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The validity of delay time analyses in VLBI observation for detecting the motion of Jovian decametric radiation sources

Tomoyuki Nakajo[1*], Tetsuro Kondo[2], Kazumasa Imai[3], Hiroaki Misawa[4], Masashi Tsuchiya[4]

[1]Fukui University of Technology, [2]National Institute of Information and Co, [3]Kochi National College of Technology, [4]Planetary Plasma and Atmospheric Researc

Among the planetary auroral radio emissions, Jovian decametric radiation (JDR) is a unique one which is observable from the ground. The character of occurrence probability is similar to that of pulsar's radio emission, then, it has been pointed out that the generation mechanism of JDR is important for considering that of pulsar's radio emission. However, the generation mechanism of JDR has not been fully understood because the source location has not been revealed by direct measurement. VLBI technique which is a powerful technique to determine the source location has not been established in decameter range because the enormous influence of propagating media on the phases of radio waves.
In order to eliminate the propagation effects, the group of Tohoku University carried out 100 km class dual frequency VLBI observation from 1995 to 2003. The results imply that sometimes source location moves between the northern and southern polar region. To verify this result, Fukui University of Technology and Tohoku University has been carried out 500 km class dual frequency VLBI observation for JDR in 2008. The dual frequency function is realized by two independent receivers installed in the observation system and enables us to try the delay time analyses for eliminate the propagation effects. The observation frequencies are set 22 MHz and 2 2.5 MHz.
The character of intensity fluctuation of received JDR signals at each observation site shows that the solar wind plasma flows with the velocity of about 400 km/s and the spatial scale of irregularity of plasma density is from 400 km to 1500 km. The fluctuation of observed fringe phases shows smooth variation caused by terrestrial ionosphere and random character caused by the scintillation effect of solar wind. However, the fluctuation is nearly equal at two observation frequencies, then the delay time is obtained to be within plus/minus 100 nsec which equals to fluctuation of source location with plus/minus 0.3 Jovian radii. The result shows that the sources are located stably at northern or southern polar region and the delay time analyses in wideband VLBI observation are useful for detecting the source motion between northern and southern polar region.
In future work, we plan to carry out the VLBI observation with wideband and longer baseline. The present delay time analyses are expected to be also useful in such observation system.

Keywords: Jupiter, low frequency, decamtric, VLBI