Analysis of the short-term variations of Jupiter's synchrotron radiation using the one-week GMRT data

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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 of 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 have analyzed GMRT observation data, which is first imaging observation focused on short term variations at several hundreds MHz. The observation using the GMRT was performed from 23 Feb 2003 to 3 March 2003 in dual-frequency of 610/235MHz. Bhardwaj et al. (2005) already suggested the monotonous increase of JSR total flux for the observation period. We will show and discuss distribution characteristics and expected causalities of the short term variations based on the GMRT analysis.