BOSTON UNIVERSITY

Space Physics Seminar
Thursday, April 16, 2015

Geospace Structure and Dynamics in the Coupled Plasmasphere-Magnetosphere-Ionosphere System: New Observational Insights

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Abstract:

There has been a recent increase in the number of in-situ observational assets in near-Earth space that can be brought to bear on topics of magnetosphere-ionosphere coupling in the sub auroral region. These recent platforms include NASA's Van Allen Probes twin spacecraft with a large suite of advanced plasma sensors capable of analyzing inner magnetosphere ion and electron composition and dynamics from near thermal levels to highly energetic, ultra-relativistic particle populations. When added to existing spacecraft missions including the THEMIS spacecraft (three in highly elliptical orbits, and two in lunar orbit) and when further combined with powerful ground based remote sensors such as GPS based total electron content (TEC) and wide field incoherent scatter radar observations, potentials are greatly enhanced for new and exciting insights into mass flows and feedback mechanisms in the coupled geospace system. We will describe two recent results from ongoing multi-instrument collaborative studies of coupled plasmasphere and inner magnetosphere dynamics that demonstrate the power of this diagnostic perspective.

After a review of phenomenology related to sub auroral polarization stream (SAPS) and storm enhanced density (SED) structures found at storm times in the boundary layer between the plasmasphere and magnetosphere, we will first describe results that employ Van Allen Probes in-situ magnetospheric electric field data combined with ground based Millstone Hill ionospheric radar flow measurements, synoptic GPS based TEC maps, and topside ionosphere DMSP spacecraft observations. The combination of these views with proper analysis provides multipoint quantitative diagnostics of stormtime mass flux moving plasmasphere material from the inner plasmasphere outward to several earth radii. Along the way, we will provide some tutorial details on how the observation technique works for GPS TEC and ionospheric large aperture high power radar.

We will subsequently focus on the impact of this cold, dense plasmaspheric plume material on the efficiency of energy transfer into the Earth system from incident solar wind and magnetospheric configurations. Using ground-based TEC maps and measurements from THEMIS platforms, we more fully complete the picture of how plasmaspheric plume material, streaming from the MLT dusk sector, can extend from regions near the Earth all the way out to the magnetopause and magnetospheric reconnection point. The presence of this plasma has direct effects on reconnection rates based on recent theories by Cassak and Shay, and we will review these predictions and combine them with observations to demonstrate that a negative geospace feedback mechanism exists between storm time energy input and system response.

3:00 pm
Refreshments
CAS Room 500

3:30 pm
Seminar
CAS Room 502

Next Week

- Michael Hecht
  MIT/Haystack
- It takes MOXIE to send people to Mars

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

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