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Fine spectral structures of a solar radio type-II burst observed with AMATERAS

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Solar radio type-II bursts are metric to hectometric radio bursts that show frequency drifting spectral structures caused by the plasma emission from shock-accelerated electrons. The emitting frequencies of them are close to the local electron plasma frequency and/or its harmonics. The burst has a rapidly drifting fine structure in their spectra called ”herringbone” [Roberts, 1959], which is composed of both negative (toward Interplanetary) and positive (toward sun) drifting burst elements. They are interpreted as the motion of non-thermal energetic electron beams accelerated by the shock. However, the particle acceleration mechanism of them has not been fully understood. The purpose of this study is to extract characteristics of the fine spectral structures of type-II bursts from high-resolution observations and investigate the acceleration processes.

AMATERAS (the Assembly of Metric-band Aperture Telescope and Real-time Analysis System; Iwai et al., 2012) is a ground-based solar radio telescope developed by Tohoku University. This system 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, which is suitable for observing characteristics of fine structures of solar radio bursts. A type-II burst event was observed on November 12, 2010, which showed distinctive fine spectral structures. We derived the following properties of the fine spectral structures;

1. Negative drift elements were found more frequently than positive drift elements.
2. In many cases, the start frequencies of the positive drift elements located near the center frequency of the main spectral structure of the observed type-II .
3. The mean value and standard deviation of the derived beam velocities increased with increasing radial distance of the radio source region from the solar surface.

Keywords: solar corona, particle acceleration, ground-based observation