LETTERS TO THE EDITORS

ASTROPHYSICS

Correlation between the Intensity of the Umbra of Sunspots and Enhanced Radiation on 200 Mc./s.

ENHANCED solar radiation at metre wave-lengths is generally supposed to originate within a restricted area of the corona above a sunspot. The position of the radio source indicates that the existence of a sunspot is a necessary condition for the emission of excess radiation.

Only a few sunspots, however, are associated with noise storms, and the question arises what makes certain sunspots show noise activity. If characteristic features of noise-active sunspots could be found, further information about the generation mechanism might conceivably be deduced. Observable properties, like area, life-time and magnetic field-strength of sunspots have been tested for correlation with noise activity, but the correlation is low.

At the Solar Observatory, Harestua, the relative intensity of umbra and penumbra of sunspots has been continuously observed since April 1959 with the aid of a pinhole photometer, operating on photoelectric principles. Measurements are made in three different wave-length regions: centred on λ4250, λ5500 and λ8500. Radiometer and interferometer measurements of enhanced radiation on 200 Mc./s. have been made during the same period. We are thus able to determine the degree of correlation between intensity of the umbra and the noise activity of sunspots.

Measurements of intensity of the umbra have been corrected to a first approximation for the light scattered from penumbra and photosphere, following the method described by Korn[1]. These corrections are usually small, as we have only considered spots with areas larger than about 400 millionths of the solar hemisphere. When more spots than one have been measured in a group, we have used the intensity of the umbra of the largest spot in the analysis.

In Fig. 1 the relative intensity of the umbra $I\mu/I_{ph}(\lambda_{5500})$ of a spot is plotted against the daily mean flux density on 200 Mc./s. received from a source situated above the spot. Observations where it is uncertain whether the spot in question is responsible for the noise activity are also included.

Fig. 1 shows that there is a high correlation between darkness of the umbra and noise activity of sunspots. The diagram indicates that in order to show noise activity, the intensity of the umbra must be smaller than a threshold value (about 0·20 at λ5500). The strongest radio sources tend to be associated with rather dark spots. The same results are obtained in the other wave-length regions (λ4250 and λ7500).

Only a slight correlation exists between noise activity and area of the sunspot for areas exceeding 400 millionths of the solar hemisphere. Nor does the intensity of the umbra appear to be determined by the area alone. This indicates that the results shown in Fig. 1 cannot be explained as a consequence of a decrease in intensity of the umbra and a rise in noise activity with increasing magnitude of the spot.

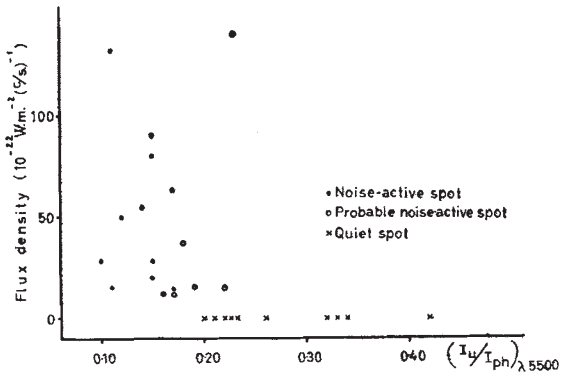

Fig. 1. Relative intensity of umbra of sunspot plotted against the daily mean flux density on 200 Mc./s. for the same spot

Although more definite conclusions can not be drawn at present, the observations single out the relative intensity of the umbra as a characteristic feature which may provide information about the mechanism of noise generation.

I wish to thank Mr. P. Ofstad for making available the observations with the pinhole photometer.

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[1] Korn, J., *Astro. Nachr.*, **270**, 105 (1940).

RADIOPHYSICS

Spaced Observations of Radio Noise from the Outer Atmosphere

IT has recently been suggested[1] that during some types of radio noise storms generated in the Earth's outer atmosphere the source of the noise may remain almost constant in position in Right Ascension. If this were so, it would be expected that the arrival of the storm would be recorded at almost the same local time at places of different longitude, rather than simultaneously. To test this idea and more generally to investigate the extent to which observations of the noise are correlated at different places, recordings have been made during June and July 1959, at Camden N.S.W. (Latitude 34°03′S Longitude 150°42′E) and Adelaide (Latitude 34°56′S Longitude 138°53′E). The geomagnetic latitudes are 42°S and 45°S respectively. The noise level in a frequency band 1 kc./s. wide centred at 4·5 kc./s. was recorded using conventional techniques.

It was found that, in the majority of cases, noise bursts were recorded simultaneously at Camden and Adelaide. Of 18 bursts only 5 were recorded at Adelaide without being recorded at Camden and only 1 at Camden but not Adelaide. Figure 1(*a*) shows a typical example of a record with good detailed agreement in the amplitude variations at the two places. 8 were of this type.

On 4 occasions bursts were recorded, where although the minute to minute variations were similar,