

Rotational Constants of the Iodine Monochloride Molecule.

OUR analysis of the rotation structure of the iodine monochloride absorption bands is now sufficiently advanced to permit of a fairly precise determination of the molecular constants. The region 6482-6837 Å. has been measured on plates taken in the second order of a 21 ft. concave grating, and practically all the lines have been allocated to series. The strongest bands in this region are $v''=1$, $v'=8-12$; some bands belonging to the $v''=0$ and $v''=2$ progressions are also present, and there are of course two complete systems,

	B_0'	B_0''	α'	α''	I_0'	I_0''	r_0'	r_0''
Cl_2	0.162 cm^{-1}	0.2429 cm^{-1}	0.003 cm^{-1}	0.0017 cm^{-1}	$170 \times 10^{-40} \text{ gm. cm}^2$	$113.7 \times 10^{-40} \text{ gm. cm}^2$	1.21 Å.	0.988 Å.
ICl	0.0869	0.1141	0.00115	0.00104	318.4	242.4	2.643	2.306
I_2	0.0291	0.0372	0.00017	0.00012	952	743	3.015	2.663

a strong one due to ICl^{35} and a weaker one due to ICl^{37} . The figures given in the accompanying table refer to the former only.

Each band consists of P , Q , and R branches, the Q being, roughly, twice as strong as the P or R . Some of the branches have been followed up to rotational quantum numbers (K) above 80, but in the neighbourhood of the origin resolution has not been found possible below $K=6$. Nevertheless, the K values may be found without ambiguity, since both initial and final terms conform accurately to the formula $BK(K+1)$ up to $K=30$ at least. Owing to the large difference between the two B 's, the R branch turns very quickly (in the neighbourhood of the third line), so that only a small correction ($<1 \text{ cm}^{-1}$) will be required to convert previous measurements of unresolved heads to true band origins.

The estimated values of r_0' and r_0'' used by Curtis and Darbyshire¹ in calculating potential energy curves for the ICl molecule are respectively 0.28 and 0.32 Å. lower than those now found, but since it is $(r-r_0)$ which appears in the formula used, the necessary correction may be easily made by shifting the origin 0.3 Å. along the r axis. The conclusions drawn from the curves depend on their relative position and are not affected by this change.

The rotation constants are given in the table, those for I_2 and Cl_2 being included for comparison. B_0'' is a direct determination, B_0' a least squares extrapolation using the formula $B_0' = B_0'' - \alpha'v'$, in which v' runs from 8 to 12.

Detailed results based on more extensive measurements will be published later.

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¹ *Trans. Faraday Soc.*, **27**, 77; 1931.

Raman Spectrum of Solid Nitrogen Peroxide.

IN the course of work on the Raman spectra of solids at low temperatures, we have succeeded in photographing the spectrum of the light scattered by solidified nitrogen peroxide (N_2O_4), at a temperature of about -80°C .

The spectrum is very simple, and consists of one line having a shift of 275 cm^{-1} , and is sufficiently strong to appear as an anti-Stokes as well as a Stokes line, thus confirming the allocation to the particular exciting line (Hg 4358). The material absorbs too strongly in that region for shifted lines excited by Hg 4047 to appear.

X-ray intensity measurements show that at liquid air temperatures the molecule exists as NO_2 and is in a linear form.¹ If this is true at -80°C , also, the Raman spectrum would probably consist of one very strong line, corresponding to the inactive fundamental frequency associated with the vibration of the oxygen atoms symmetrically about the stationary nitrogen atom, together with a very faint line corresponding to the linear active vibration. Such an explanation of the line observed is rendered less probable by the small magnitude of the shift, which might reasonably be more of the order of that due to the corresponding vibration in nitrous oxide (N_2O) (1282 cm^{-1} in the

liquid²). Longer exposures are being made in an endeavour to bring up very faint lines.

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¹ Vegard, *Zeits. für Physik*, **68**, p. 184; 1931.
² McLennan, Smith and Wilhelm, *Trans. Roy. Soc. Canada*, **24**, p. 197; 1930.

Crystal Structure of Methane.

IN view of the discovery by Clusius of a transformation-point of solid methane at 20.4°K , it was interesting to investigate if there is a change of crystal structure or not. Heuse made a dilatometric examination of the transformation and found the very small volume contraction of 2 per mille, suggesting that the crystal structure is not altered. We have established this as a fact by making two X-ray exposures with solid methane at 21.1°K and 18.5°K respectively. The films were concordant within the limits of accuracy; they can be explained by assuming this structure to be a cubic close-packed one, the side of the elementary cube being 5.88 Å. The calculated density 0.52 is in perfect agreement with the value measured by Heuse.

McLennan and Plummer, too, in their X-ray analysis of methane, found a cubic close-packed structure, with 6.35 Å. as the side of the elementary cube, however, and calculated density 0.41. Moreover, the relative intensities of the lines we observed differ considerably from those given by these authors.

A more detailed account of this work will be published in the *Proceedings* of the Royal Academy of Amsterdam.

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Forestry Research.

I AM very glad to see in *NATURE* of April 4 the communications from Dr. M. C. Rayner and the Editor on this subject, and I am in cordial agreement with their remarks.

The extensive planting schemes initiated by the Forestry Commission afford a splendid opportunity for fundamental co-operative research on the building up of new forest soils. We know little enough about the soils of our native woodlands, and practically nothing about the conditions induced by planting exotic conifers on heath or grassland in our climate. It is certain that the knowledge acquired by properly planned research will save great sums of money in the future by preventing the waste of large-scale