RESULTS OF OBSERVATION OF SPECTRA AND POLARIZATION OF METER SOLAR RADIO EMISSION WITH HIGH TIME RESOLUTION: MAY–JUNE, 1969

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Abstract. Simultaneous observations of spectra and polarization of two noise storms with high time resolution have been performed in IZMIRAN during the periods: May 17–23 and June 7–13, 1969. The results of the analysis show that for different noise storms Type I bursts and chains of Type I bursts possess different spectral and polarization characteristics and different tendencies in variation of these characteristics from day to day. In particular, the first stage of the noise storm in May presented some Type I bursts which displayed a varying degree of polarization within their individual lifetimes. In addition, 112 Type III bursts with weak or moderate polarization were observed.

1. Introduction

In recent years the time and frequency resolving power of solar radio observations in meter wave regions has been steadily improved. Thus it has become possible (1) to study the characteristics of numerous short-lived and narrow-band bursts, in particular Type I bursts, and (2) to study the fine structure of more long and wide-band bursts, similar to Type III bursts. Such research is necessary in order to convert a qualitative interpretation of events into a detailed understanding of the processes which result in the generation of both kinds of bursts.

In the majority of observations performed so far only separate characteristics of bursts have been measured with corresponding resolution, such as: time profile (in a number of cases at several close frequencies) (Vitkevich and Gorelova, 1961; De Groot, 1966; Dröge, 1967; Abrami, 1967), spectrum (Elgaroy, 1961; Philip, 1968; Ellis, 1969; De Groot, 1970) or polarization (Rao, 1965; Harvey and McNarry, 1970; Warwick and Dulk, 1969). The results described here were obtained in IZMIRAN during simultaneous observations near 200 MHz of spectrum, flux density and polarization.

The observations were carried out during noise storms; their purpose was to look for variations in the characteristics of Type I bursts, particularly the behaviour of polarization. Besides, a task was set to trace the variations in the parameters of Type I bursts during the development of a given noise storm, as well as comparing its structure and evolution for different noise storms. The observations were made during two selected periods: May 17–23 and June 7–13, 1969. These periods are described in Sections 3 and 4, respectively. Details on 112 Type III bursts observed during these periods are given in Section 5.

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2. Equipment and Method of Observation

Dynamic spectra of radiobursts were obtained with a spectrograph, working in the range 190–220 MHz which yields a frequency resolution of 0.25 MHz and a time resolution of 0.02 s for bursts with flux density $F \geqslant 3 \times 10^{-22}$ Wm^{-2} Hz^{-1} (Markeev and Chernov, 1970). The spectra were recorded on film running at a speed of 10 mm/s.

The bursts intensity and polarization has been measured at 204 MHz with a time constant of 0.01 s. The film speed of the recording equipment was 50 mm/s. To get the overall picture of radio emission the data of polarization and intensity were recorded on devices with time constant 1 s and slow velocity.

During the two selected periods the observations were carried out daily (except May 19) from 0400 to 0700 UT. Spectral observations were performed practically continuously during those three-hour intervals, and the high-speed registration of flux and polarization was obtained in runs of 10 minutes duration. Each day 5 to 7 such runs were made.

The investigation of individual Type I bursts is quite a difficult task, since in a lively storm bursts are generated so frequently that they partially overlap both in frequency and time. Therefore, only a relatively small number of bursts that are not distorted by neighbouring ones are suitable for analysis. In the present paper bursts are considered as sufficiently isolated if in the dynamic spectrum they are separated from other bursts by a frequency interval which at least amounts to their average bandwidth $\Delta f = 5$ MHz; similarly the time interval should exceed their average duration $\Delta t = 0.4$ s (Elgaroy, 1961; De Groot, 1960).

Both bandwidth Δf and duration Δt were determined on the dynamic spectrum and measured at points where a given burst can be visually distinguished from the background.

We also selected a number of isolated bursts that crossed the frequency 204 MHz and that were suitable for the analysis of polarization. Only those bursts were considered that had a time profile with one maximum and that returned to the background continuum before the beginning of a new burst. Burst polarizations were determined for the burst proper, discarding the background intensity.

The analysis has shown that the degree of linear polarization of bursts was, as a rule, low and within the limits of error (5–10%). Therefore circular polarization only will be discussed.

The high time resolution of the polarimeter allows the measurement of the burst polarization at maximum of intensity and the investigation of the dependence of the degree of polarization on time $m(t)$ in the course of an individual Type I burst. At the beginning and the end of a burst, when its intensity is small, the determination of the degree of polarization is of course less accurate. Therefore we consider the polarization development only at that part of the time profile, where the intensity is $I \geqslant 0.1\ I_{\max}$. For every burst examined the degree of polarization has been calculated at both sides from the maximum of time profile in definite intervals of time τ. For the majority of bursts we choose $\tau = 0.1$ s. In the cases when more detailed study of polarization was desired the calculations were done in shorter intervals up to $\tau = 0.03$ s.

3. The Noise Storm of May 17–23, 1969

3.1. General characteristics

The character of the variation of main storm parameters with time at the frequency 204 MHz may be judged from the data in Figure 1. Here are shown variations from day to day of the average flux density of the continuum F_c and of Type I bursts F_b, as well as the degree of polarization of the continuum m. The values of F_c, F_b and m for every day are obtained as an average over the three-hour observing interval (0400–0700 UT).

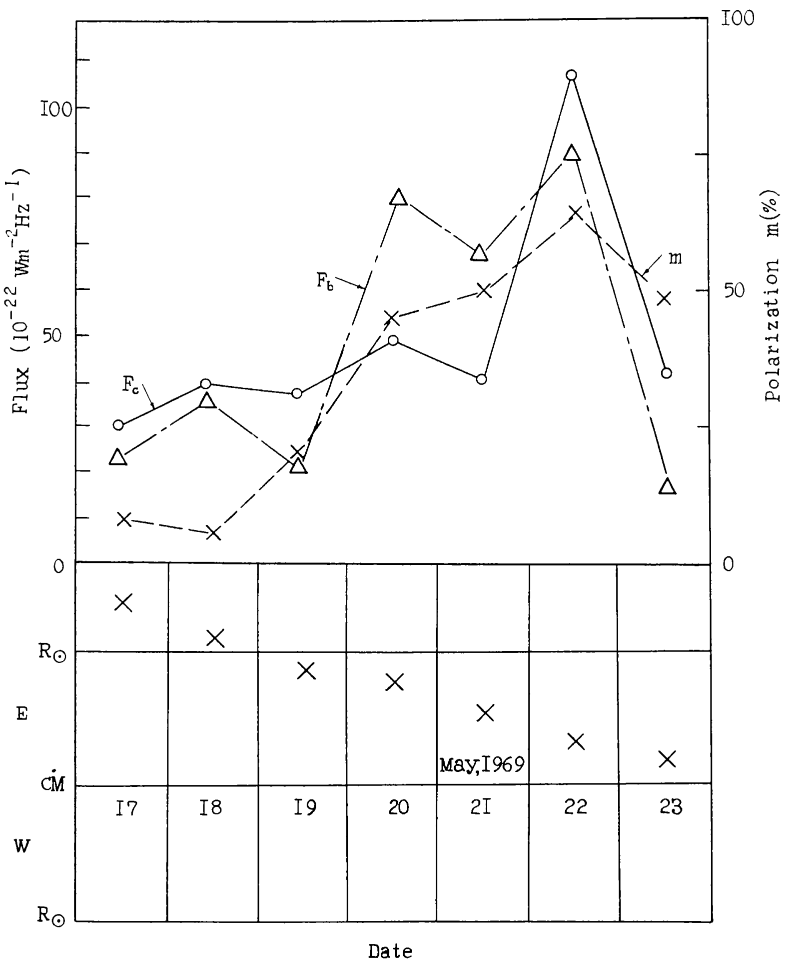

Fig. 1. Noise storm development on 204 MHz and the position of sources' centre on 169 MHz, May 17–23, 1969. F_b – flux density of Type I bursts; F_c – continuum flux density; m – degree of the continuum polarization.

In the lower part of the picture the position of the noise storm source with respect to the central meridian is shown on the basis of Nancay interferometer observations on 169 MHz (*Solar-Geophysical Data*, 1969). It is well known that the noise storms are observed over a frequency range of the order 100 MHz. Therefore, at 204 MHz the source position is likely to be close to the 169 MHz position. Consequently, during the period May 17–23 the source of the noise storm was moving from the eastern limb to the centre. The intensity of the storm (continuum and Type I bursts) was comparatively low during May 17–19; intensity increased during May 20–22. Similarly the degree of continuum polarization was $<10\%$ on May 17–18 and then gradually increased, reaching a maximum of 60% on May 22. During the period the radio emission was right-handed polarized. On May 23–24 the noise storm practically came to an end.

There was also an evolution of characteristics of individual elements of the noise storm, notably of Type I burst chains.

3.2. ISOLATED TYPE I BURSTS

The number of isolated bursts is connected in rather a complicated manner with the noise storm intensity. On the one hand, when a storm is weak, the number of Type I bursts is not great and almost all of them may be considered as isolated ones. On the other hand, during a strong noise storm both intensity of burst and frequency of their repetition increase, the latter even more. Consequently the majority of bursts overlap and the number of bursts which may be considered as isolated ones can decrease even in comparison with that of a weak storm. This is one of the reason why the following analysis is restricted to the May 17–21 period.

According to Elgaroy (1961), the Type I bursts can be divided into three main subclasses: bursts of Type I(s) – their frequency remains constant; bursts of Type I(d) with drift from high frequencies to low ones, and bursts of Type I(r) with an opposite direction of frequency drift.

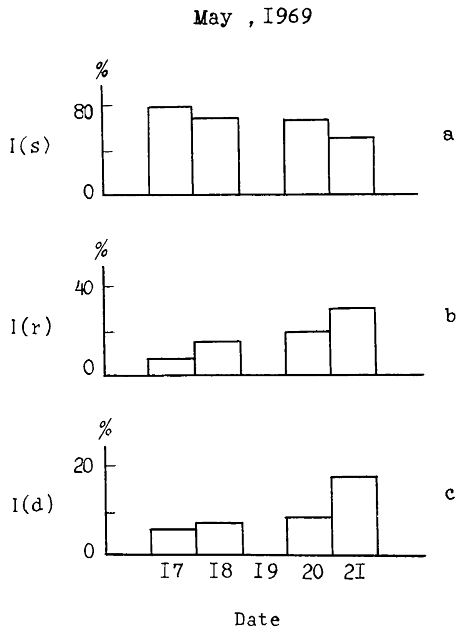

Fig. 2. Variation of relative contents of Type I(s), I(r) and I(d) bursts during storm of May 17–21, 1969.

An evolutional feature of the storm consisted in the steady decrease of the percentage of I(s) bursts (80% on May 17 and 51% on May 21). There was a corresponding increase in the relative number of bursts of Types I(r) and I(d) (Figure 2); during the total period the number of Type I(r) bursts was twice as great as that of Type I(d).

The total number of the selected bursts was 97, 234, 212 and 261 on May 17, 18, 20 and 21, respectively.

Another feature of the May storm consisted in typical variations of parameters of stable and drifting bursts, namely, bandwidth Δf and duration Δt.

Characterizing the stable Type I(s) bursts by the ratio of Δf (MHz) to Δt(s), we note that on May 17–18 bursts with $\Delta f/\Delta t = 5-10$ predominated whereas on May 20 and 21 (on 21, especially) the bursts had ratios $\Delta f/\Delta t = 10$–30. According to data in Figure 3 this increase of $\Delta f/\Delta t$ for Type I(s) bursts occurred mainly because of the shortening of their duration. During May 17–21, the average bandwidth Δf varied within 3.6–4.7 MHz from day to day, and the average duration Δt monotonously decreased from 0.46 s (May 17) to 0.23 s (May 21).

There also occurred systematic shortening in the lifetimes of the drifting bursts (Figure 3). However, the frequency bandwidth of the Type I(r) bursts and Type I(d) bursts in particular tended to increase, at variance with the behaviour of the I(s) bursts. One should notice that for drifting bursts we did not measure the instantaneous bandwidth and duration on a given frequency; these quantities were defined as the sides of a rectangle, that just encloses the of the image of the bursts on the dynamic spectrum. Therefore such a variation of Δf and Δt may be considered as evidence of a gradual increase of the frequency drift of Type I(r) and Type I(d) bursts in the course of the noise storm.

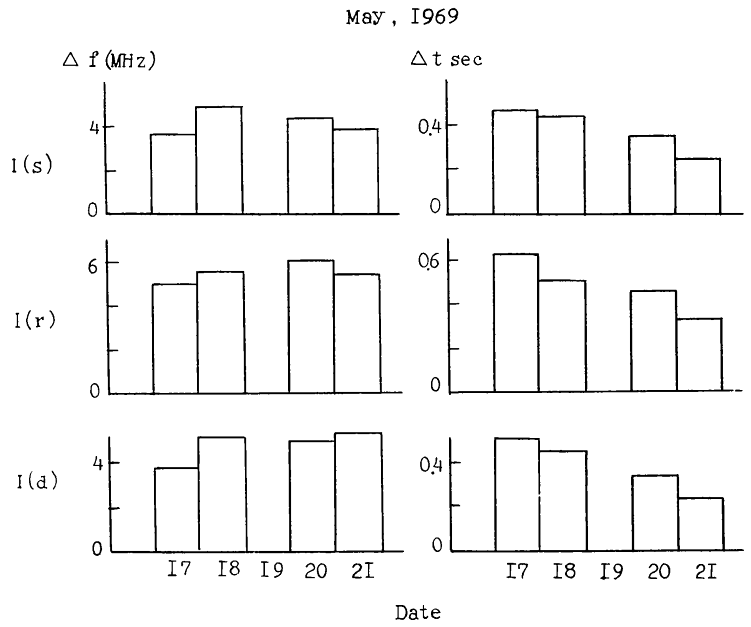

Fig. 3. Variation of bandwidth Δf and duration Δt of Type I(s), I(r), I(d) bursts for May 17–21, 1969.

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In the given noise storm the average Type I burst (irrespective of its class) is characterized by a bandwidth of 4.6 MHz and duration of 0.37 s.

The polarization of the isolated Type I bursts gradually increased with the noise storm development as well as that of background continuum. The value of the degree of polarization, measured at the moment of maximum burst's intensity and averaged for a day, was 27% and 54% for May 17 and 18, respectively. From May 20 and 21 till the end of the storm the bursts were fully polarized. Such an increase of polarization occurred for both stable and drifting bursts. During the whole period bursts had stronger polarization than the continuum (Figure 1). The sense of polarization for practically all bursts was right, i.e. it coincided with that of continuum polarization, regardless of the burst's spectral characteristics or in what part of burst (low, middle or high frequency) the polarization was measured.

At the initial stage of the storm (May 17–18), when the average polarization of the bursts was comparatively small, bursts with a variable degree of polarization were observed. The character of the variability in polarization in the course of a burst was rather diverse. Examples of $m(t)$ dependence are shown in Figure 4. Here are given the dynamic spectra and the time profiles of the bursts. From 46 analysed bursts 36 refer to Type I(s) bursts, 9 to I(r) and 1 to I(d).

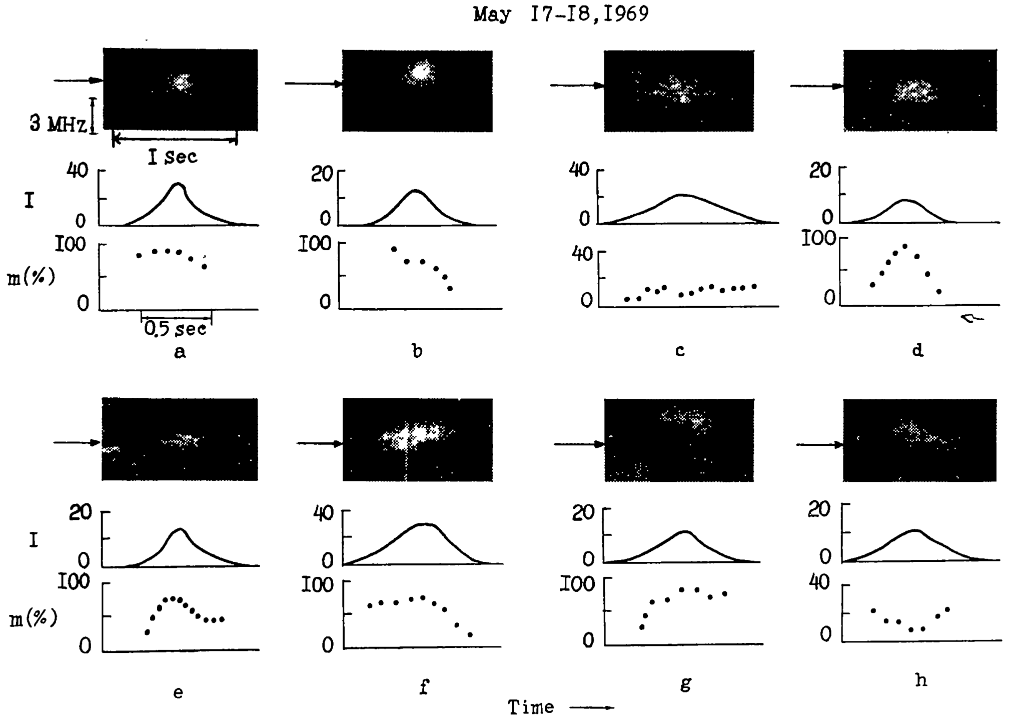

Fig. 4. Examples of the variations of the degree of polarization for isolated Type I bursts on May 17–18, 1969. Spectrum and intensity profile I is given for every burst. Horizontal arrows at the dynamic spectrum indicate the frequency of 204 MHz.

For Type I(s) bursts a decrease of the degree of polarization with time is most typical. Among 16 stable bursts there are 9 during which the degree of polarization steadily decreases (Figure 4b); for 7 of them m is constant up to the moment of maximum intensity, and after that steadily decreases until the burst ends (Figure 4a). For another 10 stable bursts the form of the polarization variation is analogous to the form of the time profile: the degree of polarization is highest at the moment of maximum intensity (Figure 4d and 4e). On the contrary, for 3 Type I(s) bursts m is minimal at maximum intensity. The other 7 bursts of that type are rather equally distributed between the bursts with a constant degree of polarization and $m(t)$ increasing during the burst.

The number of drifting bursts of Type (r) is small and therefore it is difficult to speak about the predominance of either dependence of degree of polarization. However, one can notice that out of 9 bursts there are 3 for which $m(t)$ passes through a minimum when the intensity is highest (Figure 4h).

The variation of the polarization of a single Type I(d) burst is shown in Figure 4f. In contrast with events observed on May 17–18, the general peculiarity of practically all the bursts recorded from May 20 on is a constant 100% polarization. This regularity refers equally to all the bursts which can be essentially different in all other characteristics, such as spectrum, time profile, and so on. This fact is illustrated by the examples of bursts shown in Figure 5. Here a dynamic spectrum is given for every burst, as well as the variation in time of right-handed and left-handed polarized components: I_R and I_L respectively.

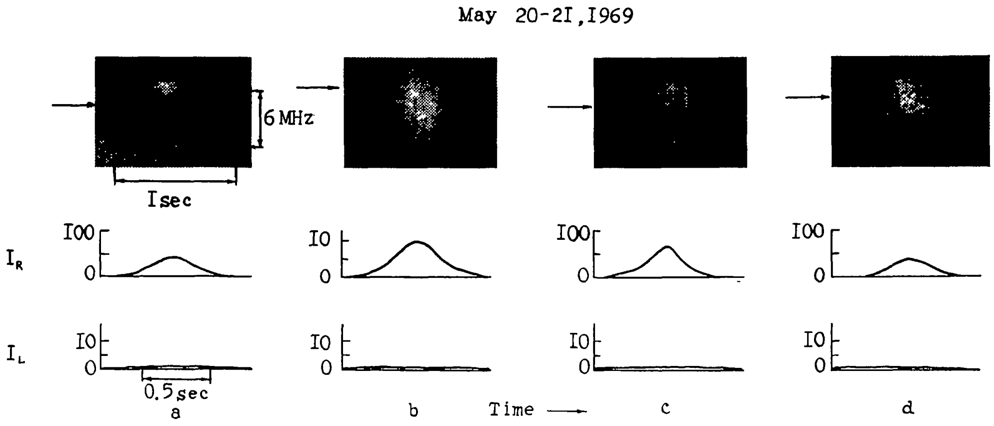

Fig. 5. Fully polarized Type I bursts for May 20–21, 1969. I_R and I_L – intensity of right-handed and left-handed polarized components respectively.

3.3. GROUPS AND CHAINS OF TYPE I BURSTS

It is well known that in a noise storm Type I bursts have a strong clustering tendency in both frequency and time, forming different complexes of bursts, such as chains, groups, and so on (Hanansz, 1966; Elgaroy and Ugland, 1970).

On May 17 and even more so on May 18 and 20 the dynamic spectrum shows noticeable enhancement of activity during definite intervals of some minutes duration. During such intervals there is an overall increase in the number and intensity of bursts. In a number of cases such large groups of bursts start very suddenly. The decrease of activity to the average level occurs more smoothly. Approximately half of the groups with a lifetime of 1 min and more, coincide in time (with the exactness of some minutes) with the maximum of a flare observed in Hα or with Type III bursts. However, there are some groups which apparently are not connected with any noticeable manifestation of activity in the optical and radio domains.

The most common form of Type I burst complex is the occurrence of fairly short and relatively narrow-band events – the so-called chains. The chains distinguish themselves by the form of spectrum, their fine structure, the character of burst grouping, and so on. Some examples of chains are given in Figure 6. Chain (a) is a typical example of a chain consisting of individual links, formed by several bursts. Such chains are recorded very often. In many chains links are practically identical. The gaps between links may change greatly, sometimes they are longer than the links. In a number of chains the bursts are situated along an arc (Figure 6b). In most cases the top of such an arc is directed toward low frequencies. The chain (c) consists of a succession of two arcs. The central frequency of a line, along which bursts in the chain are situated, sometimes undergoes quasi-regular oscillations, for example, in chain (d). The spectrum of an interesting event, where short-lived chains overlap Type III bursts, is shown in Figure 6e.

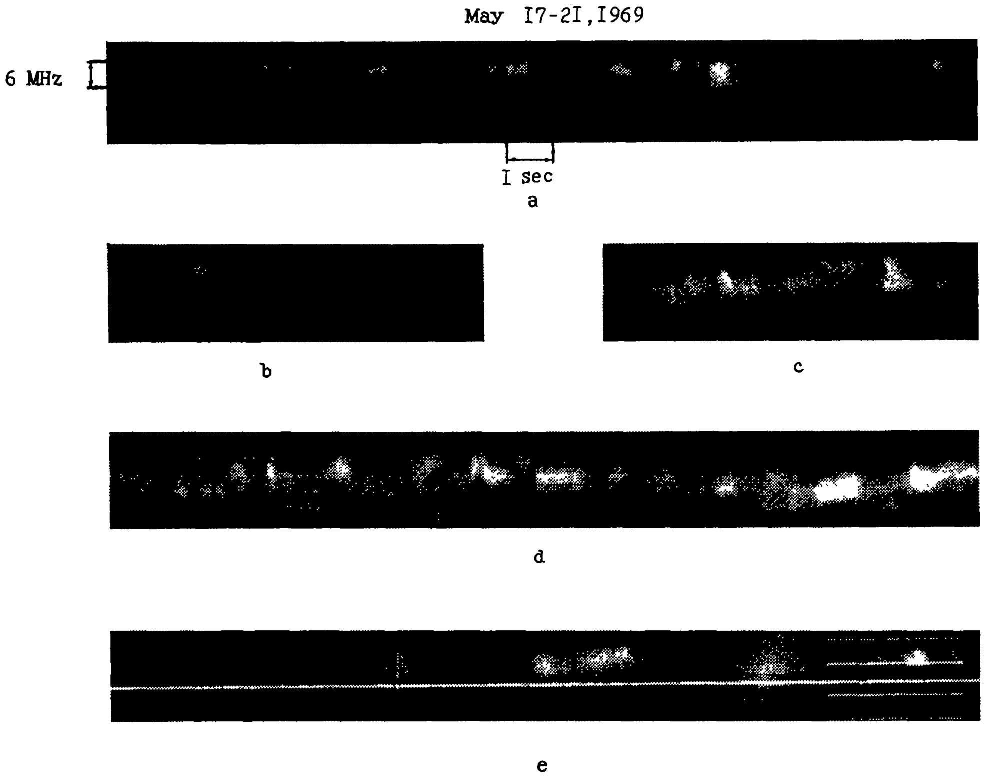

Fig. 6. Spectra of Type I burst chains for May 17–21, 1969.

Because of the very great variety of chains it is desirable to use a criterion which allows one to select chains of a definite class. Following Elgaroy and Ugland (1970) we selected chains in accordance with the following criteria:

(1) A chain must contain not less than 4 bursts or its duration must be longer than 2 s;

(2) The time separation between two successive bursts must be not more than 1 s;

(3) The chain must be characterized by regular arrangement of bursts along some line.

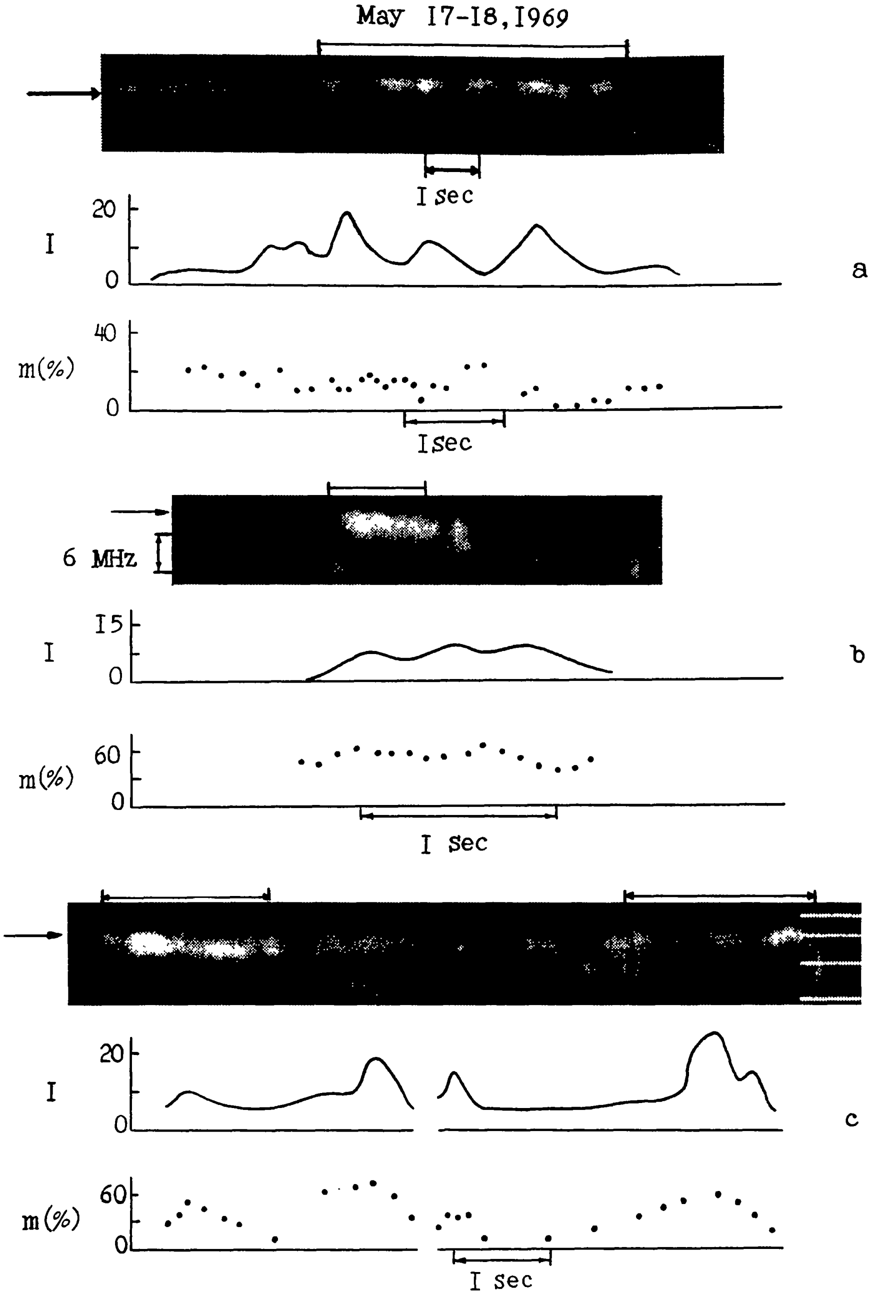

Fig. 7. Polarization of chains for May 17–18. Designation the same as in Figure 4.

According to these criteria 77 chains were selected during May 17–22; their duration varied from 2 till 30 s. For the majority of bursts it was no longer than 10 s. The average duration of chains was equal to 7.2 s. A noticeable frequency drift ($(\mathrm{d}f/\mathrm{d}t) > 0.2$ (MHz/s)) was observed only for 25% of the chains.

For the storm in May there is a typical decrease of the bandwidth of the bursts during the duration of a chain. The average value of the bandwidth at the start of a chain $(\Delta f)_s = 4.8$ MHz, and at the end it is $(\Delta f)_e = 4.4$ MHz. A number of chains with $(\Delta f)_s$ greater than $(\Delta f)_e$ was also significantly greater (55% of events) than that with an increasing bandwidth (18% of events). For 27% of chains Δf remained constant. These data are in agreement with the results obtained by Elgaroy and Ugland (1970) in a treatment of several noise storms.

The increase of the degree of polarization during the noise storm development revealed for isolated Type I bursts occurred for chains as well. On May 17 and 18 the polarization of chains was relatively low, it seldom increased more than 50% (Figure 7). For many chains the degree of polarization was relatively constant, it fluctuated with a small scattering near the average value. Chains (a) and (b) may be taken as examples. For a number of chains the polarization changed noticeably at the moment of bursts. For example, in the arched chain (c), crossing the polarimeter frequency in the start and in the end, the polarization increased during intensive bursts and maximum polarization was at the moment of maximum intensity of bursts. We recall that similar polarization development was revealed for many isolated bursts observed on these days.

Beginning from May 20 the chains were fully polarized as were the isolated bursts. The of polarization in chains was right-handed and it coincided with the direction of both continuum and isolated bursts polarization for the given storm.

The polarization behaviour of long, powerful groups is similar to that of chains.

4. Noise Storm of June 7–13, 1969

4.1. GENERAL CHARACTERISTICS

The data characterizing the noise storm of June 7–12 are plotted in Figure 8. Proceeding from peculiarities of continuum F_c and bursts F_b flux density variations from day to day, as well as the degree of polarization m of the continuum component, two stages of the storm development may be provisionally distinguished. During the first stage, June 7–9, the intensity of both storm components on frequency of 204 MHz was low and the polarization degree of the continuum was not more than 10%. Then on June 10, a sharp intensification of noise activity occurred, and all the three parameters of the storm attained maximum values: $F_c = 80$ and $F_b = 170$ units of 10^{-22} W m^{-2} Hz^{-1}, $m = 80\%$. On June 10–12 the flux density and polarization degree gradually decreased, but continued to be appreciable. On June 13 no noise storm was observed. During the second stage of the storm of June 10–12, the bursts were 1.5–2 times more intensive than the continuum. During the whole period the continuum was left-handed polarized. It should be noticed that there is a distinct relation between the variation of the flux density and the continuum polarization, as was the case with the noise storm of May 17–22. According to the interferometric observations made at frequency 169 MHz (*Solar-Geophysical Data*, 1969), the source of the

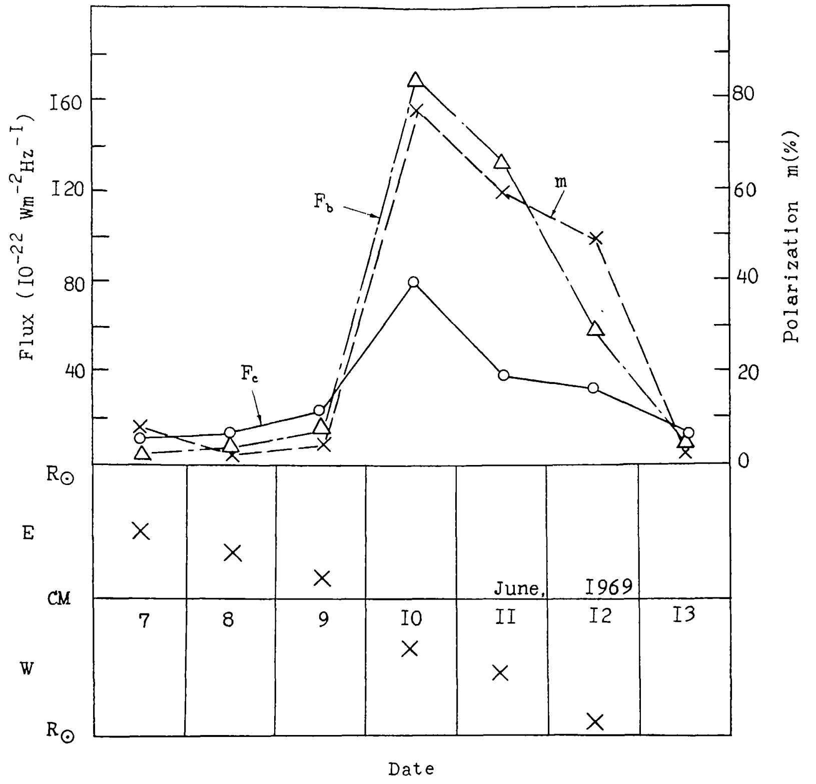

Fig. 8. Development and position of the source centre of noise storm of June 7–12, 1969. Designation the same as in Figure 1.

noise storm was situated over the central part of the solar disc. The passage of the central meridian occurred on June 9–10.

4.2. ISOLATED TYPE I BURSTS

Analysis of spectral and polarization data reveals an appreciable evolution of a number of characteristics of the isolated bursts during the given noise storm.

In Figure 9 the variation of both duration Δt and the bandwidth Δf from day to day is shown. The total number of selected bursts was 100, 219, 177, 172 and 176 for June 7, 9, 10, 11, 12, respectively. The number of bursts for June 8 is small and no data for that day are given. A tendency is well pronounced for duration increase for both stable and drifting bursts. It differs from the decrease of Δt during the noise storm of May 17–22. The bandwidth Δf increased during the beginning of the storm, it attained a maximum value on June 9–10 and it was decreasing towards the end of the storm. On the average the Type I bursts during the described period were longer ($\Delta t = 0.45$ s) than during the May storm but had approximately the same bandwidth ($\Delta f = 4.7$ MHz).

The degree of polarization of the burst component was not constant during the noise storm. On June 7–9 bursts were comparatively weakly polarized and the degree of polarization increased from day to day. From June 10 on the bursts with practically full polarization were predominating. The typical feature of that period, especially

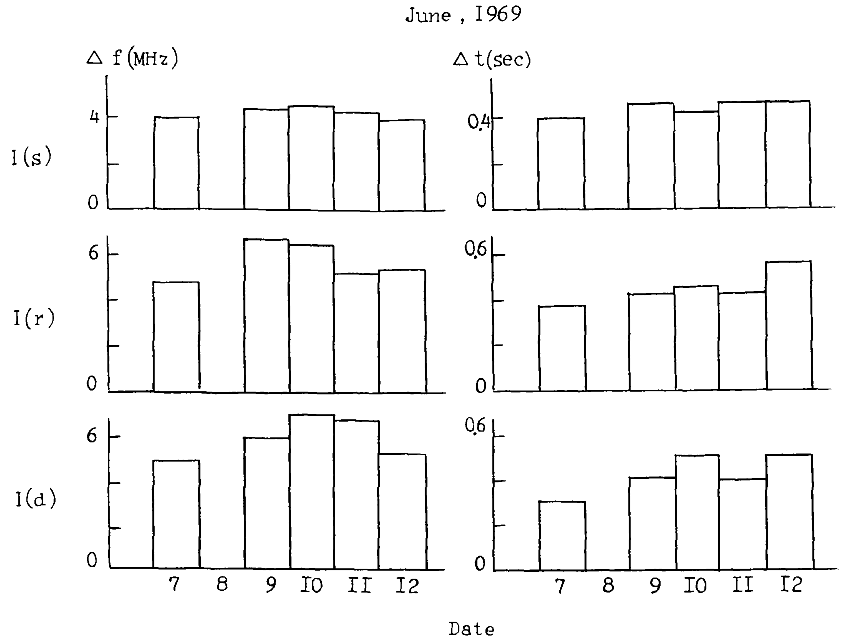

Fig. 9. Variations of both bandwidth Δf and duration Δt of Type I(s), I(r), I(d) bursts for June 7–12, 1969.

during the initial stage of the storm, was the presence of Type I bursts with opposite polarization. Bursts with the left-handed polarization i.e. polarized in the same sense as the continuum, were more numerous and possessed greater degree of polarization than those with right-handed polarization.

For the given noise storm an investigation of the variation of the degree of polarization with time $m(t)$ in the course of a given burst has been carried out as well. This consideration allows for a conclusion about the predominance of bursts with a

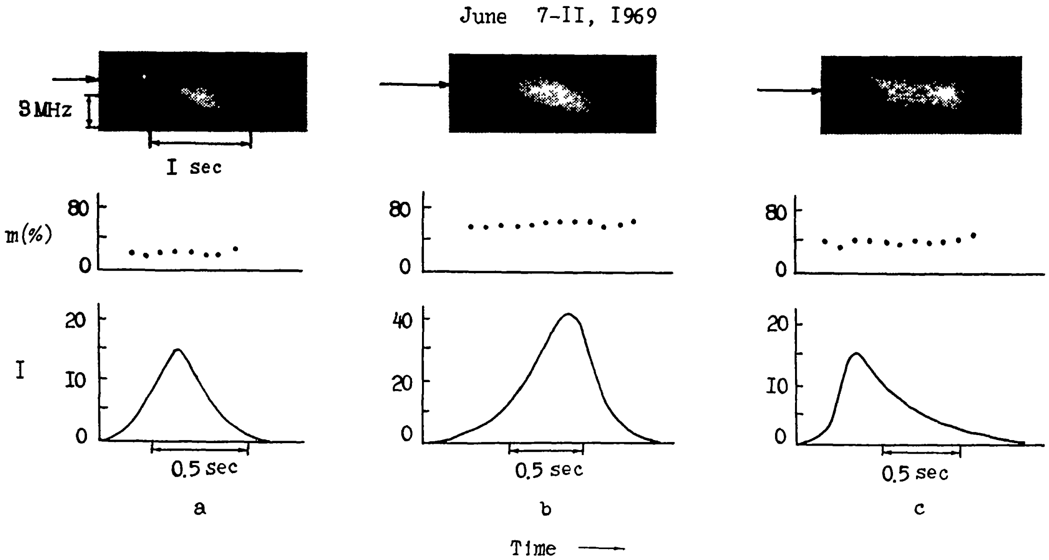

Fig. 10. Examples of spectra, profiles of intensity I and polarization m of Type I bursts for June 7–12, 1969.

stable degree of polarization throughout the given storm. So, for 21 out of 23 analysed bursts m was constant during the burst. Such stability is observed for bursts of different spectral class. Compared with the May storm they have different intensities and time profiles. Of special interest is the fact that the degree of polarization does not change even in weakly polarized bursts. Examples of bursts with a constant degree of polarization are given in Figure 10. Two Type I(s) bursts, recorded on June 7 with an interval of about 1 s, formed an exception. Here the variation of the degree of polarization roughly repeated the intensity variation as it was observed for many bursts on May 17–18.

4.3. CHAINS OF TYPE I BURSTS

An analysis of 60 chains, satisfying the criterion used by Elgaroy and Ugland (1970), shows that during the noise storm of June 7–12 the bandwidth of the initial burst $(\Delta f)_s$ of a chain was less than that of the final one $(\Delta f)_e$ in 45% of the chains. The opposite situation was found for 28% of the chains while 27% of the chains presented a constant bandwidth.

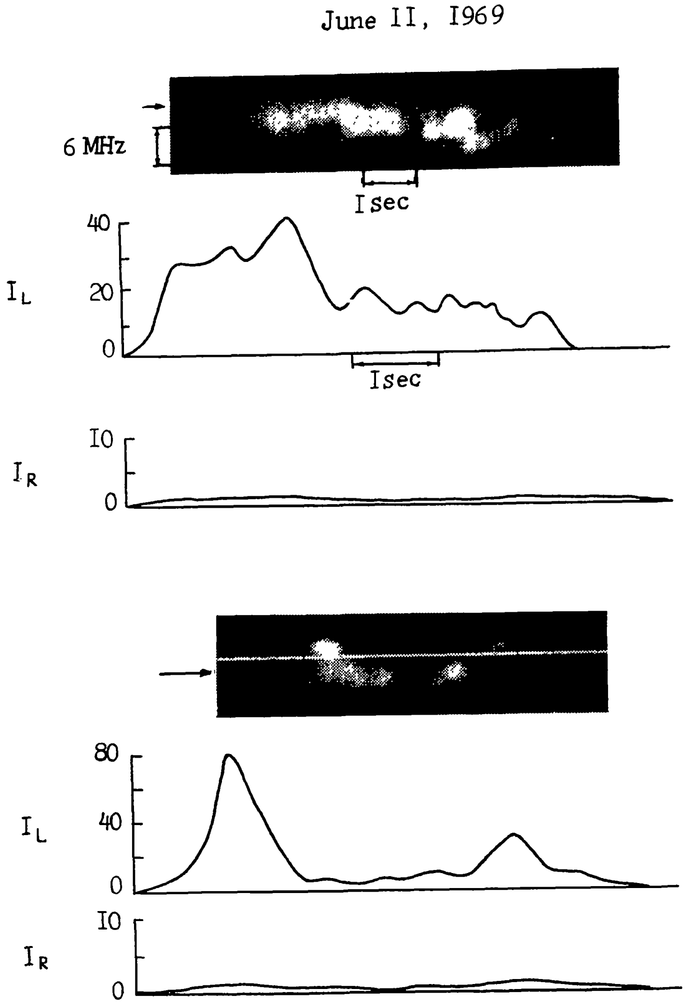

Fig. 11. Examples of chains with strong polarization, observed on June 11. Designation the same as in Figure 5.

Similar to isolated bursts, the polarization of chains was comparatively low on June 7–9. Beginning from June 10 practically all the chains were fully polarized. Spectra and intensities of the right-handed and left-handed polarized radio emission are shown in Figure 11 for two such chains.

5. Type III Bursts

Type III bursts are identified on the dynamic spectrum without any difficulty because of their wide range of frequencies, typical frequency drift and longer duration as compared with Type I bursts. However, in order to avoid any ambiguity connected with the narrow range of a spectrograph, the data of spectral observation in Weissenau (*Solar-Geophysical Data*, 1969) have been used as a confirmation of our identification. Besides, the checking of events was performed on a low frequency spectrograph, working in the range of 45–90 MHz.

112 Type III bursts were recorded with high time resolution during two observational periods: May 17–23 and June 7–13, 1969. 74 of them occurred during two days: May 17 and June 8. Analysis of the recorded bursts mainly include the investigation of some pecularities of the bursts polarization at 204 MHz.

It is well known that Type III bursts show often elliptical polarization (Cohen, 1959). According to our measurements a number of bursts had a small linear component of polarization. However, for all the investigated Type III bursts the degree of linear polarization was smaller than the circular one and not greater than 10%, that is within the error limits of the polarimeter. Therefore we report only on the circular polarization.

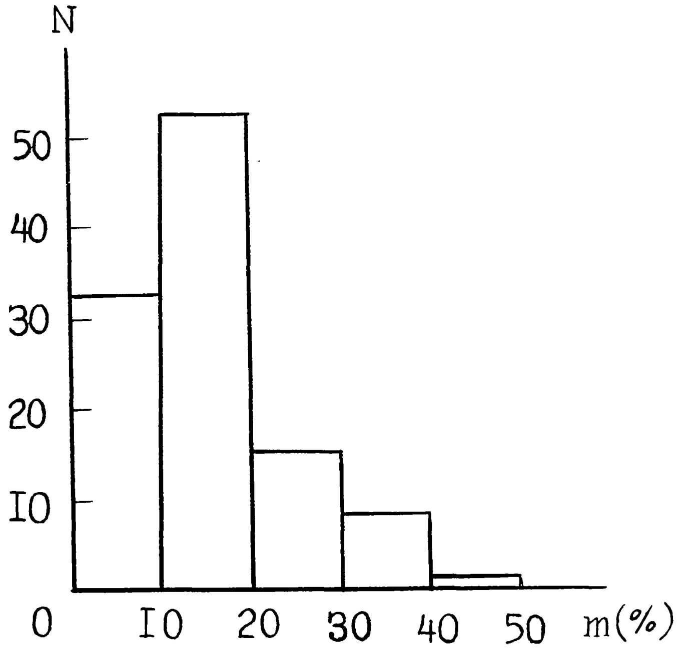

Fig. 12. Distribution of Type III bursts in depence of the value of the degree of polarization on 204 MHz.

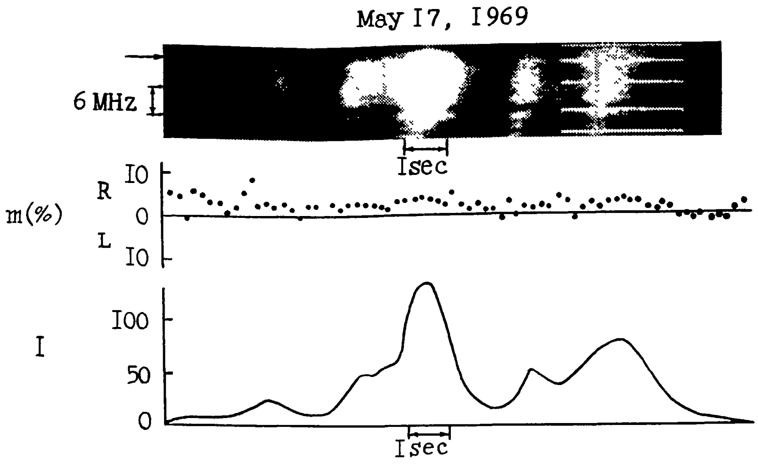

Fig. 13. Examples of spectra and time development of both intensity and polarization in Type III burst groups.

Figure 12 shows the distribution of the degree of polarization *m*, measured at the moment of maximum intensity. For 75% of bursts $m \leqslant 20\%$. Not a single burst had *m* greater than 50%. The average degree of polarization was 16%. For the majority of bursts the polarization was right-handed in both May and June.

Often bursts overlap, forming more or less compact groups. The analysis of 8 groups shows that the degree of polarization in the group does not change much with time. In Figure 13 fragments of dynamic spectrum are given, as well as the time development of polarization and the intensity for one group.

We were able to select 15 isolated Type III bursts that were not distorted by overlapping other Type III or Type I bursts. Several such bursts are shown in Figure 14. A number of such bursts remain unpolarized or weakly polarized during the lifetime, for example, bursts (a) and (b). For many bursts with noticeable polarization no variation of the degree of polarization was apparent during the burst (Figure 14d and 14e). Only 2 bursts out of 15 presented a gradual decrease of the degree of polarization to the burst's end (Figure 14c and 14f).

6. Discussion

The results given above permit one to draw some conclusions about the peculiarities of the microstructure of these two noise storms.

(1) The noise storm is not a set of Type I bursts with occasional properties. The bursts, forming the given storm, possess definite spectral, polarizational and other characteristics which vary during a storm in a process of development. This applies in particular to a change in the relative number of drifting bursts during a storm and to a systematic variation of both duration and polarization of isolated bursts.

(2) Noise storms essentially differ one from another as to the average values of a number of burst parameters and to the character of their change with time. So more short-lived Type I bursts ($\Delta t = 0.37$ s) occurred in the May storm than in the June

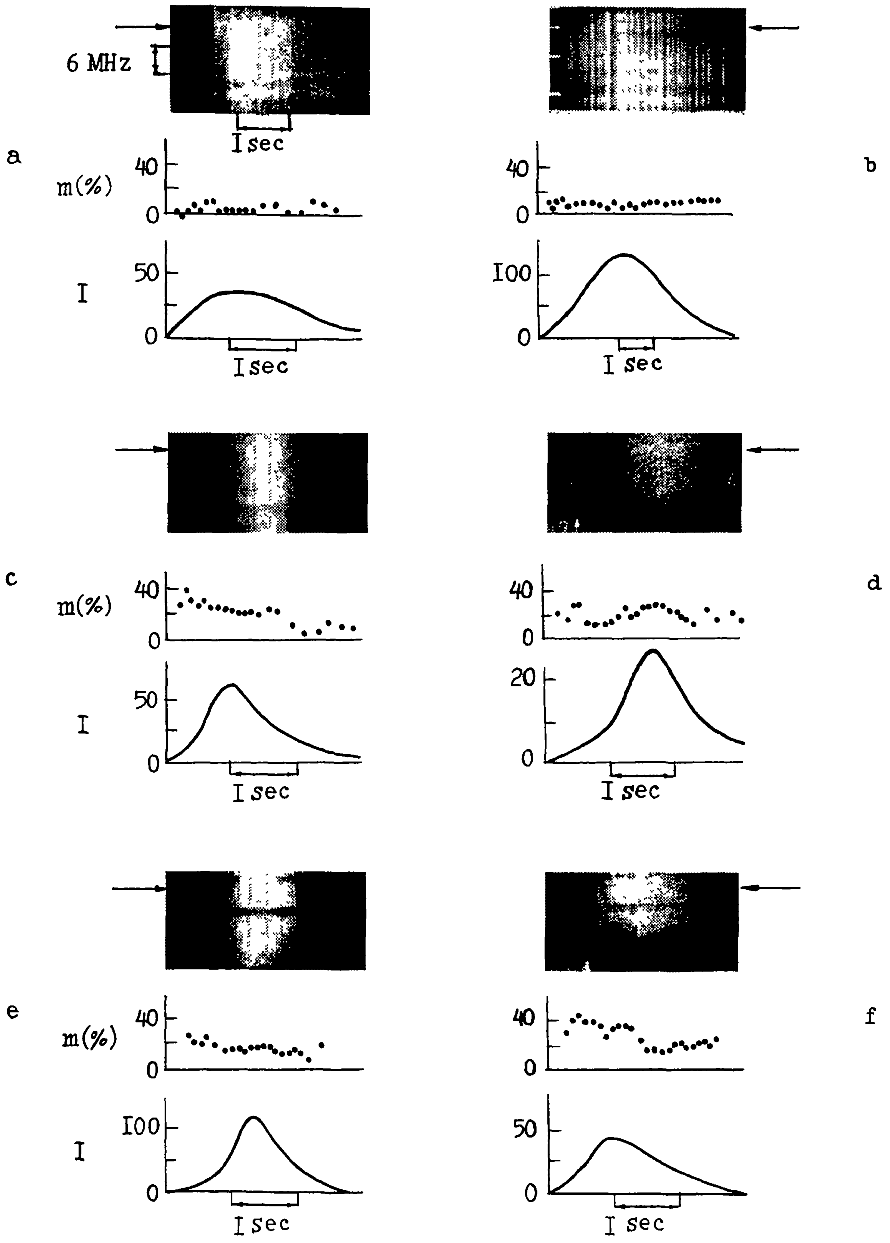

Fig. 14. Examples of spectra, profiles of intensity I and polarization m of individual Type III bursts. Horizontal dark lines and vertical bright lines are instrumental.

storm ($\Delta t = 0.46$ s), bandwidth being the same (4.6–4.7 MHz). Besides, during those storms the duration of isolated bursts changed in a contrary manner, during the May storm, a well pronounced decrease of Δt was observed from day to day for stable and drifting bursts, while the June storm the burst duration increased.

Noise storms essentially differ in the polarization behaviour of isolated bursts. During the May storm (May 17, 18), when the bursts were comparatively weakly polarized, the degree of polarization changed appreciably in the course of a majority of bursts. As for Type I (s) bursts, the most typical was the maximum polarization at the moment of maximum intensity on one hand and the steady decrease of polarization on the other hand. During the June storm the degree of polarization did not change with time for practically all the bursts, even when it was relatively small.

The difference in noise storms is also manifested in the parameters of chains. In particular, in June chains were observed which were composed of more wide-band bursts than in May. Besides that, if in chains registered in May the bandwidth of the first element was on the average greater than that of the last element, then for the June storm this tendency was just opposite. Hence the conclusion about bandwidth decrease in the course of chains, obtained by Elgaroy and Ugland (1970) on a number of storms, cannot be attributed to every individual storm.

As the source of the May storm was situated near the eastern limb, and the noise storm in June was generated over the central part of the disk, one may suppose that many (if not all) differences of storms are conditioned by the effects of a heliographic longitude. However, it is possible that certain regularities in the variation of the parameters and the noise storm structure are connected directly with the process of storm development, and the peculiarities of those changes, distinguishing one storm from another, are connected with the development of the corresponding active regions. Such properties as the intensity and the configuration of the magnetic field would seem to govern the characteristics of a particular noise storm.

The final answer may be obtained only after analysing a great number of noise storms in different stages of development and generated in different active regions.

(3) Together with some essential differences, the analysed noise storms had a number of peculiarities that apparently are common to all storms. If to take into consideration polarization, then a gradual increase of the degree of polarization of individual bursts and chains at the initial stage of storm development is a common property of both storms. After the degree of polarization of the burst component attains 100%, it remains on the same level till the end of the storm. In this case polarization is 100% in the course of chains and individual Type I bursts independently of any peculiarities in their spectrum or time profile.

The persistence of 100% polarization may be related to a relatively small radial extent of the sourse l. If bursts are generated at the electron plasma frequency, then with $l<\Delta h$ (Δh is the distance between the escape levels of ordinary and extraordinary waves) the radio emission from the sourse may occur only as waves of ordinary type. And according to observations all the bursts will be completely polarized.

The sense of polarization both for isolated Type I bursts and chains is the same for all the events of a given storm and coincides with the sense of polarization of the continuum. For the May storm this affirmation is completely right. As to the June storm the occurrence of bursts with the right-handed and left-handed polarization is connected with the presence of two active regions on the solar disk, situated approximately on equal longitudes in the nothern and southern hemispheres. Over southern active region McMath 10135 with N polarity of the magnetic field the left-handed polarized continuum and bursts with the left-handed polarization were generated. Bursts which revealed the right-handed polarization seem to be connected with the northern active region McMath 10134 with predominating magnetic field of S polarity.

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