BOSTON UNIVERSITY

Space Physics Seminar
Thursday, March 3, 2016

A Fundamental Physical Process in Collisionless Heliospheric Plasmas: Interaction Between Whistler-mode Waves and Electrons

3:15 pm
Refreshments
CAS Room 500

3:45 pm
Seminar
CAS Room 502

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Abstract:

In the collisionless heliospheric plasmas, wave-particle interaction is a fundamental physical process in transferring energy and momentum between particles with different species and energies. This talk will focus on one of the important wave-particle interaction processes: interaction between whistler-mode waves and electrons. Whistler-mode waves have frequencies between proton and electron cyclotron frequency and are ubiquitously present in the heliospheric plasmas including solar wind and planetary magnetospheres. I will use Earth's Van Allen radiation belt as "local space laboratory" to discuss the role of whistler-mode waves in electron dynamics. Van Allen radiation belt extends from 1,000 to 60,000 km above the Earth's surface, and it is the region where highly relativistic particles reside. The extremely dynamical evolution of the radiation belt electrons is caused by various solar wind drivers and thus understanding the Sun's influence on the radiation belt electrons is critical in forecasting space weather, which has broad impacts on our technological systems and society.

In radiation belt science, one of the most important and outstanding science questions is how tens of keV plasmasheet electrons are accelerated to ultra-relativistic energies (multiple MeV). Over the past few decades, local acceleration driven by whistler-mode chorus waves and inward radial diffusion have been proposed to be important to drive efficient radiation belt electron acceleration. However, the quantitative role of each physical process has not been clearly identified yet. In this talk, I will show how I use realistic global distribution of whistler-mode chorus waves obtained from an innovative technique to simulate the dynamical electron evolution during the largest geomagnetic storm over the past decade, and determine the primary electron acceleration mechanism by comparing against the Van Allen Probes electron observation. I further evaluate solar wind drivers leading to ultra-relativistic electron acceleration in the Earth's radiation belt, which is critical in predicting space weather using the upstream solar wind conditions. At last, I will discuss my other ongoing projects and future research plans followed by unprecedented opportunities of exploring heliophysics in the future.

Next Week

- Spring Recess 3/10
- *3/17—Seth Dorfman UCLA*

http://www.bu.edu/csp/edoutreach/seminar/

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