isotopes indicating a very small amount of Cl^{39}. This difference is of the same order as that between beryllium isotopes and slightly less than that between the hydrogen isotopes. But since the nicol rotation at which these minima can be seen differ by only a little more than a degree, the minima must either be due to isotopes which become visible in close succession because of mutual influence, or to a contamination that is consistently present at approximately the same concentration as the chlorine. The latter seems highly improbable. To test this point, perchloric acid was added to the solution being studied and all minima ascribed to chlorine compounds disappeared. Fresh solutions were placed in a cell and sulfur dioxide added; again the minima ascribed to chlorine compounds disappeared. It seems impossible that any contamination of such weight as to give minima in the scale region of these three chlorine compounds and that would undergo both oxidation and reduction could be present. Therefore, the minima observed must be due to three isotopes of chlorine.

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A Combination Relation in the Absorption Spectrum of Liquid Oxygen

We have investigated the absorption spectrum of liquid oxygen between the wave-length limits 27,500 and 3400A. The electronic $^1\Delta$ term predicted for the O_2 molecule in the infrared by Mulliken lies at 7930 cm^{-1}. Two vibrational terms follow at intervals of about 1480 cm^{-1}, which is approximately the magnitude of the vibrational terms of the well-known $^1\Sigma$ and normal $^3\Sigma$ states. All of the bands in the wave-length range given above can be assigned to five v' progressions, although intensity considerations require a slightly different arrangement than that of McLennan, Smith and Wilhelm.[1] The three, four, or five members of each of these progressions have approximately constant frequency separations.

If we designate the term values of the $^1\Delta$ and $^1\Sigma$ states by ν_1 and ν_2, respectively, the electronic terms of the five progressions are given within the limits of accuracy of measurement (<0.4 percent) by ν_1, ν_2, $2\nu_1$, $\nu_1+\nu_2$ and $2\nu_2$. Inasmuch as there is other evidence for the existence of loosely bound $[O_2]_2$ molecules in liquid oxygen, the most natural interpretation of this combination relationship is the following. The frequencies $2\nu_1$, $\nu_1+\nu_2$ and $2\nu_2$ are associated with an absorption act in $[O_2]_2$ molecules resulting in an excitation of both of the O_2 pairs. Either excitation of but one pair of the $[O_2]_2$ molecule or absorption by unassociated O_2 molecules in the liquid would account for the ν_1 and ν_2 frequencies.

A fuller account of this work will be submitted soon to the *Zeitschrift für Physik* for publication.

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[1] McLennan, Smith and Wilhelm, Trans. Roy. Soc. Can. 3, 24, 1–22 (1930).

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Lead Isotopes by the Mangeto-Optic Method

Bishop, Lawrenz and Dollins,[1] and Piggot,[2] have reported sixteen isotopes of lead. Their evidence for these isotopes is based upon light minima obtained when working with water solutions of various lead salts in the Allison magneto-optic apparatus described[3] in the *Journal of the American Chemical Society*, and elsewhere during the past three years. These 16 minima are not shown by pure water. Recently we have located 16 light minima between 36 and 38 Allison units when using an aqueous solution of $PbCl_2$ in the magneto-optic apparatus. Although we had read the papers by Bishop, *et al.*, and by Piggot shortly after their publication last January, we did not remember any of their scale readings for the lead isotopes and purposely did not look them up until our observations had been completed. We only knew that they had found 16 readings (minima) between 36 and 38 Allison units. Our readings, each the average of 4 to 8 independent settings in good agreement, are as follows: 36.10, 36.18, 36.29, 36.40, 36.49, 36.60, 36.70, 36.79, 36.90, 37.09, 37.30, 37.43, 37.52, 37.65, 37.81, 37.90. Readings recorded by Bishop, *et al.*, are: 36.10, 36.19, 36.28, 36.40, 36.50, 36.59, 36.68, 36.78, 36.90, 37.08, 37.30, 37.40, 37.50, 37.68, 37.79, 37.90. A comparison of these two sets of readings shows 5 minima identical, 6 differing by ±0.01, 3 by ±0.02, and 2 with ±0.03 deviation.

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[1] Bishop, Lawrenz and Dollins, Phys. Rev. **43**, 43 (1933)

[2] Piggot, Phys. Rev. **43**, 51 (1933).

[3] J. Am. Chem. Soc. **52**, 3796 (1930).