THEMIS observations of EMIC triggered emissions in dayside magnetosphere outside the plasmapause.

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The first observation of Electromagnetic ion cyclotron (EMIC) triggered emissions in space has been recently reported by Pickett et al. [2010]. These waves appear as 'risers', i.e., the EMIC analogue of rising frequency whistler mode triggered emissions and chorus waves. Also, this event is observed near the plasmapause in the equatorial region of the magnetosphere, where the resonance velocity of energetic ions(10-100keV) and EMIC waves tends to become lowest in the magnetosphere due to high density of background plasma. EMIC triggered emissions play an important role in magnetospheric dynamics. Pitch angle scattering by EMIC waves in the outer radiation belt can induce significant loss of relativistic electrons, and this scattering is affected by the frequency drift of EMIC[Omura and Zhao, in press].

We have made a statistical analysis of 100 events of EMIC triggered emissions as well as a case study of simultaneous multi-spacecraft observation by THEMIS probes. According to the statistical analysis, THEMIS observations of EMIC suggest that the nonlinear growth is more common process in the Earth's magnetosphere than we have believed previously. This means a large contribution of EMIC waves to loss of high energetic electrons. In the event, on September 9 2010 14:00-14:45 UT, the three THEMIS probes were located near the dayside magnetopause at about 8RE, 13:08MLT. In this event three probes observed three Pc1 waves at about 0.5 Hz and the EMIC triggered emissions rising from about 0.5 Hz to 1 Hz , for the period 14:05-14:11 UT, 14:22-14:31 UT and 14:37-14:45 UT. These emissions have the following properties: (1) they have high coherency, (2) elliptically left-hand polarize, (3) frequency drifts with the rate of about 8 mHz/s, (4) triggering wave amplitude is 0.1nT and triggered saturated amplitude is 1.0nT, and (5) Poynting vector directs both equatorward and poleward. The properties of (1),(2),(3) and (4) agree with the nonlinear mechanism of the wave amplification suggested by Omura et al.[2010]. In the present study, however, it is not clear that Poynting vectors and wave normal angle of 20-30 degrees suggests an oblique propergation, and furthermore the emissions are obsereved dayside outer magnetopause, where resonance velocities are relatively high. These results give us important clues in developing a theory of nonlinear wave growth of oblique EMIC waves.

References

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