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SPECTRAL CHARACTERISTICS OF Pc 3–5 PULSATIONS OBSERVED BY GEOTAIL SKIMMING THE DAYSIDE MAGNETOPAUSE (EXTENDED ABSTRACT)

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The GEOTAIL satellite was launched in July 1992 with a primary purpose of exploring the tail region of the magnetosphere, covering the magnetotail over a wide range from 8 R_e to 210 R_e from the earth. This orbit allows us also to study the boundary region of the magnetosphere as it skims the magnetopause at perigees. In December 1994 the satellite orbit skimmed the dayside magnetopause, and ULF waves were observed along the magnetopause. We examine spectral characteristics of the ULF waves detected by the fluxgate magnetometer and the electric field measurement on-board the satellite. The instruments and data processing for the magnetic and electric fields are described in detail by KOKUBUN *et al.* (1994), and TSURUDA *et al.* (1994).

We have made dynamic spectral analyses of electric and magnetic fields observed by GEOTAIL on three successive skimming trajectories. Figure 1 shows a typical example of the dynamic spectrum of the data observed in the region of the outer magnetosphere. The satellite was on the morning side (~08 MLT) at 00 UT on December 18, and proceeded along the magnetopause to the evening side (~20 MLT) at 24 UT, as shown in Fig. 2. Magnetic pulsations in the frequency range of Pc 3–4 were observed in the resulting dynamic spectra in both electric and magnetic fields. The Pc 3–4 activity was observed in the region restricted to the subsolar magnetopause (*e.g.*, 03–07 UT in the case of Fig. 1) without extension to the dawn and dusk sides. On the other hand, Pc 5 pulsations were clearly observed in a wide region from the morning to the dusk. The spectral band of Pc 5 is shown in the dynamic spectrum of the electric field more clearly than that of the magnetic field, indicating characteristics of the odd mode standing wave of the field lines. These occurrence characteristics of Pc 3/4 and Pc 5 were commonly observed on each of the skimming trajectories.

Wave characteristics of the Pc 3/4 and Pc 5 were examined in detail by using a technique of cross spectral analysis. The left panel of Fig. 3 shows the spectral parameters; autopower, cross-power, coherency, and phase difference between magnetic azimuthal (B_D) and electric radial (E_V) components of this pulsation event, which was observed around the subsolar magnetopause at 0313–0327 UT on

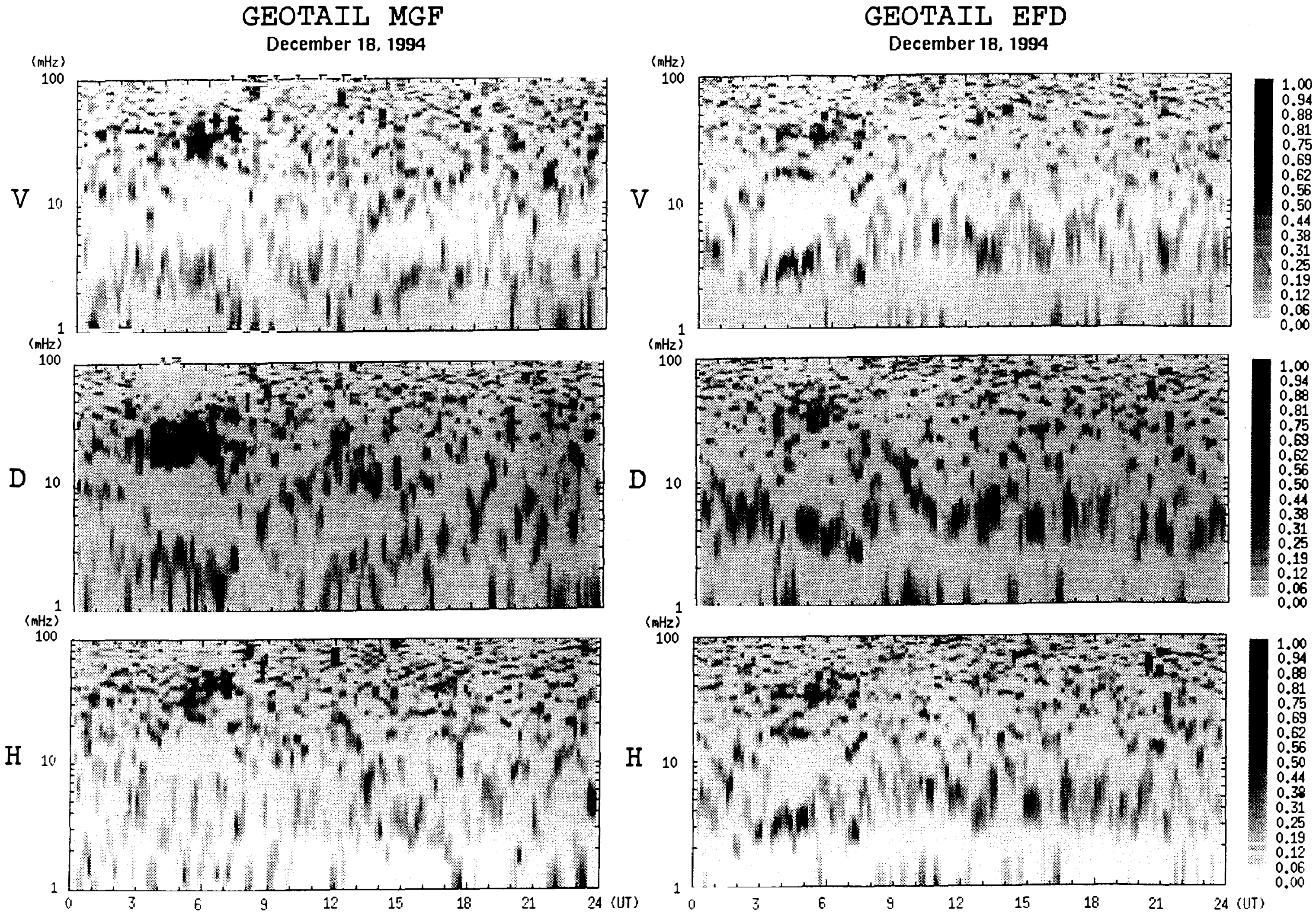

Fig. 1. Dynamic power spectra of the magnetic and electric fields observed by GEOTAIL on December 18, 1994. The spectra are calculated through the maximum entropy method for data of three seconds averaged in the VDH dipole coordinate system.

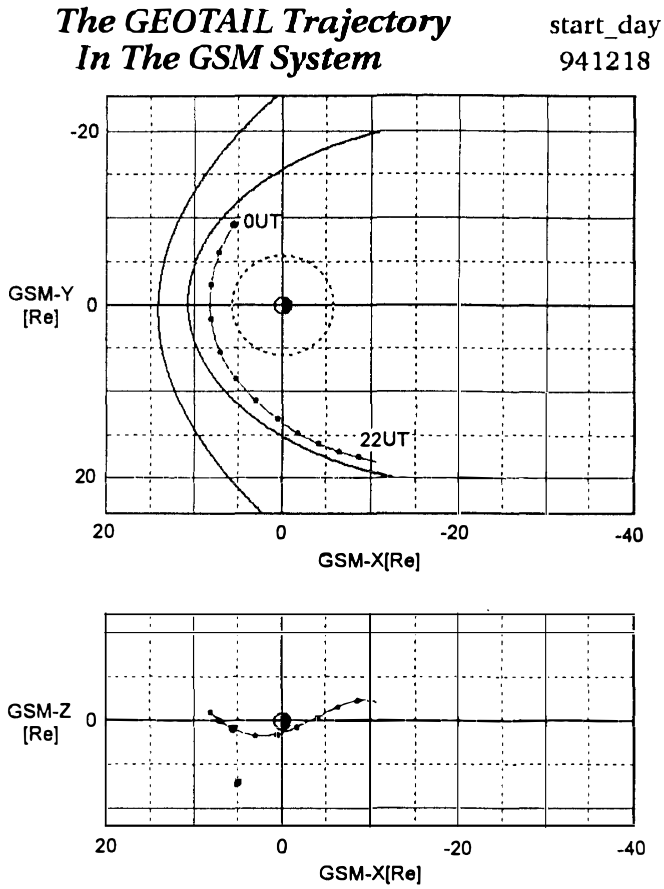

Fig. 2. Trajectory of GEOTAIL on December 18, 1994 in the Geocentric Solar Magnetospheric (GSM) coordinate system. The dots plotted on the trajectory show satellite positions at every two hours from 00 UT to 22 UT. The inner dashed circle represents the position of $L=6$.

December 18, 1994. There are two dominant spectral peaks at 18 mHz and 35 mHz in this case. The lower frequency component has a better coherence and the phase difference of 90° between B_D and E_V components. Spectral parameters for another pair, B_H and E_D components, were calculated for the same time interval and plotted in the right panel. Although the frequency of dominant spectral peaks is the same in the left and right panels of Fig. 3, the phase relationship between B_H and E_D components is different from the case of B_D and E_V. It is particularly notable that an anti-phase relation of B_H and E_D is found at the higher frequency component. These results indicate that the lower frequency component of Pc 3–4 waves had characteristics of the field line resonance wave, whereas the higher frequency component was one of the fast mode wave propagating toward the inner magnetosphere.

On the other hand, observed Pc 5 pulsations with a frequency of ~3 mHz always showed characteristics of a fundamental mode of the field line resonance. There was no evidence that the Pc 5 waves were propagating to one direction across the magnetic field line such as the Pc 3–4 waves. In addition to this ordinary feature of the field line resonance, we found some peculiar wave forms of the Pc 5 both in

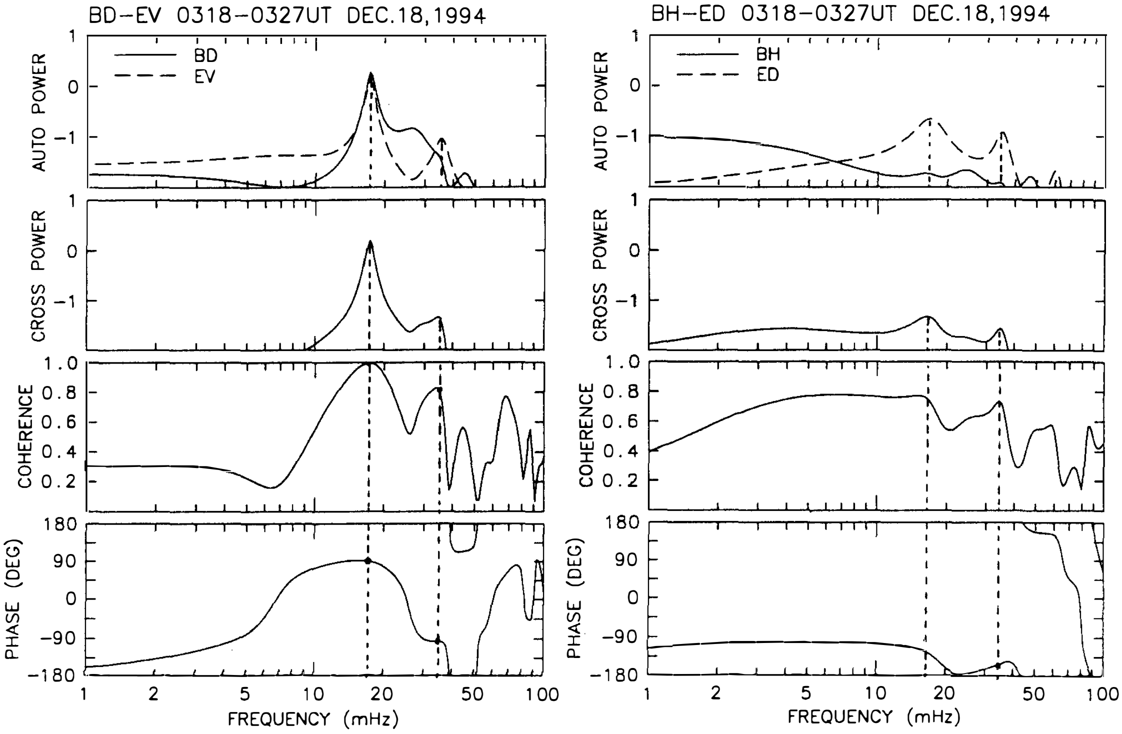

Fig. 3. Cross-spectral parameters calculated through the auto regressive method for the electric and magnetic fields observed by GEOTAIL in the time interval 0318–0327 UT on December 18, 1994. The left panel shows auto power spectra, cross power, coherency, and phase difference between the B_D and E_V components, while the right panel shows the same parameters for the B_H and E_D components. The vertical dashed lines indicate spectral peaks.

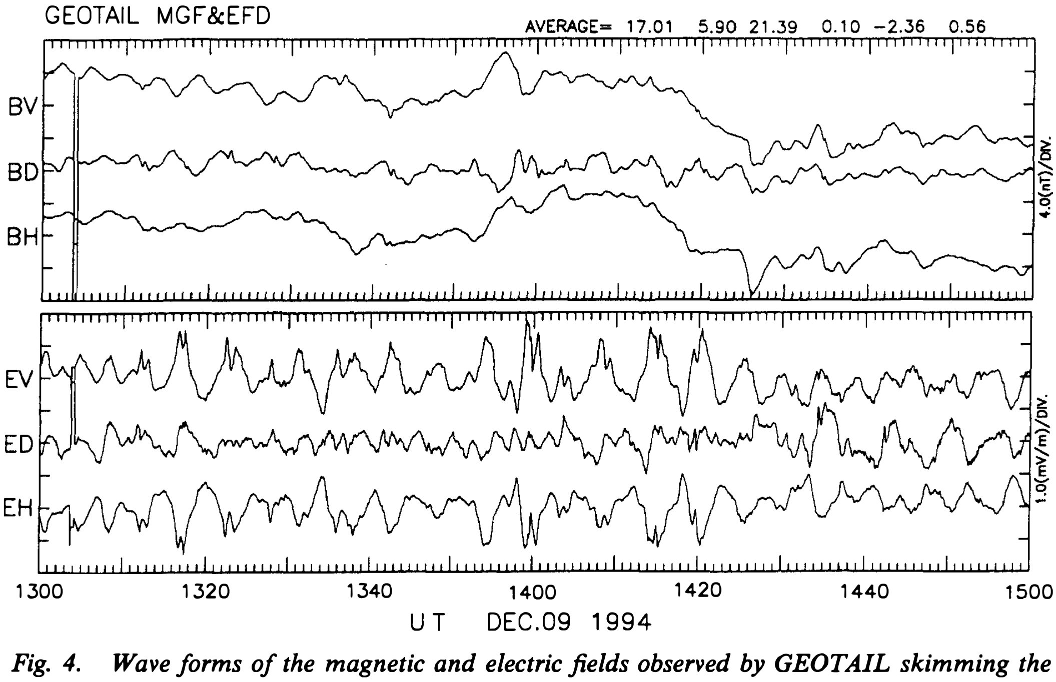

Fig. 4. Wave forms of the magnetic and electric fields observed by GEOTAIL skimming the dusk side magnetopause in the time interval 13–15 UT on December 9, 1994.

the electric and magnetic fields. Figure 4 shows the wave forms observed by GEOTAIL skimming the dusk side magnetopause during 13–15 UT on December 9, 1994. Impulsive variations with a time scale of several tens of seconds are superposed on the sinusoidal oscillations of the Pc 5. The impulses are synchronized with the timing of the maximum phase of the radial outward component of the electric field. Although we may not specify any physical process of causing this peculiar wave form at present, it could be an important piece of information concerning a possible generation mechanism of Pc 5 pulsations.

Acknowledgments

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