BOSTON UNIVERSITY

Space Physics Seminar
Thursday, March 19, 2015

Multi-Instrument Observations of Radiation Belt Physics: Van Allen Probes Perspectives

John C. Foster

Massachusetts Institute of Technology
Haystack Observatory

Abstract:

The energization of radiation belt particles to relativistic energies is a prime objective of NASA's dual-satellite Van Allen Probes mission. Adiabatic acceleration to highly-relativistic energies can occur gradually over an interval of weeks to months in the outer radiation belt (L ~ 3-6) accompanying the slow earthward diffusion of electrons due to scattering by VLF waves. In addition, more rapid local acceleration in the core regions of the outer belt (L ~ 4) has been identified as an important mechanism for repopulating the disturbance-depleted radiation belts in a matter of hours when an appropriate population of seed particles and strong VLF waves are present.

Acceleration of radiation belt electrons to ultra-relativistic energies also can take place in a matter of seconds. We describe the effects of a moderate solar wind shock on the radiation belt electrons. On October 8, 2013 the two Van Allen Probes were inside the dayside plasmaphere at L ~ 3 and L ~ 5 providing a detailed description of both the magnetosonic pulse that was launched by the shock and the resulting acceleration of electrons across a broad range of energies. As the pulse propagates through the magnetosphere, drift resonance of several MeV electrons with the initial electric field pulse and subsequent ULF waves selects these electrons for maximum energy gain with the result that a persistent new population of ~4 MeV radiation belt electrons was formed at L ~ 3.5.

In a further example, we describe how substorms can be responsible for the local acceleration of electrons to ultra-relativistic energies on a time scale of minutes. Impulsive substorm injection of 50 – 200 keV electrons into the core of the outer belt can trigger a chain of processes leading to the acceleration of the high-energy tail of the electron distribution. Dual spacecraft observations serve to unravel the spatial/temporal characteristics of this nonlinear, non-adiabatic local energization process.

3:00 pm
Refreshments
CAS Room 500

3:30 pm
Seminar
CAS Room 502

Next Week

- David Webb
  Boston College
- CME and Sunspot Number Rates for Solar Cycles 21-24

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

C · S · P

725 Commonwealth Avenue
Boston, MA 02215