The investigation of short-term variations of Jupiter's Synchrotron Radiation with the large radio interferometer GMRT

Kota Imai[1]; Hiroaki Misawa[2]; Anil Bhardwaj[3]; Fuminori Tsuchiya[1]; Tetsuro Kondo[4]; Akira Morioka[5]

[1] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.; [2] PPARC, Tohoku Univ.; [3] SPL, Vikram Sarabhai Space Centre; [4] KSRC,NICT; [5] Planet. Plasma and Atmos. Res. Cent.,Tohoku Univ.

The goal of this research is to investigate physical processes of short term variations of Jupiter's Synchrotron Radiation (JSR) which is important for revealing the origin of relativistic electrons at Jupiter's Radiation Belt (JRB).

JSR has been frequently observed by radio interferometers and single dish radio telescopes to understand characteristics of the spatial distribution and variations inferring dynamics and energetics of the relativistic electrons. Observations with radio interferometers have showed JSR source structure (Dunn et al., 2003, etc), and contributed to modeling of JRB (Garrett et al., 2005, etc). On the other hand, observations of total intensity of JSR with a single dish radio telescope have revealed characteristics of time variable phenomena. The time variations are indispensable parameters giving clues to understand particle source and/or loss processes which characterize the formation of JRB. Recently, Miyoshi et al. (1999) and Bolton et al. (2002) confirmed the existence of short term (days to weeks) variations in JSR. The detection of short term variations makes a great impact on the study on JRB because it has been believed for a long time that the strong internal magnetic field and rapidly rotating magnetosphere of Jupiter protect the JRB region from solar wind variations and magnetospheric disturbances as theoretically suggested by de Pater and Goertz (1994).

So far we have made the JSR observations to investigate the short term variations of mainly several hundreds MHz JSR which is emitted by low energy particles (less than 10MeV) and has been observed systematically only few times (Miyoshi et al., 1999, Misawa et al., 2005, etc).

The latter observation suggested that the short term variation is a general feature at low frequencies. Therefore, it is essential to study its detailed characteristics and the causalities. Theoretically expected physical processes which are responsible for the short term variation are enhanced radial diffusion initiated by solar UV flux enhancement and scattering of the JRB particles toward the polar region by whistler-mode wave, although it is still not known whether solar UV flux or whistler-mode wave is a dominant initiator.

In order to investigate physical processes of short term variations, we observed JSR with the Giant Metrewave Radio Telescope (GMRT) from 23rd May 2007 to 27th June 2007. Bhardwaj et al. (2005) first made JSR observations with the GMRT for about a week in 2003 and suggested that JSR flux increased with Solar 10.7cm radio flux (F10.7), which is correlated to solar UV flux. On the other hand, the initial results of GMRT observation in 2007 show that the total flux of JSR varies in several days but is not strongly correlated to F10.7. Then, when the total flux of JSR increased, the peak position of JSR moved outward, and the flux of JSR increased in the outer emitting region. It is implied that the other acceleration processes cause these variations except the enhanced radial diffusion, because enhanced radial diffusion increases the flux of JSR and the peak position of JSR moves toward Jupiter.

In this presentation, we will discuss the variations of JSR spatial distribution shown in the 2007 GMRT observation results.

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