Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PEM09-P01 Room:Convention Hall Time:May 21 13:45-15:15

Evaluation of nonlinear growth of chorus emissions observed by Geotail

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We analyze the generation and propagation of chorus emissions observed by the wave form capture onboard the Geotail spacecraft. The specific relationship between amplitude variation and frequency shift has been predicted by the nonlinear growth theory [1]. Such relationship has been observed for the chorus emissions reproduced by simulations [2][3]. We examine if any observational evidence of the nonlinear growth of chorus emissions is found in Geotail chorus data.

We analyze the wave form data of the chorus emissions observed by Geotail mainly in the Earth's dayside outer magnetosphere (L from 9 to 10) to analyze the relationship between "amplitude multiplied by frequency" and "frequency sweep rate," of each chorus element predicted by the nonlinear growth theory. We apply Analytic Signal Method (ASM) to calculate the instantaneous amplitude and frequency of the chorus emissions, and a band pass filter with the center frequency dynamically adapted to the frequency variation to extract each chorus element for filtering out the background noise. As a result, we find positive correlation between "amplitude multiplied by frequency" and "frequency sweep rate," which is consistent with that predicted by the nonlinear growth theory.

We also investigate the propagation of chorus emissions from their generation region to the spacecraft. We have found a chorus event with a clear gap at around half of the gyrofrequency. We assume that the upper cutoff of the lower band element indicates the half-grofrequency at the generation region, while the lower cutoff of the upper band element indicates the value at the observation point. Then, we calculate the variation of gyrofrequency with the geomagnetic latitude by using the Tsyganenko geomagnetic field model. The minimum-B region is found at 25 degrees northward of the geomagnetic equator, where the half-gyrofrequency coincides with the upper cutoff of the observed lower-band chorus element. Furthermore, we evaluate the expected amplitude of the chorus element in the generation region, as well as the nonlinear growth during propagation toward the spacecraft, which are found to be consistent with those predicted by the nonlinear growth theory [2][3]. Additionally we show that the half-gyrofrequency damping of chorus emissions would be possible based on the observed amplitude of the chorus emissions [4].

Thus, we demonstrate that the observed chorus emissions in the Earth's magnetosphere exhibit the nonlinear growth features consistent with the nonlinear growth theory.

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Keywords: Geotail spacecraft, Chorus emission, Nonlinear growth, Amplitude, Frequency sweep rate, Generation and propagation

PEM09-P02 Room:Convention Hall Time:May 21 13:45-15:15

LF radio observation of storm-time energetic electron precipitation at Athabasca: Initial result

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Low frequency (LF) radio observation system has been installed in Athabasca, Canada at Oct. 2010. Purpose of the observation is to investigate energetic electron precipitation from outer radiation belts to the atmosphere in the sub-auroral latitude region during magnetic storms and substorms. In this paper, some initial results will be presented. LF transmitter signal perturbation is caused by ionization of lower edge of the ionosphere and sensitive to higher energy electron ($>$100keV) precipitation than riometer observations. In 2011, the electron precipitation signatures were detected during the main and early recovery phases in several magnetic storms. During the night time, fluctuations in the LF phase data with the time scale of Pc5 or longer were found. Comparison of the phase fluctuation with the GOES magnetic field data during a small magnetic storm on 5 June 2011 shows significant correlation, which implies the drift resonance of energetic electrons and/or Pc5 modulation of energetic electron scattering efficiency in the inner magnetosphere.

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On the evolution of nonlinear ion acoustic waves and their stability in an unmagnetized plasma

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One dimensional fluid simulation has been performed to study the evolution of nonlinear ion acoustic waves and their stability in an unmagnetized plasma. A Gaussian perturbation is used to model the initial localized density perturbation. It is found that the time evolution of such a localized density perturbation evolve into ion acoustic solitons, as predicted by the fluid theory. Issues pertaining to their stability and mutual collisional interaction will be addressed. Possible applications to the electrostatic solitary structures observed in some of the regions of Earth magnetosphere will be discussed.

Keywords: Ion acoustic waves, Electrostatic solitary structures, Fluid Simulation, Ion acoustic solitons, Magnetosphere

PEM09-P04 Room:Convention Hall Time:May 21 13:45-15:15

The Extremely High-Energy Plasma/Particle Sensor for Electron of the SPRINT-B/ERG satellite

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The ERG satellite is a science mission of JAXA/ISAS , the purpose of which is to reveal the acceleration mechanism of high energy particles in the radiation belt. The high energy electrons of radiation belts change dramatically during a magnetic storm. After such storms occur, these high energy electrons disappear, only to subsequently proliferate during the recovery phase. There are said to be two hypotheses concerning this process, external supply (adiabatic process) and internal acceleration (non-adiabatic process). The ERG satellite consists of four instrument parts, Plasma/Particle (PPE), geomagnetic field (MGF), Plasma wave (PWE) and electric field (PWE). The PPE sensor consists of five particle sensors and four plasma sensors. Our group is now developing one of the sensors, namely the eXtremely high-Energy Plasma/particle sensor for electron (XEP-e). The XEP-e observes 100keV~20MeV electrons and has four solid-state silicon detectors (SSDs) and a high-Z scintillator (GSO). It has one way conic sight and an electric part is unified with a part of sensor that is covered with aluminum to protect from contamination. The front part of the SSDs discriminate a radiation enters into the sensor and the back part of the plastic scintillator get the value of its energy. Since this satellite will traverse radiation belts, we have to assume a harsh radiation environment. Our group has an electrostatic accelerator in Tsukuba Space Center, via which we can make a radiation environment in space and proof a sensor. It is a pelletron charging system, which involves the accelerator radiating electrons or protons to a sensor in a vacuum chamber. The energies of the electrons and protons are 0.4 ~ 2.0MeV and the beam current is 1fA ~ 10nA (table 4). If the beam current of the electrons is set to 1pA, the flux becomes almost 1*10^6 counts/ sec/cm2. It also has an electron-gun (5 ~ 50keV). We are using this system to proof the XEP-e and now we are still developing .

Keywords: XEP, electron, Sprint-B/ERG