2016 CEDAR-GEM joint Workshop

Inner Magnetosphere Cross-Energy/Population Interactions (IMCEPI) Summary Report

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IMCEPI organized three sessions, one of which joint with the "Storm-time Inner Magnetosphere-Ionosphere Convection" FG. We had 19 presentations in total, including one initiating our Challenge event on the topic of spacecraft charging (in the second session).

（1） Challenge event:

We discussed our challenge topic on "spacecraft charging" that is associated with ring current particles dynamics. We worked with LANL/SHIELD project and NASA/CCMC to fulfill such a challenge. March 17, 2013 event was selected as the candidate event, and we encouraged researchers to simulate the event and provide model results (i.e., electron/ion energy-dependent flux in the equatorial plane/ionospheric grids) to CCMC for the post-processing of charging warning to a particular spacecraft.

The concepts, status, and action plan for the challenge are available here: http://aten.igpp.ucla.edu/gemwiki/index.php/Image:IMCEPI_Challenge_SC_charging_2016GEM.pdf

（2） Joint session with "Storm-time inner magnetosphere-ionosphere convection" FG:

The two FGs shared the same audience and speakers to jointly address the following topics: (a) the impact of large-scale or transient electric fields on inner magnetosphere populations, and (b) the role of particle precipitation of magnetospheric origin on the ionospheric electrodynamics.

Seven speakers presented recent advances from both observational and modeling perspectives on the role of electric fields. For examples, Richard Selesnick reported that large-scale electric field in the inner magnetosphere is capable of replenishing the inner radiation belts. Sam Califf analyzed Van Allen Probes observations of Subauroral polarization streams and confirmed the convectional description of SAPS, as well as suggested the role of SAPS in the plasmasphere erosion. Scott Thaller investigated the asymmetries of dusk/dawn electric field. Joe Huba simulated the SAPS channel during the March 17, 2015 event and focused on the plasamsphere/ionosphere electrodynamics during disturbed time. Carlos Martinis reported conjugative analysis of ground-based/magnetosphere observantions of auroral arcs and ring current particle dynamics.

In addition to these observational efforts, numerical studies also showed significant advances towards achieving a better global geospace model regarding the electric field and coupling with the ionosphere. For example, Raluca Ilie showed a recent implementation of inductive electric field in global MHD model, and Yiqun Yu implemented a more physics-based precipitation module in a global model. These studies had helped us better understand the inner magnetospheric electric field and its role on the ionospheric electrodynamics as well as its feedback effects on the magnetospheric dynamcis.

（3） Session on “Wave-particle interactions”:

This session mainly focused on plasma waves in the inner magnetosphere and their impact on plasmasphere/ring current/radiation belts. We had 5 speakers presenting mainly the properties of EMIC waves, and its effect. For example, S. Tetrick (by A. Saikin) statistically studied the location of EMIC waves relative to the plasmapause. D. Wang investigated the occurrence rate of EMIC waves during different phases of storm time. A. Saikin tested the linear theory for the EMIC wave generation. J. Zhang showed the relationship between EMIC waves and electron precipitation with conjugative observations of Van Allen Probes and BARREL. K. Liu conducted PIC simulations and investigated the dependence of Ion Bernstein instability on the proton-to-electron mass ratio.

（4） Session on “Plasma-field coupling”:

This session mainly focuses on the coupling processes in the tail-inner magnetosphere, including tail injections and the subsequent impact on the inner magnetosphere dynamics. On these topics, both observations and modeling studies contributed to our discussion. For example, Jiang Liu presented results from an investigation of dipolarization flux bundles using THEMIS that attempted to understand how they contribute to injections into the inner magnetosphere. An evaluation of the role of Pi2 waves in accelerating particles during DFBs suggested that they are too weak to contribute. Thiago Brito demonstrated their capability to trace particles through electric and magnetic fields from a BATS-R-US/RAM-SCB simulation of a substorm period in the July 18, 2013 storm. Colby Lemon showed preliminary results of an RCM-E simulation in which ion losses driven by field line curvature scattering were calculated, showing general agreement with DMSP precipitating ions over several passes through the SAPS region, but leaving open the question of whether FLC scattering is the dominant driver of ion precipitation in that region. Christian Ferradas traced ions in a dipole magnetic field and Weimer electric field model in order to demonstrate that “nose structures” that are seen in ion spectrograms result from the competition between ExB drifts and gradient-curvature drifts, and contrasted the types of nose structures seen in different phases of magnetic storms. Jichun Zhang presented a follow-up analysis of similar “nose” structures in electron spectrograms, and suggested that although ExB and gradient/curvature drift paths are aligned for electrons, these nose structures also result from details of the electron drift trajectories and the different drift path topologies of electrons detected at different energies.