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Properties the solar S-bursts storm observed on 9 July 2013 at frequencies 9-32 MHz

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1 Extended abstract

Solar S-bursts are known to be the shortest bursts among all types of solar sporadic radio emission. Their durations are mostly less than 1 s with the shortest reported value reaching 20 ms [1]. These bursts are observed exclusively at meter and decameter waves [2,3]. Due to short durations and low intensity S-bursts can only be investigated by large ground-based radio telescope equipped with high-resolution and sensitive back-ends, such as LOFAR, NenuFAR, LWA, UTR-2, etc.

The most recent study of the S-bursts parameters was performed by Morosan et al. [3]. Authors have analyzed about 3000 individual S-bursts observed on 9 July 2013 by LOFAR tied-array in frequency band 20-80 MHz. They also obtained the image of the source. That day the UTR-2 and URAN-2 radio telescopes were also on duty. So we decided to supplement the above research with data obtained by different instrument at lower frequencies, namely from 9 to 32 MHz. On 9 July 2013 from 5:30 UT till 13:28 UT more than 1000 S-bursts were recorded in frequency band 9 -32 MHz. All S-bursts are very poor events with average flux of about 10 s.f.u. and minimum flux reaching 0.2 s.f.u., what makes their detection using small instruments practically impossible.

General dependences of S-bursts parameters on frequency were obtained. They are in good agreement with previously reported ones.

The degree of circular polarization was high with the sense opposite to that of accompanying type III and IIIb bursts. The essential feature of the observed S-bursts is that they often appear in dense groups by 5-10 individual bursts separated in time by approximately doubled half-power duration of one burst. There were few S-bursts which had the appearance of the solid line on the dynamic spectrum while drifting from its highest to lowest frequencies. The majority of them look like dashed lines with frequency width of one fragment varying from 0.5 to 2 MHz.

There was an interesting phenomenon when the fragments of successive S-bursts of the group form a kind of a chain drifting in frequency. During the session more than 20 such chains were identified. These chains have exclusively positive frequency drift rates varying from 1 to 5 MHz/s and consisted of 4 to 16 elements. The frequency widths of the chains vary from 1.5 to 6 MHz. Such chains were never described before. From the viewpoint of plasma emission mechanism the observed chains of S-bursts fragments could be the manifestation of the two exciters moving towards and outwards the Sun with average velocities of 0.1c, where c is the speed of light.

References

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