The curve also suggests that there may be periodicities of 28, 27 and 26·3 days. These may be due to radiation from active regions at different solar latitudes.

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Absorption Bands of Li_2, Na_2, K_2 and NaK

ALTHOUGH fairly complete information is available regarding the first two systems of bands of Li_2, Na_2 and K_2, the position with regard to the higher systems cannot yet be considered satisfactory. For this reason the spectra of these alkali-metal molecules, in the regions corresponding to the third, fourth and higher systems of bands, have been investigated in absorption, employing a quartz E_1 spectrograph for lithium, and a 21-ft. concave grating (Eagle mounting), having a dispersion of 1·3 A. per mm., for sodium and potassium. A hydrogen discharge tube has been used as source of continuum below λ 3600 and a tungsten lamp above that.

Li_2 : The ultra-violet spectrum of Li_2 has been previously investigated by Vance and Huffman[1]. The bands lie between λ 3500 and λ 3100, and are regarded by them as belonging to four different systems. These, however, appear fragmentary. In the present investigation, the bands have been found to appear most satisfactorily at a temperature of about 1,000° C., using argon gas at a pressure of about half an atmosphere inside the absorption tube to prevent rapid distillation of the metal to cooler parts. Bands appear between λ 3900 and λ 3100, but the heads can be marked clearly only between λ 3500 and λ 3100. All the heads measured are found to belong to a single system represented by the equation :

$$\nu = 30658\cdot5 + 231\cdot5\,(v' + \tfrac{1}{2}) - 1\cdot5\,(v' + \tfrac{1}{2})^2 - 351\cdot6\,(v'' + \tfrac{1}{2}) + 2\cdot6\,(v'' + \tfrac{1}{2})^2.$$

The upper state of this system is considered to dissociate into $2\ {}^2S + 3\ {}^2P$ atoms. No evidence for other systems is found. The few additional band heads which led Vance and Huffman to conclude that as many as three more systems of bands exist in this region have not been observed in the present investigation. It is difficult to assign any definite reason for their measuring these band heads, as they have not published any value for the intensity of their bands. Another consideration which made them think that there was a case for several systems of bands of Li_2 in this region was analogy with the case of Na_2 which was formerly regarded as having three systems of bands in the corresponding region, namely, λ 3600–λ 3200. This, too, has been disproved, both in previous work[2] and in the present investigation. It seems, therefore, that the Li_2 bands between λ 3500 and λ 3100 really belong to a single system.

Na_2 : The sodium molecule has bands in the ultra-violet region extending from about λ 3650 to about λ 2500, which are considered to belong to several systems[2]. Only the bands between λ 3600 and λ 3200 have been photographed in the present investigation for more accurate study. These bands appear well developed at a temperature of about 750° C., using nitrogen or some inert gas in the absorption tube at a pressure of about 5 cm. of mercury. The bands belong to a single system, and their heads can be represented by the equation

$$\nu = 29342\cdot0 + 119\cdot33\,(v' + \tfrac{1}{2}) - 0\cdot53\,(v' + \tfrac{1}{2})^3 - 159\cdot23\,(v''+\tfrac{1}{2}) + 0\cdot726\,(v''+\tfrac{1}{2})^2 + 0\cdot0027\,(v''+\tfrac{1}{2})^3.$$

The upper state of this system of bands is considered to dissociate into $3\ {}^2S + 4\ {}^2P$ atoms. The rotational structure of a few bands of this system has also been studied. This indicates that the bands have only two branches and are, therefore, due to ${}^1\Sigma_u{}^+ \leftarrow {}^1\Sigma_g{}^+$ transition. The values of B and r for the upper state are 0·1065 cm.$^{-1}$ and 3·70 A. respectively. It has not been possible to calculate the other constants such as D and α, for which higher dispersion would be necessary.

K_2 : The K_2 molecule has been reported to possess bands in the blue and the ultra-violet region down to about λ 3,000[3-5]. Only the bands between λ 4520 and λ 3940 have been studied in the present investigation. The bands belong to two systems : (i) λ 4520–λ 4200 ; and (ii) λ 4160–λ 3940. The band heads of the first system can be represented by the equation

$$\nu = 22970\cdot0 + 60\cdot60\,(v' + \tfrac{1}{2}) - 0\cdot20\,(v' + \tfrac{1}{2})^2 - 92\cdot64\,(v'' + \tfrac{1}{2}) + 0\cdot354\,(v'' + \tfrac{1}{2})^2,$$

and its upper state is considered to dissociate into $4\ {}^2S + 5\ {}^2P$ atoms. The heads of the second system can be represented by

$$\nu = 24627\cdot7 + 61\cdot60\,(v' + \tfrac{1}{2}) - 0\cdot90\,(v' + \tfrac{1}{2})^2 + 0\cdot001\,(v' + \tfrac{1}{2})^3 - 0\cdot003\,(v' + \tfrac{1}{2})^4 - 92\cdot64\,(v'' + \tfrac{1}{2}) + 0\cdot354\,(v'' + \tfrac{1}{2})^2,$$

with its upper state dissociating into $4\ {}^2S + 4\ {}^2D$ atoms. The K_2 bands between λ 4160 and λ 3940 were previously considered to belong to two different systems[4]. It has been found that even the previous measurements which were attributed to two systems can be combined into a single system, if due allowance is made for some missing bands due to the broadening of the principal series doublet at λ 4045.

NaK : A system of NaK bands in the ultra-violet region between λ 4020 and λ 3540 has been reported by Walter and Barratt[6] and analysed in different ways by Weizel and Kulp[7] and by Uchida[8]. These bands have also been photographed in course of the present investigation on the 21-ft. grating. It has been found that only the bands between λ 4080 and λ 3820 are due to NaK, while the rest of the strong bands of Walter and Barratt which lie between λ 3660 and λ 3540 are due to Na_2. The band heads in the former region can be represented by the equation

$$\nu = 25201\cdot0 + 95\cdot85\,(v' + \tfrac{1}{2}) - 0\cdot94\,(v' + \tfrac{1}{2})^2 - 123\cdot29\,(v'' + \tfrac{1}{2}) + 0\cdot40\,(v'' + \tfrac{1}{2})^2.$$

The upper state of this system is considered to dissociate into Na $3\ {}^2S$ + K $4\ {}^2D$ atoms.

Full details will be communicated elsewhere.

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