Double Refracting Structure of 'Corex' Glass.

SOME years ago I found that silica glass showed a doubly refracting structure (*Proc. Roy. Soc., A*, vol. 98, p. 284; 1920. Also *Proc. Optical Convention*, Part 1, p. 41; 1926). This structure is quite distinct from any due to bad annealing, and seems kindred to the 'liquid crystals' of Lehmann. Nothing of the kind could be found in the ordinary glasses consisting of silica with metallic oxides.

I now find that the ultra-violet transmitting 'Corex' glass of the Corning Co. shows a similar structure. This glass is said to consist in the main of calcium phosphate, though I have not seen an analysis. The subject evidently requires detailed examination, which I hope to make as opportunity allows.

RAYLEIGH.

Terling Place, Chelmsford,
Nov. 14.

Energy Levels of Atoms in an Electric Field.

ISHIDA has recently given clear experimental evidence that Stark levels with equal m values do not intersect (*Sci. Pap., I.P.C.R.*, Tokyo, No. 260; 1930). With increasing field, the levels approach to a limiting separation and then recede. This feature of the investigation was limited to levels with equal m but different n values.

I now notice on a plate which has been published (Neon; Foster and Rowles, *Proc. Roy. Soc.*, vol. 123, p. 80; 1929) a good illustration of this point for the case where the levels have the same principal quantum number. The diffuse line $2p_9 - 7d_4'$ approaches the sharp line $2p_9 - 7s_5$ as the electric field increases (Fig. 1). When the separation (25 cm.^{-1}) is but a

FIG. 1.

fraction of the almost constant separation observed for the other components with (initial) $m_i = 0$, it turns abruptly and retains constant displacement up to the maximum external field.

In the paper referred to, Ishida reproduces some remarkably fine plates which give strong support to the theory of the Stark effect in helium (Foster, *Proc. Roy. Soc.*, vol. 117, p. 137; 1927). On two points, however, his interpretations lead him to very striking conclusions at variance with the theory and with earlier experiments (Foster, *Proc. Roy. Soc.*, vol. 114, p. 47; 1927). I should like to suggest views which (if correct) will place the new results in harmony with previous work.

The conclusions reached by Ishida are (1) that the selection rule $\Delta m = 0, \pm 1$ is broken, and (2) that hitherto unknown series lines have been discovered in the helium spectrum. The selection rule is apparently broken by the appearance of a few weak π components having the same wave-length as corresponding members of the strongest group of σ components ($m = 2$ in initial state). This is not an effect due to the larger fields he employs, since in his photographs it persists in moderate fields. On any one plate it is found only where the corresponding σ component has extraordinary strength, yet it fails to appear on the plate showing the intense yellow line $\lambda 5876$. This irregularity attracts one to the possible view that an imperfect adjustment of the double-image prism with reference to the axis of the Lo Surdo tube may account for all that has been observed, and allow the selection rule to apply here as elsewhere. But even with this adjustment correctly made, this phenomenon has been observed, and attributed to an occasional confusion of the fields in a Lo Surdo source (Foster, *Astrophys. Jour.*, vol. 62, p. 235; 1925).

The second point is concerned with π components which vanish or become very weak as they pass under the zero field position of the $P - P$ combination line (or $S - S$ or $p - p$ or $s - s$, as the case may be) of the group to which they belong. This phenomenon has been observed in many experiments (Foster, *Phys. Rev.*, vol. 23, p. 667; 1924; *Jour. Frank. Inst.*, vol. 209, p. 585; 1930). Nevertheless, Ishida regards the lines as entirely new at the point of reappearance. One can understand that the sloping lines are cut off vertically, and doubtless appear to point to zero field positions near those of the $P - P$ lines. But as Ishida observes, there are no terms in the well-known normal helium spectrum which can account for such origins. It is doubly difficult, therefore, to deny the theory which on this point has already received adequate experimental support.

J. S. FOSTER.

McGill University, Montreal,
Oct. 15.

Determination of the Abundance Ratios of Isotopes from Band Spectra.

I RECENTLY reported an intensity anomaly in the isotopic bands of boron monoxide (*NATURE*, Aug. 9, p. 203), which showed that the intensity ratio of isotopic bands does not always give directly the relative abundance of the isotopes. The following is an account of the determination of the correction to be made in order to obtain the relative abundance from the intensity ratio, and is an abstract from a dissertation presented to the University of Utrecht.

The intensities of the heads of all the bands of the $B^{11}O$ β -system which appear on plates with exposures of four hours have been measured; variations of plate sensitivity were corrected for by comparison with a lamp the spectral energy distribution of which was known. The intensity of each band was then divided by ν^4 , ν being the frequency of the band in question, in order to obtain the square of the amplitude of the virtual oscillators, since it is the latter quantity which is additive. By adding up the values of I/ν^4 for all the bands having a common ν' , a figure was obtained which gave a measure of the number of $B^{11}O$ molecules in the ν' state. This was done for the different ν'' progressions, and so the number of molecules in the different ν' states was determined. The graph (Fig. 1) shows $f(E'_{\nu})$, the number of $B^{11}O$ molecules in these states, plotted as a function of the vibrational energy E'_{ν} .