地上電波観測による木星デカメータ電波Sバースト放射源の鉛直分布の研究

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Study on the vertical distribution of Jovian decametric S-burst sources based on the ground-based radio observation

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Jovian decametric (DAM) radiation has been studied based on analysis of a simultaneous S-burst event in the multiple frequency bands obtained by ground-based observation.

In Jovian ionospheric Alfven resonator (JIAR) model proposed by Ergun et al. [2006] and Su et al. [2006] based on the theory and observations of the Earth's ionospheric Alfven resonator (IAR), eigen-frequencies of JIAR are expected to determine the repetition rate of S-burst of Jovian DAM radiation. In the Earth's IAR, the fundamental and higher harmonics eigen-frequencies were analytically calculated and depend on the Alfven speed in the lower ionosphere and the ionospheric scale height [Lysak, 1991; 1993]. So, we can estimate Jovian ionospheric scale height using the repetition frequencies of the S-burst emissions determined from the observation.

In this study, we used dataset from observation of Jovian DAM radiation in Io-B source condition with a logperiodic antenna at Yoneyama observatory of Tohoku University and a wideband receiver, whose frequency range is from 20 MHz to 40 MHz, since 2012. Previous studies reported that intense S-burst events were often found in Io-B source condition.

We especially focus on a simultaneous S-burst event in two different frequency bands (˜23.5 MHz (DAM1) and ˜27.0 MHz (DAM2)) found at 15:56 UT on 24 November 2014. If the emissions are radiated at the local electron cyclotron frequency, the geometric distance of the sources are estimated to be ˜1.085 Rj (DAM1, ˜23.5 MHz) and ˜1.040 Rj (DAM2, ˜27.0 MHz) based on the VIPAL magnetic field model [Hess et al., 2011] at the location of Io UV footprint [Bonfond et al., 2009]. The repetition frequencies are determined to be 22.3 Hz (DAM1) and 28.5 Hz (DAM2).

Assuming that the two emission sources are considered to be on the same magnetic field line or on the different close magnetic field lines and that the repetition frequencies of DAM1 and DAM2 are respectively equal to the fundamental and harmonic eigenmode of JIAR, the Jovian ionospheric scale height is estimated to be ˜1400 km or ˜1800 km.

In the above discussion, we have considered the simplified JIAR model that made by the incident Alfven wave and the reflected Alfven wave at the position where the ionospheric plasma density becomes maximum. In the presentation, we will show further discussion that the JIAR model in consideration of the multi-layer for high distribution of the plasma density.