LOBE TRAPPED CONTINUUM RADIATION GENERATED IN THE DISTANT MAGNETOTAIL

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ABSTRACT

Lobe trapped continuum radiation (LTCR) has been observed by GEOTAIL spacecraft in the distant mangetotail. By comparing the results of the direction finding with the 3–D ray tracing analysis the possible source regions for the LTCR are the plasma sheet boundary layer away from the nominal tail axis and the low latitude boundary layer. Full wave method is used to estimate the conversion efficiency from a Z mode wave to an L–O mode wave. From the full wave calculation LTCR would be radiated in the elliptic cone with its major axis perpendicular to the plane formed by the geomagnetic field and the plasma density gradient in the generation regions.

INTRODUCTION

LTCR has been observed by the plasma wave instrument (PWI) onboard GEOTAIL spacecraft at frequencies as low as 1 kHz in the distant geomagnetic tail region. Detailed analysis of spectral structures of the LTCR has shown that they are most likely to be generated locally in the vicinity of the plasma sheet boundary layer (PSBL) and then trapped inside the tail lobe region [1].

SOURCE REGIONS OF THE LTCR

A direction finding analysis has been used to estimate the source region of electromagnetic waves. The wave form capture (WFC) which is a subsystem in the PWI can simultaneously measure the wave forms of two electric and three magnetic field components. Since the magnetic field intensities of the LTCR are weaker than the sensitivity of the magnetic search coils, the arrival directions of the LTCR are calculated only from the spin modulated electric field intensities [2]. From the direction finding analysis the arrival directions of the LTCR are almost parallel to the dawn-dusk direction. A 3-D ray tracing analysis shows that the initially radiated Sun-Earth ray directions of the LTCR are transformed into the dawn-dusk directions by the reflection at the cylindrical tail magnetopause. The arrival directions obtained from the WFC measurement are consistent with the ray directions emitted from the plasma sheet boundary layer away from the nominal tail axis and the low latitude boundary layer [3].

GENERATION MECHANISM OF THE LTCR

The LTCR is believed to be generated through a linear mode conversion from an electrostatic wave near the upper hybrid frequency (f_{UHR}) in a large density gradient perpendicular to the geomagnetic field. The Z mode wave converted from the electrostatic wave near the f_{UHR} is closely related with the generation of LTCR in the distant magnetotail. We calculate the conversion efficiency from a Z mode wave to an L–O mode wave by using a full wave method. The calculation result shows that the LTCR is radiated in the elliptic cone with its major axis perpendicular to the B_0–∇n_e plane. It would be possible to explain the generation mechanism of the LTCR on the basis of a comparison between the multi-spacecraft observation and this numerical calculation.

REFERENCES

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