Phase difference of ECH waves observed by using the interferometry observation mode of the Arase satellite

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Electron Cyclotron Harmonic (ECH) waves are a type of plasma wave observed in the magnetosphere that with a harmonic structure of intensity peaks between integer multiples of the electron cyclotron frequency. ECH waves were first observed by the OGO-5 satellite and have been observed in the magnetospheres of Earth, other planets and satellites. ECH waves have been reported to have large amplitudes, suggesting that they can affect the surrounding plasma environment. For example, ECH waves can cause pitch angle scattering of electrons, and observations have suggested that ECH waves are associated with the excitation of diffuse auroras. ECH waves have also been used to estimate the cold electron temperature because their dispersion relation depends on the cold electron parameters.
We report that interferometric observations by the Arase satellite provide phase differences in ECH waves. The Arase satellite has four wire probe antennas in the spinning plane, which are typically used as two sets of dipole antennas. In interferometric mode, on the other hand, two of these antennas, V1 and V2, are used as monopole antennas, and the potential difference between each antenna and the satellite ground is observed. The phase difference between the two waveforms Ev1 and Ev2 is calculated from the observed ECH waves. The phase difference was calculated for each frequency using a complex Fourier spectrum.
The results show that the phase differences of the observed ECH waves are significantly different between the phase difference of one harmonic band and the phase difference of the other harmonic band. This suggests that the wave vector of ECH waves in one harmonic band may be different from the ECH wave vector in the other harmonic band.

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