at |                |
|----------------|----------------------------------|----------------|------------------------|----------------|
|                | $t$                              | $p$ in mm. Hg. | $t$                    | $p$ in mm. Hg. |
| 3425 Å.        | 775°                             | 80             | 1050°                  | 760            |
| 3252 Å.        | 885°                             | 760            | 1050°                  | 760            |

If the vapour has the temperature 1050° C., the broad continuous band at 3252 Å. appears first at a pressure of 150 mm. mercury. Similar experiments were also made with a shorter absorption tube of 13 cm. length and it was found that the length of the tube does not affect the appearance.

The following are peculiar features of these absorption bands: (a) an abrupt limit on the red side which in the region investigated is independent of the temperature between 800° and 1050° C; (b) the maximum of the absorption lies close to the red edge of the band, namely, at 3425 Å.; another less prominent maximum lies at 3252 Å.; (c) the bands extend down to about 3000 Å.

Oldenberg<sup>1</sup>, investigating the influence of foreign gases on ultra-violet fluorescence of the iodine vapour, observed these bands in emission. He found that with increasing pressure of foreign gas the continuous band at 3460 Å. first increases and then spreads into many narrow diffuse bands. The same phenomenon was observed by Cario and Oldenberg<sup>2</sup> in electric discharges through narrow capillary tubes in iodine vapour and by E. Hirschlaff<sup>3</sup> in fluorescing vapour at high temperatures. The narrow absorption bands show an exact agreement with those measured by Oldenberg between 3252 Å. and 3000 Å.; in the region 3425–3252 Å., however, the bands quoted by Oldenberg were not all found and those actually

observed show an irregular increase of  $\Delta\nu$  with the wave-length.

The appearance of these bands in the absorption spectrum seems to contradict Oldenberg's suggestion ascribing their origin to the recombination of iodine ions  $I^+ + I^- = I_2 + h\nu$  (*Ionenvereinigungsleuchten*).

In connexion with the observed absorption band limit at 3425 Å. (800°–1050° C.) it is of interest to note that according to Oldenberg's observation in fluorescence (20° C.), the band limit appears at 3460 Å., whereas Hirschlaff finds it at 3439 Å. also in fluorescence (640° C.).

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<sup>1</sup> O. Oldenberg, *Z. Phys.*, 25, 136; 1924.

<sup>2</sup> G. Cario and O. Oldenberg, *Z. Phys.*, 31, 914; 1925.

<sup>3</sup> E. Hirschlaff, *Z. Phys.*, 75–325; 1932.

### Neutrons

I HAVE obtained the following result, from a unified field theory. Two particles, of charges  $e$ ,  $E$ , and masses  $m$ ,  $M$  exert on each other, apart from the usual electrostatic force, also a 'gravitational' repulsion with a potential

$$\frac{e^2 E^2}{4mc^2} \frac{1}{r^2}$$

if  $M \gg m$ .

If this result is correct, it could account for the existence of neutrons. An electron and a proton are held together in a neutron by combined attractive and repulsive forces which are in statical equilibrium. The size of a neutron is thus  $r = 1.4 \times 10^{13}$  cm., and the binding energy is  $mc^2 \sim 5 \times 10^6$  electron-volts.

Chadwick's values for the size and binding energy of a neutron are  $10^{-12}$ – $10^{-13}$  cm. and  $10^6$  to  $2 \times 10^6$  electron-volts.

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### Preservation of Fossil Bones

REFERRING to the note in NATURE of January 28, p. 129, I have found that the safest and simplest method of hardening permanently and without discoloration the tusk and osseous fragments of the great Mammalia (mammoth and rhinoceros) recently found in the west of Scotland is repeatedly to baste the pieces with a strong solution of gum Dammar. This should be done after the object has become rather dry but before any warping occurs.

The method of treatment will, however, depend upon the condition of the relics. The Scottish pieces which I have handled are now exhibited in Kelvin-grove Museum, Glasgow, and were all found in a very wet and spongy condition, 15–25 ft. under grass-level and in the laminated gravels of the old raised terrace of the Kelvin River, some eight miles east of Glasgow, at about 170 ft. O.D.

Had the pieces been allowed to remain without treatment, disintegration would now have been complete; with an incalculable loss to science.

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