VARIATIONS IN 18-MC/S SOLAR AND COSMIC NOISE

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Apparatus for measuring changes in the received intensity of 18–Mc/s cosmic noise has been in operation at the Sampson Station of the Observatory of Rensselaer Polytechnic Institute since 1957 February. It is similar in principle to the equipment of the High Altitude Observatory on which is based the contribution of the Warwicks [1] to this Symposium.

Our apparatus is fed by a simple antenna array of two half-wave dipoles, separated by a half wavelength, placed one quarter of a wavelength above ground. This sees the whole sky, with the gain greatest at the zenith.

The receiver has a bandwidth of 800 cycles, and is swept in frequency over a range of about 30 kc/s every 40 seconds, the center frequency being close to 18.0 Mc/s. A minimum-signal circuit, as in the equipment at Boulder, effectively causes the receiver output to be a measure of the minimum signal received over the sweeping cycle. This overcomes the effects of interfering stations, and it rules out the possibility that an increase in the recorded intensity is caused by anything with a bandwidth narrower than 30 kc/s or with a duration less than about 40 seconds.

The purpose of the apparatus is to record sudden cosmic-noise absorptions (SCNA) as indirect indications of solar flares, depending on the effect on our ionosphere of the ionizing radiation from the flares. The program is related to the International Geophysical Year. An example is shown in Fig. 1, in which the arrows above the record indicate the beginning and end points of optically observed flares, and the numbers are the reported optical importances.

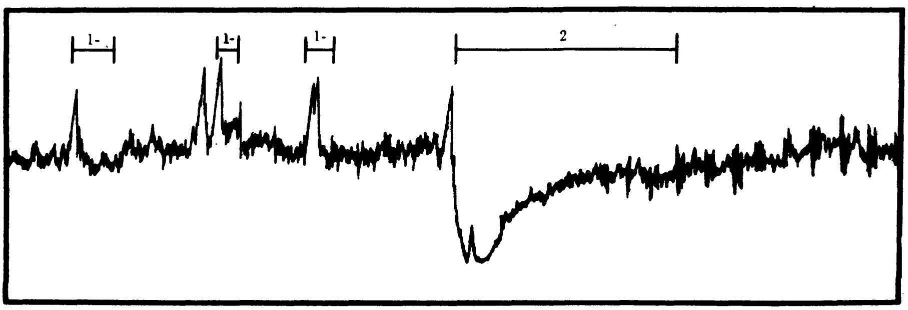

FIG. 1. Record showing intensity of 18-Mc/s cosmic noise received at the Sampson Station of the Observatory of Rensselaer Polytechnic Institute on 1957 April 18, and the times of optically observed flares as reported in the weekly summary by High Altitude Observatory. The record shown runs from 17^h40^m to 23^h12^m U.T.

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We note that the absorption corresponding to the class 2 flare is accompanied in this case by a burst of about 4 minutes' duration at the beginning and a somewhat similar burst superimposed on the trough of the SCNA. The three flares of importance 1^- are simultaneous with bursts, but it is questionable whether they have produced any cosmic-noise absorption. Very rough surveys of coincidences [2] show that, for the weaker flares especially, a burst is more likely than an absorption.

In discussing this record at the Boulder URSI Assembly, I questioned whether the bursts were of solar origin or were due to an ionospheric effect such as the sudden enhancements of atmospherics observed, often simultaneously, in the kilocycle-frequency range. Spot comparisons of records from Boulder and Troy by me, and from Boulder, Troy, Sacramento Peak, and Lake Angelus by Warwick, and a more systematic survey now in progress by Pearl Lichtenstein, all appear to show that the variations observed at one station are reproduced minute by minute at the others. This is true not only for the larger bursts, but also for the smaller variations such as we see, for example, in between the times of the flares in the figure. Since the stations are spread 2000 miles in longitude and half that in latitude purely local phenomena may be ruled out of consideration. It does not appear reasonable that the ionosphere should become suddenly more transparent in close association with sudden decreases in transparency, and the simplest explanation is that we are dealing with bursts of solar origin.

Owing to the long time constant of the receiver when the input is increasing, the slope of the rising part of the burst can be said to be only at least as steep as we see it, and similarly the height of the maximum as seen on the record is only a lower limit. Nonetheless, the relative sizes of the bursts are probably valid, though the duration of a burst will affect its apparent intensity.

We find that, in addition to the bursts that are specifically associated with flares, on days of general solar disturbances, such as the Special World Intervals of the IGY, there is a general "noisiness" or variability of the 18–Mc/s record. On such days it is very difficult to say when the radiation is enhanced and when it is absorbed. This mean level may be higher or lower or the same as on quieter days.

Because of the difficulty of presenting the complexity of these emissions and absorptions in tabular form, we have started, with March 1 of this year, to publish our recorder tapes in pictorial form in a series entitled *Rensselaer Observatory Publications*. In the future we will publish other patrol data in a similar form. Examples of variable days, and of other effects not mentioned here, may be found in that series [3].

REFERENCES

[1] Warwick, C., and Warwick, J. W. Paper 37.
[2] Fleischer, R., and Redlich, R. W. *A. J.* **62**, 243, 1957.
[3] Fleischer, R., and Lichtenstein, P. R. *Rensselaer Observatory Publications*, Number 1, 1958.