A study on short-term variations of the Jovian radiation belt using 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] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.
; [3] SPL, Vikram Sarabhai Space Centre; [4] KSRC,NICT; [5] Planet. Plasma 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 some radio interferometers or telescopes in order to understand dynamics and energetics of the relativistic electrons. 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 great impact on the study of 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 the observations of the JSR short term variations have been made at some frequencies, especially low frequencies of several hundreds MHz, at which the JSR is emitted by low energy particles (less than 10MeV). Misawa et al. (2005) and Nomura (2007) suggested that the short-term variation is a general feature at low frequencies, and implied that there are some other additional controlling factors. 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/EUV flux enhancement and scattering of the JRB electrons 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) for about 2 months in 2007 and 2008, respectively, and we established the techniques of the spatial distribution measurement for JSR.

We made JSR observations with GMRT at 610MHz totally 9 times in 2007, and 13 times in 2008. The results of the observations are as follows: (1) It is confirmed that JSR at 610 Hz usually shows more than 10 percent of total flux variations with the time scale of several days as JSR total flux at other lower freqencies. (2) There is little correlation between variations of JSR and those of the solar UV/EUV parameters in 2007 and 2008. It indicates that the causality of the JSR enhancement is not temporal enhancement of radial diffusion by solar UV/EUV enhancement, and implies the possibilities of existence of variations caused by Jupiter itself. (3) There seem to be 2 types of JSR enhancement. One is enhancement of radial diffusion in a specific radial distance. The other is transportation of electrons with the longitude dependence. (4) The existence of wave-particle interaction is suggested by increase of JSR near polar regions. (5) There is a possibility that currently proposed loss processes, e.g. synchrotron loss and interaction with ring, can not reproduce decrease of JSR in the inner region (within 2 Rj).

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

Acknowledgement: We would like to appreciate helpful support of Dr. Ishwara Chandra C. H. And, we thank the staff of the GMRT who have made these observations possible. GMRT is run by the National Centre for Radio Astrophysics of the Tata Institute of Fundamental Research.