



first order of a 21-ft. Wood concave grating having a dispersion of about 1.1 Å./mm. Between 9000 and 10,500 Å., a plane grating with dispersion 4.5 Å./mm. in the second order was used.

In the low-dispersion plates, five clear sequences appear at 7308, 7715, 8153, 8652 and 9229 Å. These bands comprise a $^1\Sigma-^1\Sigma$ band-system with the 0,0 band at 8652 Å. Sixteen bands have been analysed, namely, the 6,3, 5,2, 5,3, 4,1, 4,2, 3,0, 3,1, 3,2, 2,0, 2,1, 2,3, 1,0, 1,1, 1,2, 0,0 and 0,1 bands. The rotational constants derived in the present work are as follows:

$B'_0 = 0.396_6$	$B''_3 = 0.4328$
$B'_3 = 0.398_6$	$B''_2 = 0.4362$
$B'_4 = 0.400_3$	$B''_1 = 0.4394$
$B'_5 = 0.401_3$	$B''_0 = 0.4428_6$
$B'_3 = 0.402_3$	$r''_0 = 1.822 \times 10^{-8}$
$B'_1 = 0.403_3$	$D''_0 = 0.66 \times 10^{-8}$
$B'_0 = 0.405_3$	$\omega''_e = 732.1_1$
$r_e = 1.906 \times 10^{-8}$ cm.	$x_e'' \omega_e = 4.8_1$
$D' = 0.55 \times 10^{-8}$	
$\omega'_e \sim 715$	

In the upper vibrational levels the bands are strongly perturbed. The perturbations displace the positions of the bands in the sequences and make the analysis very complicated in some parts. In the 0,0 band a very curious perturbation appears. For some J -values the upper level $v' = 0$ is perturbed by two states. The accompanying graph shows the energy-levels $BJ(J+1)$ plotted against $J(J+1)$ of the three interacting terms. The energy curves are marked W_1 , W_2 and W_3 . In the perturbed region, three R - and three P -lines are found. As we know that the centre of gravity energy line is unperturbed, we obtain by calculation the following equation for the relation between the B -values:

$$\frac{B' + B'_p + B''_p}{3} - B'' = \frac{1}{12J} \sum_1^3 \left[P_v(J+1) - R_v(J-1) - P_v(J) + R_v(J-2) \right],$$

where the suffixes 1, 2 and 3 indicate lines from the three interacting energy-levels W_1 , W_2 and W_3 . For $J = 54, 55, 56$ and 57 , the value of $(B_p + B''_p)$ is found to be 0.7102, 0.7099, 0.7100 and 0.7103 respectively.

The B''_p -values vary rather irregularly. This is due to the strong perturbations. We would stress that

for strongly perturbed levels it is almost meaningless to speak of a fixed B -value, as it varies from one rotational level to the next. In most cases the B -value given is that nearest to the 'unperturbed' one.

A lot of bands are situated between 9500 and 10,500 Å. They form other band-systems belonging to CaO. Meggers³ has given some measurements of the band-heads.

A more detailed paper will appear in *Arkiv för Fysik*.

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¹ Brodersen, P. H., *Z. Phys.*, **79**, 613 (1932).

² Brodersen, P. H., *Z. Phys.*, **104**, 135 (1936).

³ Meggers, W. F., *U.S. Bur. Stand. J. Res.*, **10**, 669 (1933).

Electric Strength of Aluminium Oxide Films

FRÖHLICH's theory of dielectrics predicts an increase in the electric strength as the thickness of the dielectric specimen approaches the electronic mean free path. This prediction has been verified experimentally for certain crystalline materials, such as mica and the alkali halides. Recent work with thin films of amorphous aluminium oxide shows that its electric strength also increases if the film thickness is less than 10^{-6} cm. The oxide was formed by 'anodic oxidation' of aluminium which had been evaporated in a vacuum on a glass optical flat, the film thickness being measured by means of multiple reflexion fringes. The potential difference across the film was applied through small steel bearings. Some of the results obtained at 290° K. in a vacuum of 10^{-5} mm. of mercury are as follow:

Film thickness (Å.)	134	195	580	830	1540
Electric strength (volts/cm. $\times 10^6$)	11.0	9.9	7.3	6.3	5.2

A full account of the investigations is being published elsewhere.

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Oscillator Strength of the Na_2 $^1\Sigma-^1\Sigma$ Transition

WHILE the oscillator strengths (or f -values) of various molecular electronic transitions are urgently required by astrophysicists, very few experimental or theoretical results are available. I have recently carried out a calculation for the f -value of the $^1\Sigma-^1\Sigma$ transition of the sodium molecule based on the simple hydrogen-ion model. In this calculation the wave functions of the two states were represented by a simple linear combination of the appropriate atomic wave functions (these being taken as Slater-type functions with effective nuclear charge $2.2e$ and $n^* = 3$). Taking the internuclear distance as $3.36 a_0$ (a_0 is the radius of first Bohr orbit) and the wave-length of the electronic transition as 6812 Å., the f -value was found to be 0.26, corresponding to a mean life-time of 1.7×10^{-8} sec. No experimental measurement of this life-time has yet been made, but the value would not be expected to be widely