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Spectrum characteristics of solar radio type-I burst by statistical analysis

IWAI, Kazumasa[1*], MISAWA, Hiroaki[1], TSUCHIYA, Fuminori[1], MORIOKA, Akira[1], MIYOSHI, Yoshizumi[2], MASUDA, Satoshi[2]

[1]PPARC, Tohoku University, [2]STEL, Nagoya University

Non-thermal electrons accelerated in the corona emit radio waves in the metric range. They are observed as several types of solar radio bursts. Type-I noise storm is one of the most frequently observed solar radio phenomena at a metric frequency range. They are thought to be a plasma emission around local plasma frequency. Type-I contains many complex fine structures in their spectra. They are thought to be caused by some inhomogeneities of particle acceleration, wave generation, radio emission, and/or radio propagation processes. However, the fundamental spectral structures have not been resolved sufficiently because of the limited time and frequency resolutions of the observation system. Now, more detailed analysis of spectrum structures of them are thought to be important to understand plasma processes in the solar corona. The purpose of this study is to extract fundamental spectrum parameters of type-I from high resolution observation and explain its generation processes.

Iitate Planetary Radio Telescope (IPRT) is a ground-based radio telescope developed by Tohoku University. Solar radio observation system of IPRT (AMATERAS) enables us to observe solar radio bursts in the frequency range between 150 and 500 MHz with the 10 ms accumulation time and 61 kHz bandwidth. It is suitable for observing characteristics of fine spectrum structures of solar radio bursts. The observational results for Type I bursts showed that the fundamental spectral structures have a duration of between 100 and 1000 ms. Typical full-width half-maximum of the burst bandwidth is between 1 and 5 MHz. Each element shows symmetric exponential growth and decay phases in time. We have also researched the peak flux distribution of type-I bursts. The observational results suggest that type-I bursts show a power-law distribution with the spectral index of 2 - 3. The index is larger than that of flares and radio type-III bursts (< 2). According to the logistic avalanche model (see Aschwanden et al 1998), the observed soft spectrum can be explained that source region of type-I is localized in a small region or the dominant instability of type-I grows slowly.

Keywords: Sun, corona, radio burst, ground-based observation, particle acceleration