FIBER BURSTS CONCURRENT WITH
A WEAK NOISE STORM

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(Received 22 September; in revised form 8 December 1975)

Abstract. A new kind of radio burst is described and identified as quasi-fiber burst according to some striking similarities with fiber bursts. Its interpretation is discussed in terms of Kuijpers' whistler model and an explanation for a broken variety of the observed burst is given. The derived magnetic field strength in the source is 4 G at a plasma level of 300 MHz.

On December 20, 1974, we observed some peculiar fine structures with the 60-channels solar radio spectrograph at Dwingeloo (De Groot and Van Nieuwkoop, 1968; Van Nieuwkoop, 1971). These fine structures resemble fiber bursts in some respects (bandwidth, frequency drift rate), but are quite distinct from them in other respects (lack of absorption ridge, lack of polarization, no radioflare association). They show also similarities with some of the slow-drift spike bursts reported by Chernov (1974) (bandwidth, duration), but are again distinct by lack of polarization.

Figures 1 and 2 show examples of the observed fine structures, which we will call: 'quasi fiber bursts'. We can distinguish two varieties: the 'continuous' and the 'broken' type. The continuous one has a typical instantaneous bandwidth of 1 or 2 MHz and a typical duration in one channel of 0.2 s (the channel passband is 0.9 MHz). The broken type consists of a series of short-lived elements, which have as typical parameters a bandwidth of 5 MHz and a duration of 0.2 s. Both types have the same frequency drift rate of $7 \pm 2$ MHz s$^{-1}$, which is strikingly similar to that for fiber bursts around 300 MHz in type IV continua. The broken type of quasi-fiber burst is distinct from chains of type I bursts, which are much more irregular and have drift rates typically one order of magnitude lower.

The flux densities of the observed fine structures are rather low. As we did not record them with the digital equipment, we can only estimate their strengths from an earlier calibration of the quiet Sun background and a knowledge of the receivers performance. We estimate the background level at 300 MHz to be 16 s.u., in which case the maximum flux density of the fine structures would
Fig. 1. Spectrum of 'continuous' quasi-fiber bursts on 20–12–1974 between 1228:40 and 1229:15 UT. The quasi-fiber bursts are unpolarized, whereas the group of type I bursts, around 240 MHz, is strongly left hand polarized. Legend: the lower part shows the flux density fluctuations relative to the running average over 3 s of the background, with a dynamic range of ±1.7 dB; the upper part shows the circular polarization as the difference in output voltages for the left and right hand radiation components. Left-hand polarization is shown lighter, right-hand darker than the intermediate greylevel.

The fine structures were only observed between 1227 and 1237 UT in a quiet period after a weak noise storm had died out almost completely. Only a few type I bursts were still observed at lower frequencies (around 240 MHz, see Figure 1). These bursts were left-hand circularly polarized and had maximum flux densities estimated at 3–8 s.u.

The verification of the solar origin of these fine structures is difficult: there is no other instrument in this frequency range with enough resolving power to detect them. Besides they are very rare. However to the experienced observers' eye they look genuinely solar. If the association with a noise storm is not incidental this phenomenon may not be so rare at all: in many cases the strength of the background may bring it below the limit for detection or the overlapping type I bursts may obscure it.

Both kinds of observed fiber bursts can be explained if we combine the models for fiber bursts and zebra patterns recently proposed by Kuijpers (1975a, b, c).

Fig. 2. Spectrum of 'broken' quasi-fiber bursts on 1 20 Dec. 1974 between 1234:25 and 1235:00 UT