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A PECULIAR TYPE OF SCINTILLATION OF SOLAR RADIO RADIATION

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Some authors (Payne-Scott and Little (1952) [1]; Owren (1952) [2]) have mentioned a phenomenon in the enhanced solar radio emission which they call 'non-selective fading'. The present paper is meant to call attention to another, rather peculiar, type of scintillation in the radio emission of the sun, which differs from the non-selective fading in some important respects. This scintillation has been observed since 1952 by the division 'Ionosphere and Radio Astronomy' of the Netherlands Telecommunications Service in the course of a continuous survey of solar radio radiation. It has been found at the radio frequencies 140, 200 and 545 Mc./s.

The main characteristics of this type of scintillation are the following:

(1) Compared with ordinary scintillation of point sources it has a more fading-like character. Sometimes the intensity fluctuations are of an oscillatory type, but the enhancements never surpass the decrements.

(2) The duration of the fades ranges between 0·3 and 4 minutes, being mostly of the order of one minute.

(3) A high degree of correlation exists between the intensity fluctuations on different frequencies. Most of the fluctuations that are found simultaneously at 200 and 545 Mc./s. correspond in detail.

(4) At 200 Mc./s. the fractional depth of the fadings often reaches values of some 20–40 %; in exceptional cases they may be so strong as to extinguish almost the entire solar radiation. The average amplitudes at 140 and 545 Mc./s. are 1·8 and 0·3 times those at 200 Mc./s.

(5) The phenomenon may be present during periods of quiet solar radio emission as well as during disturbed periods.

(6) Solar scintillation occurs with greatest strength and frequency during the months May–August.

(7) Its occurrence is rather sporadic, being sometimes limited to just one depression or to one oscillation. The fraction of time during which solar scintillation has been observed amounts to 1 % of the total observing

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time in the months May–August of the years 1953, 1954 and 1955. The dates on which it has occurred show some tendency to cluster.

(8) The frequency of occurrence is evenly distributed over the main part of the day, until about 17^{h} local time. After 17^{h} the frequency is four to five times greater.

Many arguments make it extremely improbable that the phenomenon is of an instrumental nature. The only cause that might affect the two receivers in use simultaneously could be situated in the mains stabilizer, which is common to both receivers. The fading should then also be present when the receivers are connected to the dummy load. That this is not the case is clearly demonstrated by those few cases in which a fade happened to be in progress when the receivers were switched to the dummy load. In all these cases the level corresponding to the dummy load had remained unchanged.

Fig. 1. Two examples of solar scintillation at 140 Mc./s. (21 July 1953).

No mention of this kind of solar noise scintillation has yet been made in the literature. However, E. J. Blum, G. Eriksen and R. A. J. Coutrez have noticed a kind of scintillation that is probably the same (private information).

Unlike the non-selective fading, which by Owren (*loc. cit.*) is attributed to the sun, the solar scintillation seems to be controlled by terrestrial, probably ionospheric, conditions because of its seasonal and diurnal dependence. One might consider sporadic *E*-clouds in some way responsible. However, no correlation has been found between the occurrence of the fadings and the presence of sporadic *E*. We certainly are confronted with a puzzling phenomenon.

REFERENCES

[1] Payne-Scott, R. and Little, A. G. *Aust. J. Sci. Res.* **5**, 40, 1952.

[2] Owren, L. *Radio Astr. Rep. of Cornell Univ.* no. 15, 74, 1954.