may be connected. The results, however, are still in the process of reduction, and no definitive statement can be made at the moment.

It is suggested that astronomers with more complete and accurate solar data than is available at this Observatory may be able to make a close analysis of the work considered in this note.

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Oct. 9.

[1] Ryle and Vonberg, *Nature*, **160**, 157 (1947).
[2] Appleton, *Nature*, **156**, 534 (1945).
[3] Pawsey, Payne-Scott and McCready, *Nature*, **157**, 158 (1946)
[4] Martyn, *Nature*, **158**, 308 (1946).
[5] Lovell and Banwell, *Nature*, **158**, 517 (1946).
[6] Ellison, *Nature*, **158**, 450 (1946).

MR. THOMSEN has made an interesting analysis of our results in relation to the positions of sunspot groups. I should, however, like to make two comments.

(*a*) The suggestion (originally made by Appleton and Hey[1]) that the equivalent temperature varies as the square of the wave-length referred only to the high-intensity radiation associated with sunspots. The improved sensitivity of our apparatus makes it possible to detect solar radiation at all times, even on frequencies as low as 80 Mc./s., and the results obtained during the past eleven months show that for frequencies of 80 Mc./s. and 175 Mc./s. the ratio of the minimum equivalent temperatures which have been observed is about 2·2.

Until more information is available on the conditions of escape of radio-frequency radiation from sunspot regions, this method of determining the ratio T_{80}/T_{175} for the undisturbed sun appears more reliable than simultaneous observations on the two frequencies made at times when no disturbed region appears to be near the central meridian.

(*b*) The ratio T_{80}/T_{175} has now been plotted for a period covering twelve solar rotations, and additional confirmation has been obtained of the suggestion (made in our previous communication) of an apparent periodicity of this ratio. During this time the existence of three major 'active regions' is suggested by our results, with mean periodicities of 27·9, 27·0 and 26·3 days. The disturbances can be followed for 5, 7 and 11 solar rotations respectively.

While these results cannot yet be regarded as sufficient proof, they seem to provide good evidence for the existence of long-lived active regions, which at some time in their development give rise to the appearance of visual sunspots.

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Nov. 27.

[1] Appleton and Hey, *Phil. Mag.*, **37** 73 (1946).

Structure of Calcium Fluoride Films Evaporated on Polished Glass Surfaces

CONSIDERABLE research has been carried out on the structure of thin films of calcium fluoride deposited by evaporation on polished surfaces[1-5]. But very little, if any, attention has been paid to the temperature of the surface during the period of deposition. In a letter published in 1946[6], it was shown that this temperature plays an important part in the adhesiveness, the water solubility and the optical properties of quarter wave-length anti-reflexion films evaporated on to glass. It has now been found, mainly from X-ray examination, that the structure of a film depends very much on the temperature of the glass surface during the process of evaporation. Initial results of this investigation were included in the letter mentioned above.

In continuing the measurements, the same Seeman – Bohlin type of powder camera was employed. This camera has a radius of 10 cm. and records X-rays scattered through angles up to about 80°. With the iron $K\alpha$ radiation used, it is capable of recording the three strong spectral lines 111, 220 and 311 of calcium fluoride. With films having an optical thickness of $\frac{1}{4}\lambda_{5500}$, it was impossible to obtain sufficiently clear photographs of some of these lines. The line 220 was always present, irrespective of the temperature of the glass surface during coating. It was difficult to determine whether the line 111 was present or not as the angular deviation for this line is 36° only and the background of scattered radiation was comparatively strong. The line 311 was difficult to see, one reason being that it was weakened on account of its distance from the irradiated calcium fluoride-coated surface. For $\frac{3}{4}\lambda_{5500}$ films some photographs were taken, and it was found that the three lines were present in the case of films on glass surfaces maintained at about 25° C. during deposition, but the line 111 was absent for films on surfaces maintained at 105° C.

In order to procure clearer photographs it was decided to work with calcium fluoride films having an optical thickness of $5/4\ \lambda_{5500}$. These films proved sufficiently thick to give good definition with an exposure of 50 milliampere-hours. Results have so far been obtained for crown and flint glasses, the polished surfaces of which were maintained at various temperatures, T, during coating. Below is a summary of the results for crown glass ($n_D = 1{\cdot}52$) : (*a*) When T is 25° C. the line 111 is fairly strong, the line 220 is weak and the line 311 is very weak ; (*b*) when T is 75° C. the line 111 is fairly weak, the line 220 is rather strong and the line 311 is very weak ; (*c*) when T is 105° C. the line 111 is absent, the line 220 is strong and the line 311 is very weak ; (*d*) When T has various values between 105° C. and 300° C., the line 111 is absent, the line 220 is strong and the line 311 is very weak.

Microphotometer measurements of the half-widths of the strong 220 lines indicate that there is a growth of the crystallites as T increases from 100° C. to 300° C. This growth would correspond roughly to an increase in mean crystal diameter from 170 to 250 A.

Using crossed nicols and monochromatic light, there was very little evidence of the double refraction phenomenon[3] in the case of films for which T was 25° C. Double refraction was definitely present for 75° C. films. It appeared to reach a maximum value for those at about 100° C. and then weakened as T increased to 300° C. When a drop of liquid (chloroform acetone mixture) having a refractive index of about 1·35 was allowed to spread over the surface of a 100° C. film, say, the double refraction disappeared and returned as the liquid dried away.

Results very similar to those given above were found when *D.F.* and *E.D.F.* glasses were used.

It may reasonably be concluded from the data that in $5/4\ \lambda_{5500}$ films, for which T is 25° C., the (111) planes of the crystallites are not appreciably orientated. There is considerable orientation of