Project Details

ROSES ID: NNH07ZDA001N
Selection Year: 2008
Program Element: Focused Science Topic

Topic: Focused science topics for Strategic Goal 3 (Near Earth Radiation): Toward combined models of acceleration, loss and transport of energetic electrons and protons in the magnetosphere

Project Title:
The Excitation of Equatorial Magnetosonic Waves and Their Effect on Radiation Belt Particles

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Summary:
Intense magnetosonic waves are generated in the inner magnetosphere during geomagnetically active periods. These highly oblique whistler-mode waves are confined close to the geomagnetic equatorial plane and are thought to be excited by the injection of a ring distribution (with df/dv_perp >0) of ring current ions. The waves interact with both the ion ring current population and with energetic electrons, leading to rapid particle scattering and heating. The ion heating may enhance the generation of EMIC waves. A recent study indicates that magnetosonic waves could provide an important local acceleration process for relativistic electrons. When combined with the EMIC waves they may also enhance the rate of scattering towards the loss cone and hence precipitation. A thorough understanding of the origin of these waves and a quantitative modeling of the scattering of resonant ions and electrons is fundamentally important for understanding energetic particle dynamics during active conditions in preparation for the RBSP mission.

We propose to use a combination of data analysis and modeling to provide closure on the excitation of the equatorial magnetosonic waves and the role of these important waves in magnetospheric dynamics. Data from CRRES will be used to develop statistical models for the global distribution of magnetosonic waves, their response to geomagnetic activity and their relationship to the local ring current ion distribution. The MLT distribution of ion ring distributions, and their response to solar and geomagnetic activity will also be studied using LANL satellite data. The RAM code will be used to model the dynamic change in ring current ion flux during injection events, and identify preferred regions for magnetosonic and EMIC wave excitation. The scattering rates of resonant ions and electrons will be quantified using the statistical model developed for the global distribution of these waves, and used to follow the dynamical evolution of ions and electrons during storm conditions. Selected events will be identified for in-depth study and comparison with Cluster data.

The proposed study is directly relevant to NASA s Research Objective 3B: "Understanding the Sun and its effect on Earth and the solar system". The proposed investigation is specifically directed towards to the 2007 LWS Focused Science topic (c), and the prime science objectives of the RBSP mission: to understand the acceleration, global distribution and variability of energetic electrons and ions in the inner magnetosphere.

Publication References:

no references