

LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the

twentieth of the preceding month; for the second issue, the fifth of the month. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

The Absorption Spectrum of Diatomic Antimony (Sb_2)

The fluorescence spectrum of Sb_2 has recently been studied by Genard.¹ As Genard points out the absorption spectrum of the Sb_2 molecule has not been investigated before.

0.2 gram of pure antimony metal was sealed off in an evacuated quartz tube provided with plane-sealed-in quartz windows. This tube which served as an absorption vessel was 40 cm long and 2.5 cm in diameter. It also had a side tube through which the absorption tube could be evacuated and this tube was sealed off about 20 cm from the main tube. The absorption tube was inserted into an electric oven which could be heated to 1050°C. A second electric oven was built round the side tube. Both ovens were provided with calibrated thermocouples. The temperatures of both ovens could be kept at any desired temperature by regulating the currents flowing through them by means of resistances.

A hydrogen tube was used as a continuous source, the power being supplied by a 5 kw transformer.

Test plates were first taken with a Hilger E3 spectrograph with the temperature of the main tube varying between 600 and 1050°C while the temperature of the side tube was kept fixed at 600, 700 and 800°C. In this way the pressure of the vapor and the number of antimony molecules in the light path could be varied. It was found that with the side tube at 600°C and the main tube at 800°C an intense absorption spectrum appeared between $\lambda 2300$ and $\lambda 2200$. This spectrum could not be extended by raising the temperature of either tube, but as the pressure of the vapor was increased, complete absorption set in and spread to longer wave-lengths with increasing pressure.

A more extended band system was observed between 3300 and 2840 when the temperature of the main tube was increased to 1000°C, that of the side tube being 700 or 800°C. This spectrum was very sensitive to changes of temperature or pressure of the antimony vapor in the main tube. This band system has been photographed with a Hilger E1 spectrograph and analyzed. The provisional equation representing the heads of the bands observed

may be given as:

$$= 31,605 + [212(v' + \frac{1}{2}) - 0.2(v' + \frac{1}{2})^2] \\ - [268(v'' + \frac{1}{2}) - 0.6(v'' + \frac{1}{2})^2].$$

The constants of the molecule corresponding to the lower state of this system agree with those given by Genard. The upper state appears to be perturbed in the same way as Christy and Naudé² first observed in the spectrum of the S_2 molecule. The band head at $\lambda 2842$ is diffuse and for shorter wave-lengths the spectrum becomes very diffuse. This must probably be ascribed to predissociation.

According to Aston³ antimony has two isotopes: Sb^{121} and Sb^{123} which have the abundance ratio 10 : 8 approximately. One would therefore expect to observe bands corresponding to the molecules $(\text{Sb}^{121})_2$, $\text{Sb}^{121}\text{Sb}^{123}$, and $(\text{Sb}^{123})_2$. If one takes account of the fact that the first and third types of molecule will only have half the number of rotational lines the second type of molecule has, the intensity ratio of the band heads corresponding to the three types of molecule should be 50 : 80 : 30, respectively. Actually the bands at $\lambda 2858$, 2877, 2886, 2895 and 2906 have been observed to show a distinct fine structure which agrees within experimental error with the calculated fine structure. Moreover the head corresponding to the $\text{Sb}^{121}\text{Sb}^{123}$ molecule is the most intense of the three in every case.

A preliminary analysis of the first-mentioned band system indicates that it probably has its lower state in common with the upper state of the latter system.

The work is being continued with a view to establish the perturbations in the upper state with greater accuracy.

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¹ J. Genard, Phys. Rev. **44**, 468 (1933).

² A. Christy and S. M. Naudé, Phys. Rev. **37**, 903 (1931).

³ F. W. Aston, Proc. Roy. Soc. **A132**, 487 (1931).

Flame and Spark-in-Flame Spectra of Rare Earths

While attempting to use the spark-in-flame method of Hultgren¹ for the analysis of rare earth salts, spectrograms of the flame were taken with rare earth salts introduced

in the form of a spray. It was found that lanthanum,

¹ Hultgren, J. A. C. S. **54**, 2324 (1932).