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SPECTRA OF SHORT-LIVED TRANSIENTS IN SOLAR NOISE AT 400 MC/S

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The solar work at the radio observatory near Dwingeloo concentrates on the investigation of relatively small bursts, which, having the aspect of elementary phenomena, could give some insight into the way in which they are related to their immediate cause.

Measurements were started in 1956 with a simple receiver (noise factor 6; i-f bandwidth 1 Mc/s), which was ultimately connected to an Ediswan moving coil recorder, resonant at about 90 c/s and operated with paper speeds up to 4 cm/second. Bursts with an intensity of a few per cent of the quiet sun level were the weakest distinguishable.

To begin with, we obviously had to make a statistical attack on the dura-

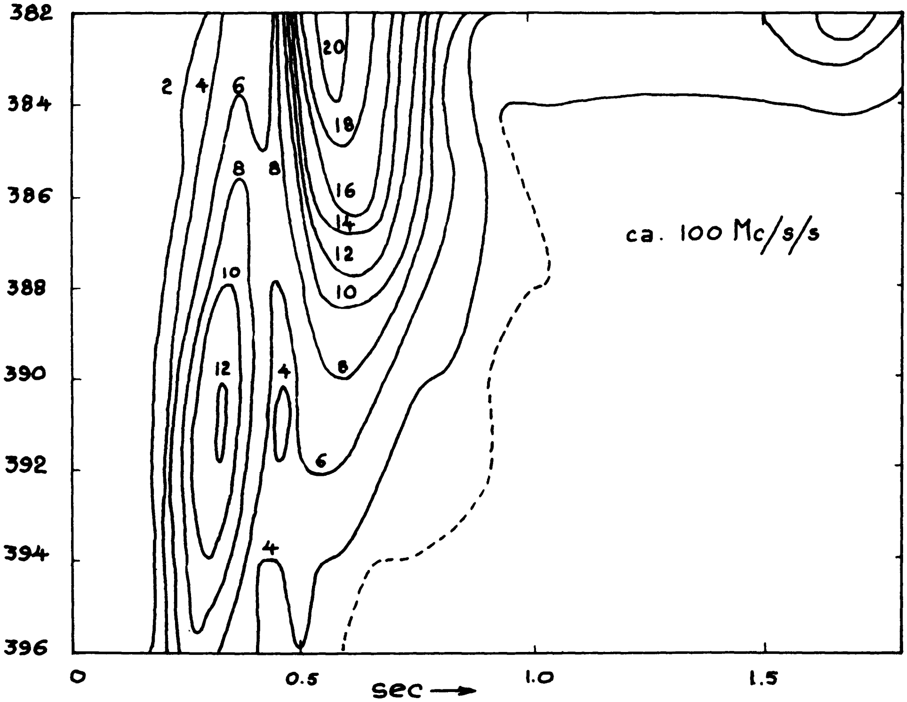

Fig. 1. Small burst with frequency drift.

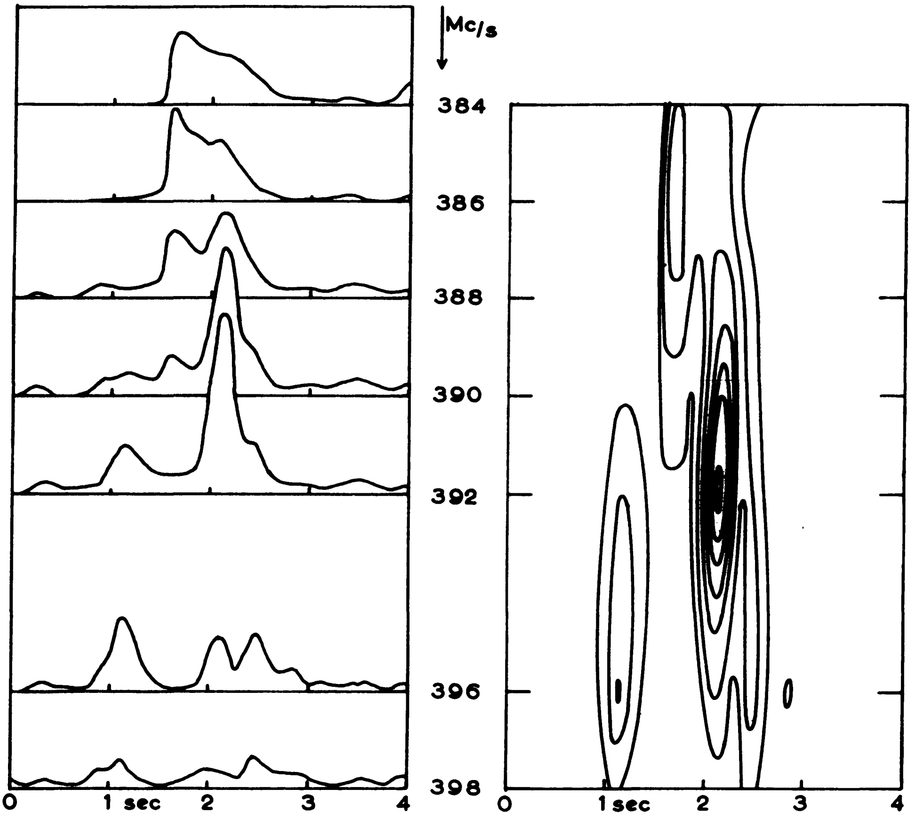

FIG. 2. Small burst without frequency drift.

tion—defined as the time interval between half-power points—of single bursts. The average duration came out with a quite small spread, and its determination has since been adopted routinely. The main maximum of the histograms always appears between 0ˢ.15 and 0ˢ.25, and clusters around 0ˢ.18. The records show no bursts shorter than 0ˢ.05, and no correlation between duration and intensity.

In the second place, we investigated the spectral profile of the individual bursts. In our case the swept-frequency method is incompatible with the small time constant required, so we set up a multi-channel receiver, beginning with a two-channel one. Measurements with this receiver showed that the bandwidth of small bursts had the same order as the receiver, which justified an extension to eight channels. In the present version, each is 1 Mc/s wide and is 2 Mc/s from its neighbors; the center frequency is 390 Mc/s.

Frequency drifts f can be determined with an accuracy of about $0.2f$ per cent (f in Mc/s per second). In a few cases such a drift was definitively present, extreme values being 16 and 150 Mc/s per second. Fig. 1 shows an example. Most small bursts, however, have frequency drifts larger than 500

Mc/s per second if any (Fig. 2). It is not yet certain if there is a real gap between this lower limit and the upper one of the above-mentioned variety.

The spectral profiles obtained thus far have half-power bandwidths ranging from 4 to more than 14 Mc/s. About half of them have a gaussian shape and an average bandwidth of 6 ± 2.5 Mc/s. The remainder consist of various irregular forms with bandwidths of the order of 12 Mc/s.

Although this spectral work has just been started, it seemed appropriate to introduce it here. It illustrates the use of narrow-band spectrometry with a low time constant as a means of getting a detailed knowledge of the microbursts. Comparison with simultaneously obtained broad-band spectra will be necessary to complete the picture.

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