F curve was calculated from the atomic field of Thomas and Fermi as previously employed.

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[1] NATURE, Oct. 4, 1930; *Proc. Nat. Acad. Sci.*, **16**, 814; 1930.
[2] *Phys. Rev.*, **35**, 926; 1930.
[3] *Indian J. Phys.*, **3**, 357; 1928.
[4] *Phys. Rev.*, **32**, 22; 1928.
[5] *Helv. Phys. Acta*, **1**, 518; 1928: cf. also Kirchner, "Allgemeine Physik der Röntgenstrahlen", p. 496.
[6] *Proc. Roy. Soc.*, A, **124**, 121; 1929.

Band Spectrum of Bismuth Hydride.

A BISMUTH arc, operating in a hydrogen atmosphere at reduced pressure (10-20 mm.), emits the line λ4722 of bismuth (Bi) with great brilliance. A faint band spectrum was found to occupy the vicinity of this line. However, using a quartz discharge vessel, fed with 0·5 amp., 1200 v.d.c., and the bismuth vapour distilling at 900° C. through a narrow end-on tube, this band spectrum comes out with great intensity, and so we succeeded in photographing the bands at large dispersion.

The bands are composed of single P- and R-branches, having their lines well resolved, and consequently we assign the system to a $^1\Sigma - {}^1\Sigma$ transition in the bismuth hydride (BiH) molecule. From an analysis of the bands (0, 0), (1, 1), and (1, 0) the following constants were calculated:

$$\nu_0 = 21278{\cdot}3 \text{ cm.}^{-1},$$

$B_0' = 5{\cdot}216$ cm.$^{-1}$,	$B_0'' = 5{\cdot}066$ cm.$^{-1}$,
$a' = 0{\cdot}19$ cm.$^{-1}$,	$a'' = 0{\cdot}16$ cm.$^{-1}$,
$D_0' = -20{\cdot}25 \times 10^{-5}$ cm.$^{-1}$,	$D_0'' = -18{\cdot}5 \times 10^{-5}$ cm.$^{-1}$,
$r_0' = 1{\cdot}791 \times 10^{-8}$ cm.,	$r_0'' = 1{\cdot}818 \times 10^{-8}$ cm.,
ω_0'~1674 cm.$^{-1}$,	ω_0''~1677 cm.$^{-1}$,
$\omega_0' x'$~15·5 cm.$^{-1}$,	$\omega_0'' x''$~21 cm.$^{-1}$.

The vibrational frequencies ω_0' and ω_0'' were derived from the relation $D_0 = 4B_0^3/\omega_0^2$. Up to the very last lines observed ($K = 32$) the rotational structure of the (0, 0) band is well checked by the ordinary formula $F(K) = BK(K+1) + DK^2(K+1)^2$ if we add a small uncoupling term ϵK in the final term ($\epsilon = -0{\cdot}042$).

The near coincidence of ν_0 with the atomic line λ4722 and the close agreement between the constants of the initial and the final terms of the band system, make us inclined to suggest that the electronic states of the molecule originate from the corresponding states $2s$ and $^2D_{3/2}$ in bismuth, the hydrogen atom remaining unexcited. Our suggestion also harmonises with the appearance of a small, negative l-uncoupling term in the final state of the molecule. Such uncoupling terms are, according to the theory,[1] to be expected in molecular terms derived from atomic P, D terms. It is further of some interest to note that while the triplet band systems known in the spectra of NH and PH are derived from deep-lying quartet terms in N and P, the singlet system of bismuth hydride probably originates from the doublet system in bismuth.

A full report of the spectrum will appear later in connexion with the analysis of other band systems of bismuth hydride situated in the red part of the spectrum.

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[1] See esp. W. Weizel, *Phys. Zeits.*, **31**, 880; 1930.

The Values of e, h, e/m, and M_P/m.

IN a recent paper,[1] I showed that the six methods usually used for deducing the value of Planck's constant, h, could be used collectively to evaluate both e and h, without assuming any direct determination of e (such as that of Millikan). This seems to be the most accurate way of estimating e and h that is so far available.

I have now repeated the calculations, using all the data referred to by Birge as suitable for estimating h,[2] as well as all the estimates of e/m given by Birge and in the "Handbuch der Physik" of Geiger and Scheel (vol. 22, p. 81). From the values of e and h thus deduced I find

$$hc/2\pi e^2 = 137{\cdot}01_7 \pm 0{\cdot}05_9.$$

This is in such good agreement with Eddington's theoretical prediction of exactly 137, that his equation is slightly more firmly established than any of the other equations relating e and h.

By assuming Eddington's equation, the values of e and h can be deduced somewhat more accurately. I give for comparison Birge's estimates.

	Birge.	Bond.	Difference.	Sum of probable Errors.
$e \times 10^{10}$	$4{\cdot}770 \pm 0{\cdot}005$	$4{\cdot}779_4 \pm 0{\cdot}001_1$	$0{\cdot}009_4$	$0{\cdot}006_1$
$h \times 10^{27}$	$6{\cdot}547 \pm 0{\cdot}008$	$6{\cdot}558_6 \pm 0{\cdot}003_1$	$0{\cdot}011_6$	$0{\cdot}011_1$
$(e/m) \times 10^{-7}$	$\left\{\begin{matrix}1{\cdot}761 \pm 0{\cdot}001\\ 1{\cdot}769 \pm 0{\cdot}002\end{matrix}\right\}$	$1{\cdot}769_0 \pm 0{\cdot}0004_6$		
M_P/m	$\left\{\begin{matrix}1838{\cdot}26 \pm 1\\ 1846{\cdot}61 \pm 2\end{matrix}\right\}$	$1846{\cdot}5_7 \pm 0{\cdot}4_8$		

My probable errors should be accurate to about 10 per cent, as the calculations depend on 36 sensibly independent data.

The difference between my estimate of M_P/m and Eddington's theoretical suggestion of $(136)^2/10 = 1849{\cdot}6$, is $3{\cdot}0_3$, or 6·3 times as large as my probable error. I can only conclude that this is very strong evidence against the value of M_P/m being exactly $(136)^2/10$.

I write this in memory of J. R. B.

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[1] *Phil. Mag.*, December 1930.
[2] *Phys. Rev. Suppl.*, vol. 1, No. 1, pp. 48-57.

A New Band System of Copper Hydride.

A BAND system consisting of six band-heads has been found in the region λλ2900-2200. It is different in nature from the two systems previously known for the molecule. The bands are double-headed, indicating that their emitter consists of an odd number of electrons, and thus they have been attributed to the ionised copper hydride (CuH^+) molecule. The band structure has been analysed. It consists of nine branches, namely, six main branches and three satellites, and the branch lines obey the K-selection rule. From the intensity relations of the branch lines for low quantum values, it is found that $Q > R > P$. Thus the system has been assigned a $^2\Pi \longrightarrow {}^2\Sigma$ transition. The $^2\Pi$ level is inverted. From the vibrational quantum analysis, $\omega_0'' = 1874$ cm.$^{-1}$. This is in good agreement with the value as calculated from the relation given by Kratzer, namely, $\omega_0^2 = -4B_0^3/D_0$. The values of B_0'' and D_0'' are 3·30 cm.$^{-1}$ and $-4{\cdot}16 \times 10^{-5}$ respectively.

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