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ABSTRACT

Four multi-source radio bursts observed with the new 17GHz interferometer at Nobeyama are analyzed and presented from the point of view of their time-variations.

Three of them (Sep.6,1978 ; Oct.9,1978 ; and Feb.17,1979) were essentially of an impulsive nature and all showed distinct double-source structures. Their polarization structures and time-variations are discussed and compared with type III and type II burst occurrences. The results of the comparison suggest either that electron accelerating regions moved across magnetic lines of force or that a rapid magnetic field re-arrangement occurred near an accelerating region.

A quite different type of multi-source radio bursts was observed on Nov.10,1978. It had a long duration of several hours and was associated with type IV bursts at metric and decimetric wavelengths. At least five radio sources were observed to appear at 17GHz. A detailed description of this event is presented in comparison with the evolution of both H α -flare and type IV bursts.

1. DOUBLE-SOURCE IMPULSIVE BURSTS

The Sep.6,1978 event is a typical example of impulsive bursts with bipolar structure (Figure 1). The structure corresponded well to both the underlying H α feature and the distribution of sunspot magnetic polarity. Figure 2 shows the time profiles for each of the two sources. It can be pointed out that the west-side source reached its peak simultaneously with the subpeak of the east-side one. Concerning with this point, the Feb.17,1979 event is a better example, in which a large number of impulsive bursts occurred successively during about 10 min. It is possible to divide the whole event into several subgroups of impulsive bursts, with which type III subgroups occurred simultaneously. The east-west profiles obtained with the interferometer reveals that some subgroups showed bipolar structure and the others single source structure (with a very weak companion, if any). It is interesting that no or

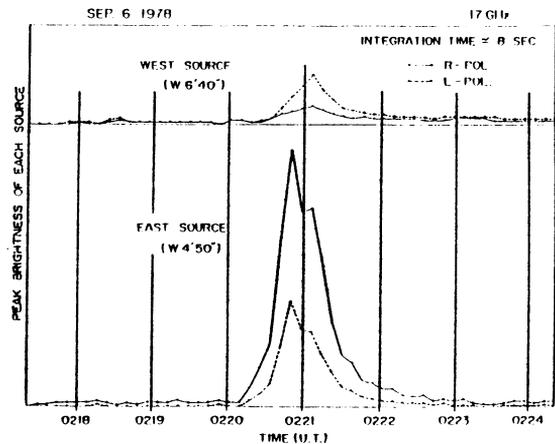
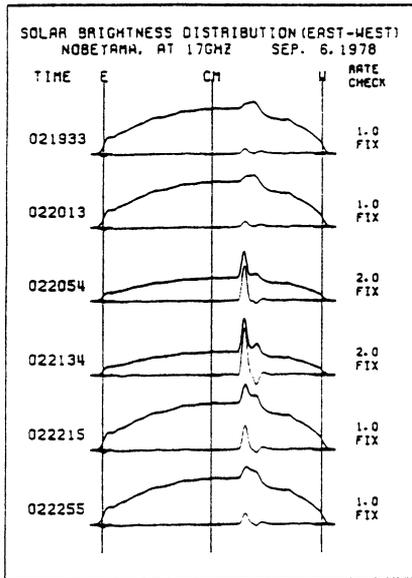


Figure 1 (left). East-west profiles of the Sep.6,1978 event. Thick and thin lines of each map represent the sum (I) of and the difference (V) between the right and left circular polarizations respectively. The vertical scale of V map is three times that of I map.

Figure 2 (right). Time profiles for each of the two sources of the Sep.6,1978 event.

weak type III subgroups occurred in association with the impulsive bursts of bipolar structure. The relationship between the 17GHz source structures and the type III occurrences suggests either that electron accelerating regions moved across the magnetic lines of force or that a rapid magnetic field rearrangement occurred near an accelerating region.

The Oct.9,1978 event also showed double-source structure, but both of two sources were polarized in the left-handed sense. The polarization degrees were $\sim 100\%$ and $\sim 15\%$ respectively. Though this event was weak, type III bursts occurred simultaneously and type II bursts ~ 5 min later.

2. MULTI-SOURCE MICROWAVE TYPE IV BURSTS

On Nov.10,1978 a very complex 17GHz radio burst was observed (Figure 3) in association with a two-ribbon H α flare of importance 2N. Type IV radio bursts with spectral fine features such as radio pulsation and

rain-structure occurred simultaneously at metric and decimetric wavelengths. Detailed analysis of the 17GHz east-west profiles shows that at least five sources existed; two of them occurred successively near above the area where one branch of the H α two-ribbon invaded the umbra of the preceding spot and showed relatively high polarization degrees of $\sim 70\%$ ('spot sources'); a pair of two sources seemed to correspond to the H α two-ribbon itself and showed weakly polarized bipolar structure ('two-ribbon sources'); and the fifth source occurred above a separate region near a separate spot group ('separate source').

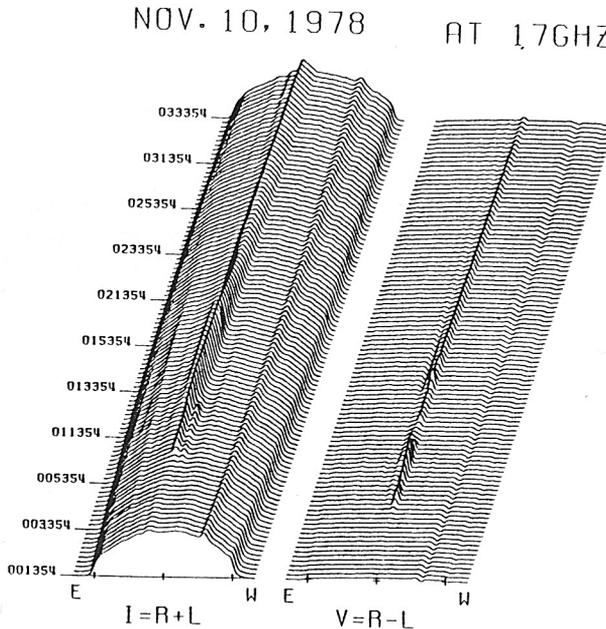


Figure 3. East-west profiles of the Nov.10,1978 event. Each map is drawn at equal intervals of 2 min. Time is written at the left in UT. The vertical scale ratio (V/I) is three as same as in Figure 1.

From the comparison between the time profiles of each source at 17GHz and the total flux records (Toyokawa ; 1000, 2000, 3750, 9350MHz), it can be pointed out that the 'two-ribbon sources' corresponded to the slowly-varying enhancement of the total flux records, and that the 'spot sources' to the several spikes of a few minute duration. The spectrum of the latter showed softer spectrum compared to that of the former. Moreover, it is interesting that the spectral fine features at metric and decimetric wavelengths begun simultaneously with the appearance of the second 'spot source'.

The interpretation of this complex event will be described later in a separate paper.

DISCUSSION

Alissandrakis: It seems that whenever you observe a bipolar circular polarization structure one polarity is considerably stronger than the other. Kundu and myself reached the same conclusion in our Westerbork observations of bursts. Kundu and Vlahos recently developed a model which explains this observation in terms of an asymmetric loop, with different magnetic field intensity at its footpoints.

Kosugi: Yes, that is right, yours is one possible interpretation.