

with a 1 meter vacuum spectrograph. Only three combinations between $d^{10} \ ^1S_0$ and known terms are possible, *viz.*, combinations with $^3P_1^0$, $^3D_1^0$, and $^1P_1^0$ of the d^9p configuration. Only three lines with the expected frequency differences appear in the region and thus locate 1S_0 with certainty. The lines are:

Int.	λ	ν	Classification
4	1362.44	73398	$^1S_0 - d^9p \ ^3P_1^0$
7	1224.65	81655	$^1S_0 - d^9p \ ^1P_1^0$
5	1166.81	85704	$^1S_0 - d^9p \ ^3D_1^0$

The wave-lengths are believed good to somewhat better than one-tenth of an Angstrom and the separations somewhat better.

A Band Spectrum due to the Molecule N_2O_3

During a study of the absorption of light by N_2O (Abstract No. 19 Chicago Meeting of the American Physical Society, Nov. 27-28, 1931), the authors were lead to an investigation of mixtures of NO and NO_2 , and have observed, in the near ultraviolet, an absorption spectrum consisting of apparently diffuse bands, due in all probability to the molecule N_2O_3 . The bands are observed in relatively large amounts of NO when small amounts of NO_2 are added, the new bands predominating over the absorption of NO_2 under these conditions. Their centers are located approximately at wave-lengths 3843, 3682, 3539, 3509, 3417, 3386, 3305, 3279. The bands do not appear to possess sharp edges nor to show any pronounced tendency to degrade

The frequency differences agree with McLennan's analysis to within 2 frequency units. The value of 1S_0 based on McLennan's term values is -15036 .

This value of the low level is further confirmed from a study of the spectrum of the low voltage arc in helium and gold vapor. In this excitation lines from the two levels $d^9S \ ^3D_1$ and 1D_2 , which are respectively 24.11 and 24.15 volts above the normal state of the gold atom and thus nearly in resonance with the He ion (24.47 volts), are very strongly excited.

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November 25, 1931.

one way or the other. The first member is exceptionally diffuse. The third member appears most intense. The bands grow weaker as they proceed to shorter wave-lengths suggesting that there may be further weaker members among the NO_2 absorption. The new bands show qualitatively the dependence to be expected upon the pressures of NO and NO_2 , and upon the temperature, decreasing noticeably with increasing temperature. A more detailed description of this spectrum will be published later.

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November 23, 1931.

A. Effect of Crystal Symmetry on the Energy Levels of Solids.

B. Experimental Evidence of Definite Orientation of Coordinated Water Molecules About Rare Earth Ions in Solution

Because of its interest to physicists, who perhaps would not see the complete paper in a chemical journal, we think that it is desirable to publish a brief summary of an article which we shall submit soon to the Journal of the American Chemical Society.

A. Photographs were taken of the absorption spectra of the Gd^{+++} ion in monoclinic crystals of $GdCl_3 \cdot 6H_2O$, $GdBr_3 \cdot 6H_2O$, $Gd_2(SO_4)_3 \cdot 8H_2O$; in hexagonal crystals of $Gd(BrO_3)_3 \cdot 9H_2O$, $Gd(C_2H_5SO_4)_3 \cdot 9H_2O$, and in a triclinic crystal, $Gd(NO_3)_3 \cdot 6H_2O$. Gadolinium IV was chosen because it is by far the most desirable ion for this type of work. It gives sharp lines at room temperature, it has the simplest spectrum of any of the rare earths, its lines and multiplets being well sepa-

rated from one another, and its basic level, $^8S_{7/2}$, is known to be single. Its chief disadvantage is that its absorption lines occur in the ultraviolet.¹

In all cases the same multiplets were observed at approximately the same frequencies, although a slight shift of the multiplets toward shorter wave-lengths was noticeable in the case of crystals of higher symmetry. The lines within the multiplets were, however, greatly affected by changes in the crystal system.

¹ Freed and Spedding, Nature **123**, 525 (1929); Phys. Rev. **34**, 945 (1929); *ibid.* **38**, 670 (1931); Spedding, Phys. Rev. **37**, 777 (1931).