ABSTRACTS (MASTER THESIS)

A method for estimation of cold plasma density from whistler mode waves observed by Magnetospheric Multiscale mission spacecraft

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We developed a method to obtain the cold plasma density by using a phase difference of whistler mode waves observed by two of the Magnetospheric Multiscale Mission. We chose large amplitude events with coherent packet structures such as chorus emissions. We applied a band-pass filter to the magnetic and electric wave-form data to extract whistler mode waves. We calculated time variation of phase differences of the waves between the two spacecraft. If the phase differences are nearly constant, we can assume that the waves detected by two spacecraft consist of the same waveforms. When the distance between the two MMS spacecraft is less than one wavelength, we can easily determine the wave number vector from the phase difference. Combining with the background magnetic field vector, the wave vector and instantaneous wave frequency, we can obtain the local plasma frequency from the oblique whistler mode dispersion relation with the quasi-longitudinal approximation. The plasma frequency gives the background plasma density, which is in good agreement with that from upper hybrid resonance (UHR) emission observed by the electric field double probes. This result suggests that it is possible to observe fluctuations in the actual cold plasma density through analysis of coherent whistler-mode wave waveform data recorded by the MMS spacecraft at high time resolution. We calculated frequency sweep rate by the estimated plasma density obtained from this method. We found that the frequency sweeps rate are in good agreement with the sub-packet structure of the instantaneous frequency.