LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the twenty-eighth of the preceding month; for the second issue, the thirteenth of the month. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

Alternating Intensities in the Absorption Bands of Li_2

The absorption spectrum of lithium vapor shows two band systems in the visible, one in the red and another in the blue-green. Both in position and structure they are strikingly similar to the corresponding bands of Na_2, which have been studied in detail. We expect, however, two interesting features not shown in Na_2. The bands of the isotopic molecule Li^6Li^7 should have about 1/15 the intensity of the stronger Li^7Li^7 bands, and hence should be observed. Furthermore, the rotational structure of the bands due to the symmetrical molecule Li^7Li^7 should show alternating intensities unless the nuclear spin is too large, as it appears to be in Na_2. We have undertaken a study of the structure of the two Li_2 band systems, and have been able to confirm the existence of alternating intensities in the lines of the blue-green system. Detection of the isotope effect will require a modification of our experimental conditions.

From our preliminary results, the heads of the blue-green system are given approximately by

$$\nu = 20{,}398.9 + 268.0n' - 3.24n'^2 - 349.0n'' + 2.66n''^2.$$

The vibrational intensity distribution is very similar to that in the corresponding system in Na_2, which is to be expected since the ratio of the vibration frequencies in the lower and upper states, ω_0''/ω_0', is nearly the same in the two cases (1.30 for Li_2; 1.27 for Na_2). It therefore seems possible that the blue-green systems of these two molecules are due to the same type of electronic transition, $^1P \rightarrow {}^1S$. A preliminary study which has been made of the rotational structure of the (0, 0) band, λ4901, using the first order of a 15-foot concave grating, confirms this view, since three branches are found, of which the Q is the strongest.

The alternation of intensity in successive lines of a given branch is very apparent on microphotometer curves taken with the new Zeiss instrument in this laboratory. Thus the electrometer deflection for every other line in the P and Q branches (some 52 lines in all) is without exception smaller than the mean deflection for the two adjacent lines of the same branch. The same alternation is observed in the case of the R branch, but here the branch is rather weak and the irregularities consequently more pronounced. The average ratio of the electrometer throws for adjacent lines is 1.19:1 for the Q branch and 1.24:1 for the P and R branches (mean value for the two). In order to estimate the alternation factor for intensities from the microphotometer readings, we may assume the law of blackening $S = a + \gamma \log I$. The calculations show that, with any reasonable value of γ for the plates used, the alternation ratio cannot exceed 1.33:1 and more probably is in the neighborhood of 1.20:1. The latter value would require an unexpectedly large value for the nuclear spin, 5 Bohr units. This result may be significant, however, since hitherto it has been impossible to account for certain satellites of wide separation in the hyperfine structure of the atomic Li lines by referring them to nuclear spin. In the quantitative intensity measurements to be carried out later, statistical methods will have to be adopted, because of the numerous irregularities in the intensities due to blending with lines of faint underlying bands, etc.

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