'primary' adsorbate film, and hence the surface charge, might be expected to alter the degree of adsorption. In this manner, a great variety of adsorbents may be prepared.

This work will be discussed in detail in a paper to be published elsewhere.

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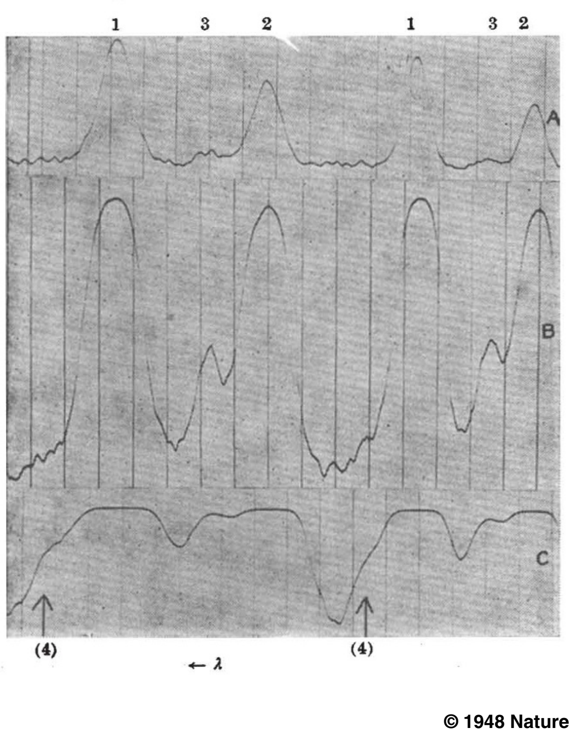
Fine Structure of the Hydrogen α-Line

Though the doublet structure of the Balmer lines has been known for sixty years, attempts at a more complete resolution of the fine structure have met with difficulties owing to the large Doppler width of the individual lines. In the α-line, a third component arising from the transitions $2S_{1/2}$–$3P_{1/2}$ and $2P_{1/2}$–$3S_{1/2}$ was resolved by Williams[1] in 1938, using a deuterium discharge tube in liquid air; but the resolution was not complete enough to allow an accurate measurement of the positions of the components. From these results, Pasternack[2] deduced a displacement of about 0·03 cm.$^{-1}$ of the $2S_{1/2}$ level from its position given by Dirac's theory. This value was no more than a rough estimate, and only through the microwave experiments of Lamb and Retherford[3] was the reality of the shift established.

By using a deuterium discharge tube immersed in liquid hydrogen and run at very low current densities ranging from 2 to 6 milliamp. per sq. cm., we have been able to resolve the third component much more completely, and under conditions where the relative intensities are in qualitative agreement with the theoretical prediction for undisturbed atoms. Fabry-Pérot étalons with spacings of 5 mm. and 7·5 mm. were used.



The photometer tracing A shows the main components (1) and (2), the latter appreciably weaker as predicted by the theory. Tracing B, of a plate with longer exposure, shows the component (3) well resolved from (2). As the result of measurement of thirty-six fringes in eleven different exposures, the spacing (3)–(1) was found to be $0{\cdot}183 \pm 0{\cdot}005$ cm.$^{-1}$.

Though each of the three components is a blend of two unresolved lines, in both (1) and (3) one of the two constituent lines is so weak that its presence has only a small influence, a rough estimate of which is sufficient. With these corrections, our results lead to an upward displacement of the $2S_{1/2}$ level of $0{\cdot}043 \pm 0{\cdot}006$ cm.$^{-1}$.

This value does not agree well with the shift of 0·033 cm.$^{-1}$ found by Lamb and Retherford. These authors do not apparently claim great accuracy for their measurements; but an error of more than 10 per cent would have to be assumed to make them compatible with our results. The values of the radiation shift of the $2S_{1/2}$ level calculated by Bethe[4] and Dyson[5] are 0·033 and 0·034 cm.$^{-1}$, which agree with Lamb and Retherford's measurements, but not so well with ours.

With very long exposures, we have also been able to resolve and to measure a fourth component due to the transition $2P_{3/2}$–$3S_{1/2}$. On account of its small intensity, it had not hitherto been resolved from the fifty times stronger component (1). It can be seen in tracing C, in which the other lines appear broadened by over-exposure. The separation (1)–(4) was found to be $0{\cdot}138 \pm 0{\cdot}006$ cm.$^{-1}$.

The measurement of this new component allows the position of the term $3S_{1/2}$ to be determined. The value 0·138 of the separation (1)–(4) would give the position of the $3S_{1/2}$ term in almost complete agreement with Dirac's theory (only 0·003 cm.$^{-1}$ higher), whereas Bethe's theory predicts an upward shift of 0·011 cm.$^{-1}$. On account of the incomplete resolution, however, we do not claim that our value for this term is completely certain.

Further work is being done in an effort to achieve better resolution.

We are greatly indebted to Prof. F. Simon and his co-workers for the supply of liquid hydrogen.

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Photodisintegration of Deuterium and Beryllium by Thorium C″ γ-Rays

The ratio has been measured between the numbers of neutrons emitted from sources made by placing 300 mC. of radium–thorium in the centre of spheres of heavy water and beryllium respectively. These sources emit neutrons according to the well-known reactions:

$$\mathrm{H}_1^2\,(\gamma,n)\,\mathrm{H}_1^1 - 2{\cdot}18\ \mathrm{MeV}. \qquad (1)$$

and

$$\mathrm{Be}_4^9\,(\gamma,n)\,\mathrm{Be}_4^8 - 1{\cdot}63\ \mathrm{MeV}. \qquad (2)$$

$$[\mathrm{Be}_4^8 \rightarrow 2\mathrm{He}_2^4 + Q].$$