Investigation of the solar UV/EUV heating effect on the Jovian radiation belt by GMRT observation

Hajime Kita[1]; Hiroaki Misawa[2]; Fuminori Tsuchiya[1]; Takeru Uno[3]; Akira Morioka[4]
[1] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.; [2] PPARC, Tohoku Univ.; [3] Tohoku Univ.; [4] PPARC,Tohoku Univ.

Jupiter's synchrotron radiation (JSR) is the emission from relativistic electrons in the strong magnetic field of the inner magnetosphere, and it is the most effective probe for remote sensing of Jupiter's radiation belt from the Earth. Recent intensive observations for JSR reveal short term variations of JSR with the time scale of days to weeks. Brice and McDonough (1973) proposed a scenario for the short term variations; i.e, the solar UV/EUV heating for Jupiter's upper atmosphere drives neutral wind perturbations and then the induced dynamo electric field leads to enhancement of radial diffusion. The purpose of this study is to confirm whether sufficient solar UV/EUV heating occurs on Jupiter's upper atmosphere and it actually causes JSR total flux and brightness distribution variations.

We have made JSR observations using the Giant Metrewave Radio Telescope (GMRT) in 2003, 2007 and 2008, and suggested important characteristics of short term variations; relatively low energy particles in Jupiter's radiation belt are accelerated by some acceleration processes which might be driven by solar UV/EUV heating and/or Jupiter's own magnetic activities. In order to evaluate the effect of solar UV/EUV heating on JSR variations, we made coordinated observations of the GMRT and NASA Infra-Red Telescope Facility (IRTF). By using IRTF, we can measure the temperature of Jupiter's upper atmosphere from spectroscopic observation of $H_3{}^+$ infrared emission. Hence, we can evaluate relationship between variations of Jupiter's upper atmosphere initiated by solar UV/EUV heating and those of JSR from these simultaneous observations.

The GMRT observations were made from 6th Nov to 17th Nov in 2011 at the frequency of 235/610MHz. The IRTF observations were made from 7th Nov to 12th Nov, and observed line was $H_3{}^+$ Q(1,0-) 3.953 microns. During the period, solar UV/EUV flux variations expected on Jupiter showed monotonic increase. A preliminary analysis of GMRT 610MHz band shows that a radio flux variation occurred corresponding to solar UV/EUV variations, and radio images show that the position of equatorial peak emission move outward direction. These results suggest that radial diffusion is increased only at the outer region around L=2-3. We will also introduce analyzed results of the IRTF observations and discuss possible causalities of the short term variations of JSR.