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THEMIS observations of electromagnetic ion cyclotron emissions in the innere magnetosphere

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Electromagnetic ion cyclotron (EMIC) triggered emissions were first reported by Pickett et al. [2010]. These were observed by the Cluster spacecraft close to the plasmapause in the equatorial region of the magnetosphere, which have rising tone spectra similar to those of whistler-mode chorus emissions. These phenomena have received much attention because of the possibility of their strong interaction with particles in the inner magnetosphere pointed out by Shoji et al. [2011] and Omura and Zhao [2012], regardless of their few observations.

This study reports the presence of various EMIC triggered emissions found in the flux gate magnetometer (FGM) data onboard the THEMIS probes during the interval from 2007 to 2011. They are Pc1-2 emissions with narrow-band frequency and sporadic frequency variation with the timescale of tens of second. We can find them over a broad area between the magnetopause and the plasmapause, mainly in the dayside of 6-10Re. We recognize various type of emissions which have typical rising-tone spectra, have falling-tone spectra analogous to whistler-mode faling-tone discrete emissions, and are exited simuletaneously in the different frequency bands bounded by the cyclotron frequencies of ions.

Omura et al. [2010] have developed the nonlinear wave growth theory which explains the generation of the EMIC triggered emissions. We compared some events observed with their theory, and found that the obtained relation between the magnetic amplitudes of the emissions and variations in frequencies are well explained by the theory. In addition, there are rising-tone emissions with right-hand polarization and the lower limits in frequency corresponding to the equatorial crossover frequency. We consider that they are the L-mode emissions generated by nonlinear growth and suffered the mode change through the propagation process. According to the nonlinear growth theory, a rising-tone emission is initially generated with a continuous frequency waves in the generation region, normally equatorial plane. This belongs to two different branchs in dispersion relation of EMIC wave with a boundary at the crossover frequency around half of the gyrofrequency at the source region. These two branchs propagate from the source region through different processes, and it is expected that the branch with upper frequencies can propagate over a relatively high latitude than the lower branch. This result is important as these emissions generated in the equator as L-mode waves.

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