Occurrence characteristics and source mechanisms of Jovian Broadband Kilometric Radiations

Tomoki Kimura[1]; Fuminori Tsuchiya[2]; Hiroaki Misawa[3]; Akira Morioka[4]

[1] Planet.Plasma Atmos.Res.Cent.,Tohoku.Univ; [2] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.; [3] PPARC, Tohoku Univ.; [4] Planet. Plasma and Atmos. Res. Cent.,Tohoku Univ.

http://pparc.geophys.tohoku.ac.jp/

Ulysses had a Distant encounter event when it was within 0.8 AU of Jupiter in February 2004. The passage of the spacecraft was from north to south, and observations of Jovian radio waves were carried out from high to low latitude (80-10 deg) for a few months. In the present study, to clarify the occurrence characteristics of Jovian Broadband Kilometric Radiations (bKOM) from the Jovian polar magnetosphere, statistical analyses were performed based on the wave data observed by Ulysses. Fundamental properties (source locations, directivities, and generation mechanisms) of the radio emission were, then, discussed by using the ray tracing approach.

Statistical approach provided occurrence features of bKOM including high-latitude component as follows:

1.Emission intensity of bKOM has a sinusoidal dependence on CML, showing a broad peak at CML˜180 deg,
2.bKOM is preferably observed in the latitudinal range of +30 deg to +90 deg, and emission intensity greatly increases as magnetic latitude of observer increases.
3.Emission intensity is possibly controlled by the planetary spin phase (Sub Solar Longitude, SSL). The emission intensity has a sharp peak around SSL˜210 deg.
4.bKOM events observed in the high latitude region exhibit storm-like nature throughout the period when IMF sector boundaries pass across the Jovian magnetosphere, accompanying the interaction region.

3D ray tracing analysis of bKOM was, then, performed to derive the source distribution. The results suggested that:

1.R-X mode wave generated through the Cyclotron Maser Instability process is unreasonable to reproduce intense higher latitudinal component of bKOM.
2.Wave mode applicable to the previous and present observation results is L-O mode wave, and the L-O mode wave is generated at frequencies near the local plasma frequency.
3.Source region of bKOM is located at the altitude of f/fp=1.01-1.5 along magnetic field lines with the larger L-value than 10, which is similar to the source region of QP40 burst.

Simulation results also indicated that bKOM is controlled by planetary rotational factor, which may excite bKOM during a particular spin phase of planetary rotation. Thus, it is intensively suggested that source location of bKOM exists along the source lines connecting to the outer magnetosphere or outer boundary region of the Jovian magnetosphere.