Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PEM26-P04 Room:Convention Hall Time:May 23 18:15-19:30

Narrowband fiber bursts (NFBs) in type IV bursts observed with IPRT/AMATERAS

Yukio Nishimura[1*], Takayuki Ono[2], Yuto Katoh[2], Atsushi Kumamoto[2], Hiroaki Misawa[3], Fuminori Tsuchiya[3], Kazumasa Iwai[4]

[1]C3IS Systems Corporation, [2]Department of Geophysics, Graduate School of Science, Tohoku University, [3]Planetary Plasma and Atmospheric Research Center, Graduate School of Science, Tohoku University, [4]Nobeyama Solar Radio Observatory, National Astronomical Observatory of Japan

Solar Type IV bursts are a type of intense radio phenomenon that accompanies solar flares. Following the discovery by Elgaroy (1959), many observations have suggested that Type IV bursts are accompanied by several kinds of spectral fine structure. One type of prominent fine structure is fiber bursts, which are generally assumed to be emitted through the wave-wave coupling between Langmuir waves and whistler-mode waves propagating in the corona. Recent observations in a frequency range of several GHz with high frequency and time resolution have revealed that narrowband fine structures similar to fiber bursts occur in Type IV bursts. In the meter-wavelength range, however, few spectral observations with high resolution have been carried out, unlike at decimeter wavelengths.

In the present study, we have investigated the fine structures in a wide frequency range from 100 to 500 MHz, obtained with a large-aperture radio telescope and a high-frequency and high-time resolution spectrograph, the Assembly of Metric-band Aperture Telescope and Real-time Analysis System (AMATERAS) installed on the Iitate Planetary Radio Telescope (IPRT) was developed by Iwai et al. (2012) and enables us to observe solar radio bursts in the frequency range from 150 to 500 MHz with a time resolution of 10 ms, a frequency resolution of 61 kHz, and a minimum detectable flux of 0.7 SFU. Moreover, both left- and right-handed polarized components can be observed simultaneously. The resolution of IPRT/AMATERAS for observations of metric solar radio bursts is the highest in the world as of January 2013.

We analyze Type IV bursts observed on 7 June, 2 and 4 August, and 6 September 2011 with IPRT/AMATERAS. They consist of the spectral fine structures drifting within narrow-frequency bands. In this study, these fine structures are termed as narrowband fiber bursts (NFBs). They are similar to the phenomena previously reported by Elgaroy and Sveen (1979) in the meter-wavelength range, and Chernov et al. (2008) in the decimeter range. The present analysis of the event on 7 June 2011 reveals the following results: (i) the individual NFB has a negative frequency drift with about -30 MHz s^{-1}, (ii) NFBs exhibit two types of large-scale frequency drift, characterized by negative and positive frequency drift rates, (iii) the negative frequency drift rate is almost the same as that of the individual NFB, while the positive one is about 90 MHz s^{-1}.

Based on the observed characteristics, we discuss the generation mechanism of NFBs as follows: (i) the observed negative frequency drift rate of NFBs can be explained by the propagation of whistler-mode waves in the corona, (ii) the observed frequency interval of NFBs is too small to account for it by the double plasma resonance (DPR) theory, which was applied to similar phenomena in the frequency range above 1 GHz (Chernov et al., 2008), and (iii) a new model is proposed in which a single NFB is emitted from a localized micro-scale emission region and widely distributed emission regions form a group of NFBs. We suggest in the proposed model that the regions are generated by upward whistler-mode waves and intermittent downward-propagating electron beams.

In this presentation, we report the analysis results of NFBs and discuss the generation mechanisms.

Keywords: Sun, radio, Type IV burst, AMATERAS