The GEMstone

Volume 23, Issue 1 November 2013

Notes from NSF Program Director

Ray Walker

This has certainly been an "interesting" year. For GEM there have been successes and disappointments. High on the list of accomplishments is the completion of the GEM White Paper "The Geospace Environment Modeling Program: Need, Goals, Accomplishments and Implementation" laying out an updated approach to the GEM program. The GEM White Paper restated the overarching goal of GEM: "…to explore, understand, and ultimately predict the dynamics of the geospace system by advancing increasingly realistic numerical simulations, including global and specialized regional models, and capabilities for synoptic observations."

Significant changes include redefining the five overlapping research areas that support this goal and expanding the responsibilities of the Research Area (RA) Coordinators. The five research areas are:

1. Solar Wind – Magnetosphere Interaction (SWMI);
2. Magnetotail and Plasma Sheet (MPS);
3. Inner Magnetosphere (IMAG);
4. Magnetosphere – Ionosphere Coupling (MIC);
5. Global System Modeling (GSM).

In this issue	Page

The Research Area (RA) Coordinators are responsible for coordination within these research areas. There are two coordinators for each RA. The RA Coordinators develop and periodically update concise statements of the scope and goals of each RA, work with the GEM community to identify and articulate science targets for community study, identify system-level problems that go across research areas, and develop selection criteria for Focus Groups that are consistent with GEM goals and are within the scope of the RAs. However they will not participate in focus group proposals.

The White Paper provides a fresh look at GEM and I encourage all those interested in the GEM Program to read it. It can be found at (http://aten.igpp.ucla.edu/gemwiki/index.php/Main_Page). I want to thank Bill Lotko (chair), Jeff Hughes, Mike Liemohn and Katariina Nykyri for doing an outstanding job in preparing the White Paper.

GEM has been and remains an extremely dynamic and productive program. But don't take my word for it, after you read the White Paper read the accompanying supplement listing the GEM Program accomplishments. They are impressive and are strong evidence of how well community driven research can work.

The Geospace Section of NSF also has released its Strategic Plan. It provides our blue print for the future of geospace research. It can be found at (http://cedarweb.hao.ucar.edu/wiki/index.php/Main_Page).

In FY 2013 we received proposals for 41 GEM projects (48 proposals). At the GEM Workshop I told you that I still did not have final budget numbers and had only been able to award the four highly recommended proposals up to that time. I added that I would try to find resources once the budget was known to award at least some of the top rated proposals in the recommended category. I had hoped to award as many as six of the top recommended projects but there were funds for only three. This was down from 10 of 38 projects in FY 2012.

For FY 2014 we received proposals for 43 projects (56 proposals). In the next couple of weeks I will be contacting members of the community to serve on the panel and I also will be asking for ad hoc reviews. I know everyone is very busy but please agree to serve if you can when I call.

Ray Walker

2013 GEM Mini-workshop
Sunday, December 8
Westin San Francisco
Market Street
50 Third Street
San Francisco, CA

http://aten.igpp.ucla.edu/gemwiki

The GEMstone Newsletter is edited by Peter Chi (pchi@igpp.ucla.edu) and Marjorie Sowmendran (margie@igpp.ucla.edu).

The distribution of GEMstone is supported by the National Science Foundation under Grant No. 0903107.

Notes from Outgoing GEM Chair

David Sibeck

It has been a pleasure serving as Chair of the GEM Steering Committee over the past two years. What I enjoyed most was having the chance to meet and learn from so many dynamic scientists, at all stages in their careers. GEM meetings are always lively, the quickest route to identifying current hot topics (as well as controversies), an opportunity to forge new research partnerships, and a great way to identify future science leaders. One of the main reasons for this is that GEM emphasizes bottom-up science in which members of the community advocate and then decide on what should happen next. That can only happen if researchers become and stay engaged, and I hope everyone reading this finds a way to do so.

The preparation of the GEM White paper and efforts to establish a community voice represent two of the most important activities that occurred over the past two years. I would like to thank William Lotko (lead), Jeffrey Hughes, Michael Liemohn, and Katariina Nykyri for their successful efforts to encapsulate the reasons why we have a GEM program, what it has accomplished, and describe our vision for the future. Their work will be of immense benefit in defending the program and guiding decisions concerning its future. The report they prepared is a living document and comments from the community are always welcome. Readers can find a copy here: http://aten.igpp.ucla.edu/gemwiki/index.php/Main_Page.

The last GEM meeting saw our community taking its first concrete steps towards self-advocacy. Those steps have now culminated in the formation of an AGU Space Physics & Aeronomy Advocacy Committee chaired by Len Fisk, with members Dan Baker and Harlan Spence who are well known to the GEM community. It is our duty as active researchers to make the case for the work we do clearly, concisely, accurately and in as many places as possible. I would like to thank those who are already doing so, and encourage others who are not to become involved.

Next summer's GEM meeting will be held in Portsmouth, Virginia. I visited the area twice last year and know from personal experience that that Tidewater Virginia is a fascinating region, with attractions ranging from beaches through history, and family theme parks. Please do plan on attending. If you have suggestions for venues after that, please let the GEM steering committee know.

Finally, it is both the custom and my wish to thank all those who have helped, and there are many. First of all, I'd like to thank Ray Walker. His transition from UCLA to the NSF went very smoothly- he gave our Steering Committee both a concrete direction and considerable latitude. The members of the steering committee never failed to express their opinions but also to volunteer their time and efforts, enabling us to finish all our tasks on time. Leaders of the focus groups deserve great thanks for ensuring productive science discussions (and preparing the reports that follow). Special thanks are due those who work quietly behind the scenes to keep things running. Peter Chi maintains our GEM Wikipage, provides institutional memory, and invariably replies 'yes, I can do that' when asked for help. Bob Clauer and Xia Cai work tirelessly and enthusiastically to prepare for our meetings and keep them running smoothly. Our student representatives Nathaniel Frissell and Roxanne Katus are true innovators, always coming up with new ideas to engage the students. It has been a pleasure working with all of them.

Now it is time to pass the baton (actually in GEM's case the Captain's Bell) to Eric Donovan. Having worked closely with

him both inside and outside GEM, I know we are all in good hands and can look forward to some lively meetings. See you soon at the Fall AGU mini-GEM!

Notes from Incoming GEM Chair

Eric Donovan

I did my PhD at the University of Alberta. My supervisor, Gordon Rostoker, gave me the very (perhaps too) challenging topic of exploring the effects of field-aligned currents on magnetic mapping between the magnetosphere and ionosphere. During that time, I struggled with the very under-constrained empirical models of the day. I also worked along side very accomplished MHD modelers including Robert Rankin and Igor Voronkov. They too were struggling: their models were self consistent, but the physics driving them was incomplete, so connecting their results to reality was problematic. In the end I came to two conclusions: modeling is hard, and I'm probably not well suited to it.

During my post-doc years, first in Uppsala with Hermann Opgenoorth, and after that in Calgary with five different supervisors over just two years, I started to get drawn into the beauty and power of auroral observations. Leroy Cogger convinced me that there was a lot of ways we could make them better, and John Samson (back at the University of Alberta) convinced me that the auroral observations could be used to constrain magnetic mapping. I found I could attack the same problems, and that I personally seemed to do better using data that models.

Over those years (1988-1997), I found the work interesting, but I lamented that in the Canadian system we were working in silos. More than that, I was stuck in a (self-imposed) limited way of thinking, namely that I was going to work on modeling or data analysis. The idea of a more complete approach had not even occurred to me.

I got a faculty position in 1997, and my first grant in 1998. I made my first trip as a faculty member in June 1998 – to GEM in Snowmass. I did this because a few people recommended the meeting, and I liked the sound of Snowmass. What I found at GEM had a transformative impact on me, personally and professionally. Hundreds of researchers from across the US and around the world were coming together to explore geospace with a blend of models, data, and theory. Observers were challenging modelers, and vice versa. Better yet, the mood was really upbeat, and the interactions lively and friendly. It was especially exciting because of the focus on bringing students into the fray. Though I was more senior, the GEM community offered the same opportunity of engagement for me.

Now, 15 years later, GEM remains incredibly valuable for my research. I have come to look forward to the meetings as one high-point of the summer and as perhaps the high-point of my annual sojourn to AGU. I have developed friendships that I value, and fostered collaborations that are fundamentally important for my research. I note especially to the students… many of the people you are meeting here will be friends of yours for decades to come.

I am honored to be the GEM Steering Committee (SC) Chair, and look forward to giving back to the GEM community in some key ways. This is an exciting time for GEM. We are redefining our overarching vision, trying to better capitalize on the many synergies we have with CEDAR, and making a more concerted effort to bring in more representation from the international community. In many ways, GEM is the world's flagship space physics initiative, and it sets the bar for everyone. Though a US program, I find GEM to be the most inclusive research community that I have ever encountered.

Dayside Research Area Report

Coordinators: Karlheinz Trattner and Katariina Nykyri

The Magnetosheath Focus Group

Co-Chairs: Katariina Nykyri and Steve Petrinec

During 2012-2013 several publications relevant to the topics put forward in the GEM magnetosheath FG proposal and magnetosheath challenge have either been published or submitted. Magnetosheath FG sessions were well attended at both the Fall-AGU mini-GEM and the Summer GEM meeting. The summer workshop held two sessions and had nine speakers and few posters. We have listed two main conclusions for each speaker and have divided the talks under five different topics:

1. Magnetosheath Structure and Properties
2. Impact of the Magnetosheath Properties on the Physical Mechanisms at the Magnetopause
3. Magnetosheath and Magnetotail Structure at Lunar Distances (new results from Artemis mission)
4. New Imaging Techniques of the Magnetosheath
5. Magnetosheath and Cusps as a source for Magnetospheric Plasma

1. Magnetosheath Structure and Properties

Nick Omidi: "Generation of large scale density and temperature structures in the MSH in global hybrid simulations": 1. Localized ion acceleration at quasi-parallel shocks results in the formation of large density and temperature structures in the MSH. The structures show anti-correlation between

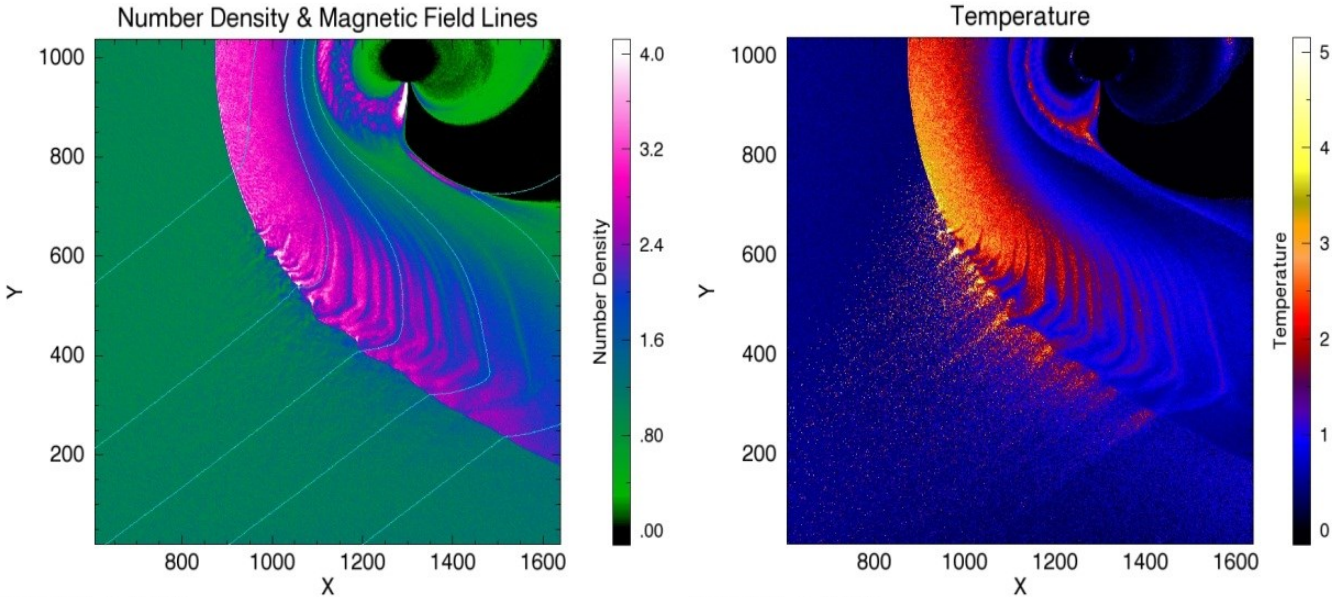


Figure 1. Hybrid simulations (by N. Omidi) show that localized ion acceleration at quasi-parallel shocks form large, anti-correlated density and temperature structures in the magnetosheath, which typically do not exhibit electromagnetic signatures.

density and temperature and typically have no electromagnetic signatures. 2.The structures are more coherent at lower Mach numbers where the level of ULF turbulence in the sheath is low.

Andrey Samsonov: "Influence of IMF cone angle on MSH parameters: isotropic and anisotropic MHD results": 1. Magnetic field stronger on quasi-perpendicular shock side and for small cone angles; dawn side magnetosheath has smaller magnetic field strength. 2. For large cone angles, the magnetosheath is wider and has a larger discrepancy between anisotropic and isotropic MHD. Anisotropic MHD predicts growth of firehose instability in radial IMF cases.

Katariina Nykyri: "Statistical study of the MSH properties using 5 years of THEMIS data": Statistical methodology addresses the motion of the magnetosheath boundaries, the bow shock and magnetopause. Results show that:

1. MSH at the quasi-parallel shock side is at least 10 percent hotter than in the quasi-perp. side.

2. density, velocity and magnetic field profiles agree reasonably well with global MHD simulations except that quasi-perp. shock MSH is thicker and that no clear MSH density asymmetry was observed.

Jean Berchem: "3D Global Hybrid – Global MHD Comparisons": 1. Northward IMF: Global MHD did not observe cusp flows.

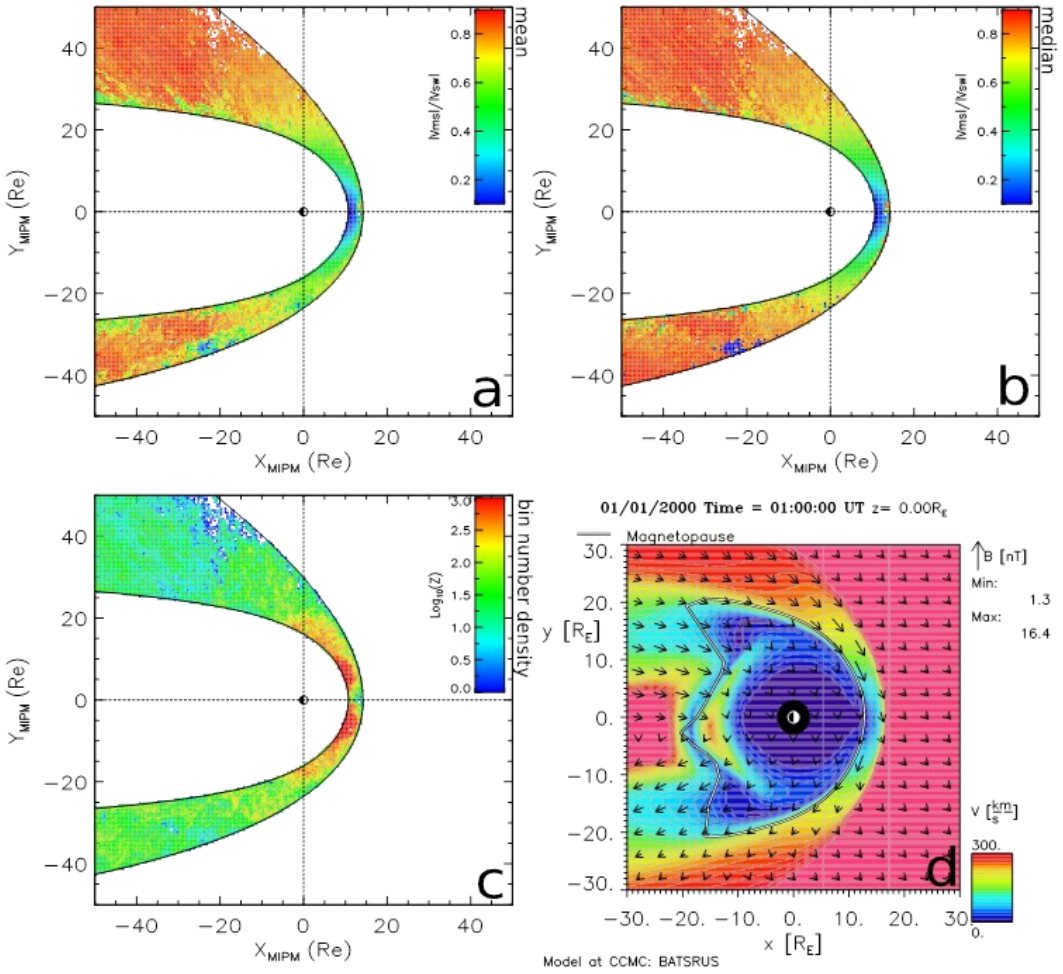


Figure 2. 5+ years of THEMIS measurements in MIPM reference frame of the magnitude of the normalized plasma velocity (mean (a) and median (b) values in each 0.5x0.5 R_E bin are shown). Bin count rates (c) and BATSRUS Global model results (d). For more information see *A. Dimmock and K. Nykyri, JGR 2013 ,doi:10.1002/jgra.50465.*

Higher temperature in magnetosphere in global MHD. 2. Southward IMF: Higher density for global MHD than for global hybrid. Greater magnetic field intensity erosion at the dayside in the global hybrid model, possibly due to a different reconnection rate. Higher temperature in the cusps for global MHD.

2. Impact of the MSH Properties on Physical Mechanisms at the Magnetopause

Viacheslav Merkin: "Kelvin-Helmholtz instability(KHI) of the magnetospheric boundary in a 3-dimensional global MHD simulation (LFM) during northward IMF conditions": 1. The KHI is not limited to low-latitude boundary layer; high-latitude boundary layer also shows undulations; the surface modes are coupled to body modes; field-aligned currents are generated on closed field lines in the inner part of the velocity shear layer. 2. Computed growth rates of the instability are in excellent agreement with the linear theory.

3. Magnetosheath and Magnetotail Structure at Lunar Distances

David Sibeck: "Global MHD simulations of the size and shape of the distant magnetotail (at lunar distances)": 1. The anisotropic pressure of the IMF magnetic field lines flattens the dimensions of the magnetotail in the direction perpendicular to the IMF, but enhances these dimensions in the direction parallel to the IMF. 2. For a typical ecliptic IMF orientation, the northern and southern magnetosheath thicknesses are greater than the dawn and dusk magnetosheath dimensions.

Chih-Ping Wang: "Unusual encounters with the magnetosheath within the nominal magnetotail": 1. Magnetosheath-like plasma can sometimes be observed by ARTEMIS well within the nominal magnetopause in the magnetotail (X < -40 Re). 2. The appearance of the magnetosheath-like plasma is usually short (from a few minutes to 10s of minutes). From one event of simultaneous observation by the two ARTEMIS spacecraft, the scale of the magnetosheath-like plasma is about 1 Re.

4. New Imaging Techniques of the MSH

Brian Walsh: "X-ray emissions from the Earth's MSH": 1. Soft X-rays are generated through charge-exchange and are emitted from the Earth's magnetosheath. 2. Modeling and instrument development show global images of the MSH and bow shock can be created through observing soft X-rays from charge exchange.

5. Magnetosheath and Cusps as a source for Magnetospheric Plasma

Ted Fritz: 1. High-energy electrons accelerated in the cusp appear to travel along the magnetopause to the magnetotail, coupling into the plasma sheet all along the distant dusk magnetopause. The resulting pitch angle distributions can be used to infer the arrival time of these drifting electrons at the four Cluster satellites. 2. Modeled electron drift rates (295 km/s) are higher than 65 km/s drift rates computed from spacecraft timing of the arrival of one example of these electrons at three of the satellites separated in GSE-Y. The technique should be very sensitive to establishing the large-scale configuration of the geomagnetic field and the role of the cross-tail electric field.

Transient Phenomena at the Magnetopause and Bow Shock and Their Ground Signatures Focus Group

Co-Chairs: Hui Zhang, Q.-G. Zong, Michael Ruohoniemi, and David Murr

The "Transient Phenomena at the Magnetopause and Bow Shock and Their Ground Signatures" focus group held four sessions with 25 presentations. The sessions were organized as follows: 1. Foreshock Phenomena 2. Ground Signatures 3. Magnetopause Phenomena (joint with Reconnection FG) 4. Planning session

Session 1 - Monday, June 17, 3:30-5:00pm (Foreshock Phenomena)

Various foreshock phenomena including hot flow anomaly (HFA), spontaneous hot flow anomalies (SHFAs), and foreshock bubbles (FBs) were investigated by this focus group using both in-situ observations and global hybrid simulations.

Turner et al. gave an overview of foreshock bubbles and their effects on particle acceleration and the magnetosphere-ionosphere system. They showed the enhanced fluxes of energetic particles up to ~10 keV seen in FBs and attributed the enhanced fluxes as evidence for acceleration via Fermi and shock-drift acceleration processes. They also showed that FBs can excite global ULF waves with Pc 5 frequencies, which were observed by Cluster, THEMIS, and GOES located in the magnetosphere.

Great progress has been made on SHFA studies since 2012 GEM, when Omidi et al. and Zhang et al. showed that HFAs can be generated spontaneously (in the absence of any current sheets) at quasi-parallel bow shocks through both in-situ observations and global hybrid simulations. Using global hybrid simulations, **Omidi et al.** demonstrated that SHFAs are generated at M_A as low as 3, however, their rate of formation increases with M_A. They also showed that SHFAs may form at all cone angles. **Wang et al.** (presented by **Zhang**) investigated more than 500 HFAs from Cluster-C1 observations from 2003 to 2009 and found that 58% of the HFAs are SHFAs and statistical study based on Cluster data shows that traditional HFAs have larger amplitude than SHFAs.

Facsko et al. presented a case study of the magnetic turbulent properties inside a mature HFA observed by Cluster spacecraft. With high-pass filtering, they showed the existence of magnetic turbulence inside the HFA cavity, while the low frequency part of the turbulence might be hidden by wave activities.

Zhang et al. investigated the ion and electron spectra inside HFAs and found that both ion and electron spectra can be used to classify young and mature HFAs. In addition, classifications according to ion and electron spectra are not absolutely consistent, which might be due to different heating mechanisms and efficiency for ions and electrons. They also found that the motional electric fields pointing towards the discontinuity on at least one side of the discontinuity is not a necessary condition to generate HFAs. **Chu et al.** showed that both mature and young HFAs are more prevalent when there is an approximately radial interplanetary magnetic field.

Omidi et al. presented hybrid simulation results of interaction of CIR shocks with the bow shock. They showed that this interaction can: 1. Cause waves that propagate through the magnetosheath and the plasma depletion layer. 2. Modify magnetopause reconnection and compress the magnetosphere. 3. Energize ions including those accelerated through reconnection to higher

energies and result in their trapping in the magnetosphere. 4. Generate/amplify electromagnetic waves in the magnetosphere. 5. Enhance ion precipitation into the ionosphere.

Session 2 - Tuesday, June 18, 10:30-12:15pm (Ground Signatures)

The foreshock phenomena may have significant impacts on the Earth's Magnetosphere-Ionosphere System. Presentations in this session used a variety of space- and ground-based measurements to examine the response of the magnetosphere to solar wind transients and various foreshock phenomena.

There were two talks on MI Coupling aspects. **Michael Hartinger** demonstrated that foreshock transients are effective drivers of the full range ULF waves; from single transient TCV/MIEs, stimulating field line resonances, and global modes as well. However, **David Murr** showed that not all foreshock transients cause ground signatures. This is not surprising but it means that we will now need to focus some effort on studying how different foreshock transients deform the magnetopause and which deformations are effective in driving field-aligned current systems in the MI system.

There were three talks on Pc1-3 wave activity (**Engebretson**, **Kim**, and **Bering**) and the main conclusions can be summarized as follows. In addition to the field-aligned current system traditionally used to identify events from the ground, Pc1-3 wave bursts are an important observable for identifying and cataloging events (particularly near noon, where the FAC system is generally weak). Dayside transients including solar wind pressure pulses and foreshock transients can stimulate EMIC waves and modify the transmission of foreshock Pc3 waves to the ground.

There were two talks on other observational techniques (**Frey** and **Baker**). Optical and radar observations have not yet been fully exploited to regularly characterize dayside transients (at least not in our FG activities to date).

Session 3 - Tuesday, June 18, 1:30-3:00pm (Joint Transient Phenomena/Reconnection session)

The broad topics of the joint Transient Phenomena/Reconnection session were (1) the production, evolution, and consequences of flux transfer events (FTEs), (2) plasma transport into the magnetosphere due to Kelvin-Helmholtz instabilities (KHI) and magnetic reconnection, and (3) the effect on reconnection rate and particle acceleration due to strong asymmetries such as those habitually at the polar cusps and transiently from plasmaspheric drainage plumes impacting the magnetopause.

There were two presentations on observational aspects of FTEs. **Karlheinz Trattner** (Lockheed Martin) showed observational evidence for a hemisphere effect for FTEs. **Yaireska Collado-Vega** (GSFC) presented Cluster observations showing FTE motion is strongly dependent on conditions in interplanetary space. Some FTEs move with a sunward component; most of these events had a strong By, which is consistent with predictions from **Sibeck and Lin**.

There were four presentations broadly on plasma transport through KHI and reconnection. **Binzheng Zhang** (Dartmouth) showed LFM simulations that included a non-zero By. He discussed the entry of electrons into the cusp due to dayside reconnection, and that there are two different populations. There was a discussion on the relative importance of reconnection and KHI. **Takuma Nakamura** (Los Alamos) showed results of 3D particle-in-cell simulations of secondary reconnection occurring during KHI, emphasizing the necessity of 3D. The reconnection can disturb the vortex and generate turbulence, which enhances mixing and transport. **Xuanye Ma** (University of Alas-

ka) discussed the interaction of KHI and reconnection for large magnetic shear. In particular, each affect strongly impacts the other, with KHI limiting the reconnected flux and modifying the dissipation region structure. A guide field decreases the growth of KHI. Finally, **Shiva Kavosi** (University of New Hampshire) showed global magnetohydrodynamic simulations with Open GGCM of the KHI using parameters obtained from observations by THEMIS. She showed that results from Open GGCM simulations and THEMIS observations are consistent. She also showed that the frequency and amplitude of the KH waves depend on the solar wind driving velocity-larger driving velocities generating KH waves with higher frequencies and larger amplitude.

There were two presentations on reconnection affected by asymmetries in the cusp and due to plasmaspheric plumes. **Rick Wilder** (CU-LASP) showed Cluster observations of reconnection at the polar cusp, which is strongly asymmetric and has a significant shear flow. He observed the exhaust is predominantly on the magnetospheric side of the magnetopause, consistent with theoretical predictions of asymmetric reconnection. He also compared the observed outflow speed to theoretical predictions. **Sun-Hee Lee** (University of Alaska) presented observations of cold ions in magnetopause reconnection, which likely come from plasmaspheric plumes. The particles accelerate near the flow boundary, being picked up by the electric field and have a mass dependent energization. These particles are not seen on the magnetosheath side, indicating that they may play a very limit role in the reconnection process.

The results presented in this session are important for the role of reconnection in solar wind-magnetospheric coupling, magnetospheric convection, particle acceleration, and for plasma transport into the magnetosphere.

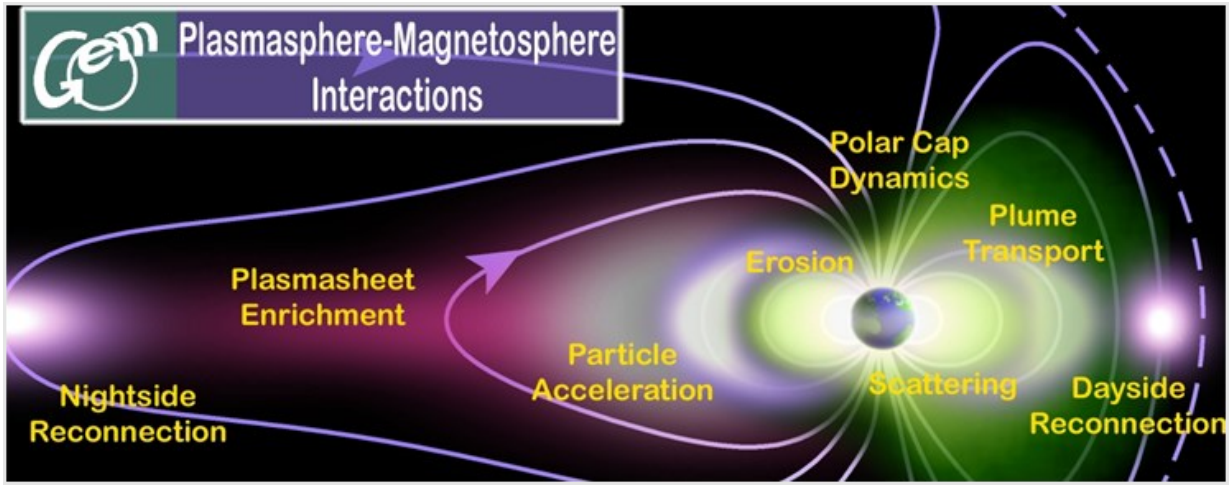
Session 4 - Tuesday, June 18, 3:30-5:00pm (Planning Session)

Three talks were presented in this session because they could not fit into other sessions due to limited time. **Joe Borovsky** presented the effect of sudden wind shears on the Earth's magnetosphere predicted by MHD simulations, including boundary-layer motions, transient magnetosphere-ionosphere currents, transients in cross-polar-cap potential, and magnetotail disconnections**.** **Andrey Samsonov** presented THEMIS observations of sudden impulses in the magnetosphere. He showed that compressional waves can be observed very deep (~1.8 R_E) in the magnetosphere and amplitude of these waves will decrease closer to the Earth. **Xiaoyan Zhou** presented the aurora signature of the magnetopause reconnection. The red aurora emissions indicated an equatorward expansion of the cusp due to the magnetopause erosion during the dayside magnetic reconnection.

During the last 40 minutes of the planning session, we discussed post summer workshop plan. The focus group is working on a list of events that can be analyzed by the entire community from different perspectives. A table and a short description of some transient foreshock phenomena, together with a list of HFA and FB events observed by THEMIS in 2008 with summary plots has been posted on the GEM wiki page. We plan to extend the event list to include 2007 THEMIS events as well as Cluster events. We also plan to put other event list online, e.g., interplanetary shock list and TCV list. The focus group will also be joining the GSFC Monday Dayside science teleconference (supported by THEMIS) at noon as a mechanism for continued communication and presentation of science topics.

IMS Research Area Report

Coordinators: Anthony Chan and Scot Elkington



Plasmasphere Magnetosphere Interactions (PMI) Focus Group

How Are Magnetospheric Processes Regulated By Plasmaspheric Dynamics (and Vice Versa)?

Co-Chairs: Jerry Goldstein, Joe Borovsky, and Maria Spasojevic

Wiki: http://aten.igpp.ucla.edu/gemwiki/index.php/FG11._Plasmasphere-Magnetosphere_Interactions
ABRIDGED LINK: http://tinyurl.com/pmiFGwiki

This is a report of activities of the Plasmasphere-Magnetosphere Interactions (PMI) Focus Group (FG) at the 2013 Geospace Environment Modeling (GEM) Workshop.

PMI Breakout Sessions
This was the final year of sessions o the PMI Focus Group. To close out the FG and address the central question, "How Are Magnetospheric Processes Regulated By Plasmaspheric Dynamics (and Vice Versa)?" we hosted two (2) Breakout sessions at the 2013 GEM Summer Workshop:

A. Scientific Progress Since 2012: The first session (and of course part of the second) consisted of people giving talks about progress made since the previous GEM Summer Workshop.

B. Does the Plasmasphere Have a Future? The second session contained a discussion about the future of plasmaspheric research at GEM, and whether or not a new plasmaspheric-oriented Focus Group was needed.

Session A:
In the first (plus) session, the following speakers/topics were included:

1. **Wen Li** -- An unusual enhancement of low-frequency plasmaspheric hiss associated with substorm injected electrons.
2. **Brian Walsh** -- plumes at the magnetopause.
3. **Joe Borovsky** -- estimates of plumes and dayside reconnection.
4. **Dan Welling** -- long lived plumes.
5. **Vania Jordanova** -- simulation results.
6. **Richard Denton** (for **Jonathan Krall**) -- simulations with SAMI3.

7. **Richard Denton** -- simulation of EMIC waves for the June 9-10 2001 event.
8. **Konstantin Gamayunov** -- model results for EMIC waves.
9. **Kyungguk Min** -- quiet time equatorial mass distribution.
10. **Jichun Zhang** -- on the "trunk-like" ion spectral feature at the inner edge of the plasma sheet.

Taken as a whole, the presentations showed that there was solid progress on ongoing plasmaspheric research topics and there were new findings. Many of the talks were not primarily concerned with the plasmasphere, but rather with another particle population which is influenced by the plasmasphere (or vice versa). This breadth of topic illustrated how intimately coupled the plasmasphere is with the rest of the magnetosphere and ionosphere.

Session B:

In the second session, a good discussion was had about what plasmaspheric research efforts were ongoing, what people wanted to do in the future, and whether or not a new umbrella Focus Group is needed at GEM which would deal primarily with the plasmasphere. The overwhelming consensus was that there was no need for a new Focus Group. There are a lot of ongoing and evolving plasmaspheric research topics, but each one of them is synergistic with another ongoing Focus Group at GEM. Hence, the plasmaspheric research will continue, and it will still fit in well with the GEM program of research. Specific matchups that were talked about:

- Plasmaspheric waves --- Radiation Belts and Wave Modeling (ending soon)
- Plasmasphere effect on radiation belt -- Radiation Belts and Wave Modeling
- Plasmaspheric refilling -- The Ionospheric Source of Magnetospheric Plasma
- Plasmaspheric drainage -- Magnetic Reconnection in the Magnetosphere
- Plasmaspheric convection -- Storm-Time Inner Magnetosphere-Ionosphere Convection
- Plasmaspheric composition -- The Ionospheric Source of Magnetospheric Plasma
- Adding the plasmasphere to codes -- Metrics and Validation

After 5+ years of the PMI focus group, we quit 10 minutes early.

Science and Programmatic Imperatives for the Community

The PMI Focus Group has identified several science and programmatic recommendations for continued progress on the science that the Focus Group has supported in the last several years.

• Ion Composition: More observations and models of inner magnetospheric ion composition are urgently needed to close the loop on several PMI science topics, including wave growth and wave-particle interactions, global MHD, and the possible role of oxygen enrichment in modulating dayside reconnection and substorms.

• Plume Structure: Modelers need to get more meso- to fine-scale structure into their simulated plumes, in order to match the observed cross-scale structure.

• UT and Longitudinal Effect: For several years various case studies have hinted that there may be a longitudinal (and/or UT) modulation of the strength of storms and the density of plumes. This effect must be quantified and understood.

• Wave Growth, Propagation, and Resonance: Simulations need to use 3D, realistic density for their plasmaspheres (e.g., cross-scale spatial structure both in and out of plumes, nonmonotonic density profiles, and profiles constrained by measurements). We need to know the conditions that drive waves, and we need to know the effects of both those conditions and of the waves. We also must gauge how well measured plasma conditions agree with the linear theory that is widely used.

• Epoch Time Analysis: For anything linked to plume dynamics (density, waves, etc.), a superposed epoch analysis is recommended because standard (purely indicial)

statistical analysis may obscure physical processes that are initiated or terminated at particular storm phases.

Plasmasphere-Magnetosphere Interactions (PMI): What Has Been Learned?

Since 2008 when the PMI FG was first convened, four main topics have been addressed, I through IV below. As described below, during the tenure of the PMI Focus Group, much scientific progress has been made in all three topics.

(I) Wave Particle Interactions:

This topic has focused on: (A) How the evolving global distribution of cold plasma governs the growth and propagation of waves, especially those that control energetic particles; and (B) How ambient plasma properties such as temperature, density, and composition influence wave particle interactions.

The theoretical quantitative effect of background plasma upon wave development and propagation has been quantified and elucidated. Ray tracing simulations indicate that VLF whistler waves spend more time in the plasmasphere than in regions with more tenuous plasma, and the whistler wave growth rate is heavily dependent upon the background density. The wave normal angle clearly influences the scattering rate. Ducting of whistlers is most effective for density irregularities satisfying particular relationships to the wave properties. Non-linear (or quasi-linear) theory may very well be required, in fact, given some very large wave amplitudes (e.g., 2-100 mV/m chorus) found in recent observations. Ray tracing modeling of hiss and chorus has shown good agreement with observed wave dynamic spectra, suggesting the conclusion that cold plasma can exert significant control on wave power, and on the resonance condition with energetic particles. A key development has been the application of regression analysis to produce a THEMIS-based empirical model of chorus emissions. Very relevant to PMI, cold plasma plumes must be considered in mature models: a broad plume may stop chorus from getting in, while the normal narrowing (with time) of the plume can gradually "open the gate". The current consensus is that 3D simulations with nonmonotonic density are a high priority for future progress. ULF waves are also severely attenuated inside the plasmasphere. Simulation results have demonstrated a significant effect of the plasmasphere upon the ULF wave mode structure: the frequency of FLRs is lowered, and spectral power is shifted inward in L-shell by the presence of the inner cavity. Very recent results have shown the importance of proper characterization of these ULF waves that can modulate the loss cone angle of energetic electrons.

Multiple simulation results indicate that knowledge of cold plasma (composition and density) is crucial to properly constrain and understand EMIC wave propagation and growth. Observational evidence also indicates that background density is a crucial influence upon wave growth and propagation. Simulation of EMIC waves indicates that structure within plumes (on spatial scales from meso- to fine-scale) can strongly modulate wave growth, and therefore this internal structure must be considered/included in future models. But cold plasma must be considered self-consistently with other particles and fields to get the whole picture. There is certainly a correlation between plumes and electromagnetic ion cyclotron (EMIC) waves, as revealed both by direct in situ cross-comparison and in situ plasma proxies for EMIC growth. However, it has become clear that the plume-EMIC correlation must be considered carefully and separately from EMIC growth from magnetic compression by solar wind pressure pulses. While cold plasma properties make a big difference in simulations of EMIC wave growth and propagation, statistical analysis of ground-based Pc1 observations reveals at best a weak correlation with the simultaneous occurrence at geostationary orbit of plasmaspheric plumes. On the other hand, EMIC wave occurrence does correlate well with solar wind pressure pulses. This sys-

tematic organization (by physical process) of EMIC wave growth has emerged from all observations: in situ, ground-based, and global imaging. Because EMIC waves are believed to scatter ions effectively, two imaging tools have emerged as possible proxies for EMIC waves: proton aurora seen by IMAGE FUV and low altitude ENAs observed by the two TWINS spacecraft. During the PMI FG's tenure, in situ (at geostationary orbit) proxies for EMIC growth have been advanced to a mature state as well. EMIC linear wave growth proxies are in agreement with actual EMIC wave observations (and with detached proton arcs seen in FUV imaging), and can be useful where actual wave measurements are not available. Epoch time analysis is recommended for any processes linked to plume dynamics, such as the possible link between EMIC wave growth and plume density.

(II) Plume Dynamics and Recirculation: This topic has examined how eroded plasmaspheric plasma is transported throughout the magnetosphere, how it evolves, and how plumes may influence reconnection and solar-wind-magnetosphere coupling.

The global structure of plumes is reasonably well understood and quantified: plasmaspheric models do a good job of predicting where and when plumes will occur, and what density they will have. During storms and substorms plume plasma convects sunward inside a "drainage corridor" whose shape, size, and location vary with epoch time and disturbance level. This "drainage corridor" is a region where plumes are most likely to be found (based on global convection characteristics found from a simple superposition of cross-tail and corotational E-fields); the plasmaspheric drainage corridor is the global pathway for cold plasma to make its way to the dayside reconnection site.

Even after several years of effort, the structure inside plumes is not yet so well captured. Numerous observations have illustrated that plume plasma is highly structured, both in flow field and in density, with indications of fine structure on scale sizes below what instruments have ever measured. The creation of this fine structure is still an outstanding question: does it arise from turbulent electric/magnetic fields, or does ExB-drifting plume plasma spontaneously shred itself as it convects? The high degree of plasmaspheric and plume density structure (and sub-structure) has been a major component of this topic. Plume structure can arise from either rapid temporal variation of the solar-wind-driven E-field, or local inhomogeneity of the convection field; it is the latter effect in particular that is not yet well characterized enough for models to reproduce interior density structure. Statistical analysis of ion density data has, however, produced the first reported observation of a possible minimum scale size of under 250 km (0.04 RE) for the fine-scale structure within plasmaspheric plumes, hinting at the mechanism responsible for the structure. Interhemispheric asymmetries (linked to north-south asymmetry in the field-aligned flows), composition of the ionosphere, and kinetic processes add yet more complication to the density structure of the plasmasphere.

Penetration electric fields have been shown time and time again to be a strong influence on both the plasmasphere and the lower-energy range of the ring current, and these fields are observed in SuperDARN radar to closely correlate with the IMF north-south conponent, with a 15-20 minute delay, consistent with older IMAGE-EUV-based estimates for the "penetration delay time" for the inner magnetospheric E-field. The sub-global convection field is still being characterized: observations of strong spatial and temporal E-field gradients and variability in the subauroral ionosphere within SAPS channels are seen in both low-altitude orbiting spacecraft and ground-based radar.

During the PMI FG's tenure, increasing evidence has emerged in support of the effect of plumes on reconnection. Some observations have shown a measurable control of plume plasma upon the reconnection rate. Theoretical analysis has quantified how

asymmetric reconnection (i.e., reconnection in which inflow and outflow regions have different properties) is applicable to the plume influence on dayside magnetopause reconnection. Observations also show that the super dense plasmasheet (possibly enriched by plumes) may influence the stormtime level of relativistic electrons. From simulation results, it may be that plumes affect the dayside reconnection rate most strongly for the strongest storms, which feature severe magnetopause contractions.

(III) Plasma Density Structure and Evolution:

This topic has been concerned with how density structures of various spatial and temporal scales form and evolve, and how plasmaspheric filling varies spatially and on time scales from hourly to solar cycle.

An early thread of this topic was how cold plasma density features can be used to diagnose inner magnetospheric (IM) electrodynamical effects such as erosion, shielding, and subcorotation. For example, modeling of undulatory ripples that travel across the duskside plasmapause has revealed a new type of region-2 current system, i.e., traveling pairs of filamentary region-2 currents that arise from interchange unstable ring current plasma and modulate the cold background density. In support of this capability, new observational capabilities have been explored, such as plasmaspheric tomography using GPS signals and analysis of ultra-low-frequency (ULF) waves observed by ground magnetometer stations. Tomography is now allowing us to obtain a global snapshot of the entire (or the majority of the) dayside cold density distribution. These newer and still developing observational techniques can augment the already extensive cold plasma measurement database used by the GEM community. Significant progress has been made in characterizing the average composition (H+ versus O+) of the plasmasphere, using statistical analysis of geostationary observations (both plasma and waves), and the average refilling rates during recovery, using radio-sounding of field-aligned density.

It is clear that the next generation of models must incorporate sub-global structure, and account for dynamics on longer time scales, especially during and after the recovery phase. Refilling is a major example of long-time-scale density. Numerous studies, both observational and theoretical, have honed our understanding of time-dependent and time-averaged refilling rates. Plume shredding is a major example of sub-global structure, motivating the conclusion that modelers need to think about how to put more structure into the plume. Significant discussion in this topic has dealt with possible formative mechanisms of particular meso-scale features such as the plasmaspheric "armpit", i.e., global density depletion inside and west of the base of an afternoon-sector plume, with a likely candidate being a combination of the natural corotation of plasma plus a sub-global duskside eddy flow whose existence is merely postulated. These results have added new emphasis to the understanding that our knowledge of the meso-scale convection field must be increased by an order of magnitude, if our models are to provide truly improved predictions for the plasmaspheric density distribution.

(IV) System-Level Plasmasphere-Magnetosphere Interactions:

This topic has focused on the role of the plasmasphere in the overall magnetosphere-ionosphere-thermosphere system response. To address this topic, sessions were typically held jointly with scientists from the CEDAR community. The goal was to develop our understanding of the interaction among components of the larger system.

Numerous results have shown how various subsystems (e.g., ionosphere, ring current, neutral winds, etc.) fit together into the larger magnetospheric system, and how these various components interact as part of the overall system response during stormtime. Significant discussion in the PMI FG has focused upon what concrete progress has been made in understanding specif-

ic subsystems or their interrelationship. For example, the relationship between plasmaspheric plumes and ionospheric storm-enhanced density (SED) tongues has been explored at length, with the conclusion that the dynamics of SED tongues and plumes are clearly linked during stormtime, indicating strong M-I coupling along the entire flux tube. The role of oxygen ions in SAR arc formation also points to the urgent need for better understanding and modeling of composition. The inner magnetospheric electric field, including variability in the PBL, and general electrodynamics initiated by region-2 M-I coupling, is a major topic still requiring more exploration. A major accomplishment presented at PMI Sessions is the development of newer, improved statistical analysis of the inner magnetospheric electric fields: a superposed epoch analysis of Cluster electric fields was shown to produce dynamic features of the inner magnetospheric fied, keyed to storm phase, and statistical characterization of SAPS was presented. Inclusion of ionospheric-thermospheric coupling has also been shown to have a measurable and significant impact on the generation of SAPS. All in all, concrete progress has been made, and future work along these lines should yield continued progress in the coming years.

Radiation Belts and Waves (RBW) Focus Group

Co-Chairs: Jacob Bortnik, Yuri Shprits, Scot Elkington, and Craig Kletzing

The Radiation Belts and Waves (RBW) focus group enjoyed a particularly large attendance at the 2013 GEM summer workshop, undoubtedly due to the recent launch of the Van Allen Probes mission, and a number of related missions such as BARRELL and CSSWE. We had 6 sessions scheduled to take place on Wednesday June 19th and Thursday June 20th, originally planned for Cathedral Peak but relocated to Salon A due to the large number of attendees. There was a total of 60 speakers over the 6 sessions, thus averaging 10 speakers per session, which was achieved by imposing a nominal 5-minute or 3-slide per speaker rule (a poll of the audience taken at the end of session 6 revealed that this rule turned out to be not as onerous as initially thought, and surprisingly the audience voted unanimously to keep it).

A wide range of topics was discussed at the sessions which we cannot cover in detail but only highlight a few selected topics:

- The RBW particle challenge: session 1 focused primarily on the results of a challenge initiated in the RBW group, to use a variety of models in order to simulate several preselected storms over the CRRES period. Several modeling groups showed their results, including ever increasing complexity into their modeling, such as radial diffusion, scattering due to chorus, hiss and EMIC waves. First results were shown from the coupled BATSRUS-RAM code, the VERB 4D code, and the K2 model, among others.
- Radiation belt dropouts: a big theme this year was understanding the causes of radiation belt dropouts. Various projects highlighted different ideas such as electron loss due to magnetopause shadowing together with outward radial diffusion, precipitation into the atmosphere due to ULF wave action, and precipitation loss due to chorus and hiss waves. This was supported by a number of observational studies using NOAA/POES satellites, THEMIS and of course Van Allen Probes. Several studies seem to suggest that dropouts are not accompanied by precipitation loss. Notably, first results were shown of the student-built CSSWE satellite which had been successfully launched in Sept 2012.
- Radiation belt acceleration: the acceleration of radiation belt electrons to relativistic energies is an ongoing area of in-

tense research, with much debate about the dominant mechanisms that cause this acceleration. Notably, results were reported from the Van Allen probes that showed compelling evidence of phase space density peaks forming at low L-shells, in the aftermath of a storm. Interestingly, evidence from the Van Allen Probes has also been presented of non storm time enhancements of radiation belt particles, apparently not associated with chorus waves.

- Wave excitation and wave particle interactions: a number of studies focused on the detailed behavior of particles using test-particle scattering, for instance extremely rapid scattering was shown to occur when interacting with EMIC, and the trapping limit of protons was investigated due to field line curvature. New models were shown that simulated wave excitation and growth using hybrid-PIC codes, and yet other models showed the often non-diffuse transport of particles due to ULF waves (modeled with MHD codes). A direct, detailed observation of wave-particle interaction from the Van Allen Probes was shown, with pitch-angle distributions collected at up to 1000 samples per spin.
- RBW challenges: while the particle challenge is now in a mature phase, and will continue into the final year of the RBW focus group, a new wave-excitation challenge has been initiated whose focus is modeling the excitation of a single chorus element, given a standard set of input parameters. Initial results will be presented at the GEM mini-meeting at the 2013 Fall AGU, and final results will be discussed at the 2014 GEM summer workshop.

Snapshots of 2013 GEM Summer Workshop
(Photographs provided by Xia Cai)

Tail Research Area Report

Coordinator: Larry Kepko

Tail-Inner Magnetosphere Interaction Focus Group

Co-Chairs: John Lyon, Frank Toffoletto, and Pontus Brandt

We discussed four topic areas:

1. *Origin and evolution of BBFs and related phenomena:*
   Raeder and **El Alaoui** discussed their MHD simulations. In each case they found BBF-like structures. **Birn** and **Sitnov** both showed results from PIC simulations for magnetotail-like situations. They both found broad dipolarization fronts (DF's). **Wang** used the Rice Convection Model (RCM) to show how low entropy bubble could form in the tail. **Drake** discussed how the Hall current could give rise to the initial B_z dip observed in front of dipolarization fronts.
2. *The impact of BBFs and other phenomena on transport during different levels of activity (e.g., quiet times, SMCs, substorms, storm main phases):*
   Zhou discussed the observed effects of an interplanetary shock on the mid-tail. **Gdioulidou** showed RBSPICE data of multiple ion injections during a storm. Sitnov and Yang (RCM-E) modeled moderate storm events. **Sitnov** used an empirical model based upon the recent TS07D magnetic field model. **Yang** used the RCM-E – Rice convection model with an equilibrium magnetic field. **Ohtani** showed EUV solar cycle effects on Region 1 currents. **Kissinger** found in a statistical study relatively more SMC's in storm recovery phase.
3. *The impact of BBFs et al on the inner magnetosphere:*
   Runov found oscillations at 8 R_E apparently caused by a precursor of the DF. **Zhang** discussed ion "trunks" in RBSP data near perigee. **Ukhorskiy** showed a model for DF quasi-trapping of ions. **Gabrielse** found particles could be injected by a channel using a strong potential (not inductive) field. **Claudepierre** discussed ULF waves in LFM driven by long period pressure waves in the solar wind.
4. *Auroral streamers and other ionospheric signatures of BBFs:*
   Nishimura and Zou showed separate airglow and radar data of a flow channel in the open polar cap that led to a PBI and streamer when it reached the open-closed boundary. **Lotko** discussed the question of how ionospheric conductance affects flux transport in the tail. **Angelopoulos** found correlation of ECH waves with DF's.

There were also few possibilities discussed for coordinated workshops.

1. In July/Aug 2013 Artemis/Themis will be in the tail in drift conjunction with the Van Allen Probes and possibly Cluster and Geotail. (This needs to be checked.)
2. Two Themis events that Andrei Runov has looked at in some detail (April 4&8, 2009
3. Modeling challenge to reproduce the polar cap flows that are observed to lead to streamers as observed by Nishimura.

Modes of Magnetospheric Response Focus Group

Co-Chairs: Larry Kepko, Bob McPherron, and Jenni Kissinger

The Modes of Magnetospheric Response Focus Group held two breakout sessions at the 2013 workshop. As usual for our focus group, talks were kept short and there was plenty of discussion between the participants. The response of the magnetosphere to solar wind driving is manifested in a variety of ways. We used to think there were substorms and storms, and storms were simply a superposition of substorms. Today we know the situation is more complex. There are at least three main response modes: Substorms, steady magnetospheric convection (SMC), and sawtooth. The objectives of the focus group were to: characterize the modes; identify the solar wind conditions associated with each mode; determine the internal state of the magnetosphere during each mode; and determine what causes a transition between modes.

The first session on the morning of June 20 had 7 speakers. **Suzie Imber** spoke on behalf of **Steve Milan** and discussed recent results on the role of MI coupling in producing different convection events. Milan had calculated variations on size of polar cap area as functions of time within mode, and showed occurrence distribution of SYM-H vs oval radius (ring current strength orders size of auroral oval). SMC intervals occurred at lower oval radii (higher latitudes), but with wide oval with high driving. SMCs might not be able to occur on an expanded auroral oval as frictional coupling becomes stronger as onset is at lower latitude. **Vahe Peroomian** showed a CIR/HSS storm event from 8-9 March 2008. He showed a linear increase in ring current energy density for Bz>0, but uncorrelated with Bz<0. The Interpretation is that the closed system responds directly to dynamic pressure, open system is more chaotic, stripping flux tubes. **Binzheng Zhang** wondered how do some SMC states emerge without an initiating substorm? He stated that the answer is entirely due to plasmasheet density. If systems starts with dense plasmasheet, needs to have a substorm. If not dense plasmasheet, can enter SMC without substorm. **Jenni Kissinger** examined how SMCs end. SMCs that end with substorms have higher velocity (450) 400 for no substorm end. *Bz* has a more southward turning that terminates SMC with substorm. If IMF moves northward, SMC fades away. **Xia Cai** examined the solar cycle dependence of sawtooth. SMC occurrence peaks before and after solar maximum, with minimum sawtooth occurrence during solar max. Fall preference for SMC, due to IMF polarity which had a preference for 'away' polarity. **Anna DeJong** compared the first tooth in a sawtooth with an SMC initiating substorm. **Xiangning Chu** suggested that substorm onset waiting time shows solar cycle dependence. Sawtooth events waiting time is different. Shows decrease during solar max.

The second session in the afternoon broadened to include ion outflow effects and energy coupling. **Joe Borovsky** discussed his first-principles derived universal coupling function. $R \sim 0.2\ Va_{slow}(B_{slow}B_{fast})^{1/2}$. Starts with Cassak-Shay formula, recasts in terms of observable properties. High Mach number leads to lower reconnection rates. **Shin Ohtani** presented results on how ionospheric conductance affects MI coupling, and by extension, the mode of response. He showed that Region 1 currents increase as F10.7 increases. On dayside, this reduces the magnetic field strength and causes increased flaring. **Bill Lotko** suggested that ion outflow controls the appearance of sawtooth event, by using the LFM model with ion outflow. They first calculate the Poynting flux, using the Strangeway formula to put in localized transverse accelerated ion (oxygen) outflow. They then run a CME event, which showed in the measured data a sawtooh event, puts in ion outflow, and gets sawtooth in simulations. Turning off ion outflow pushes the simula-

tion into an SMC. For second event, which had variable IMF, got sawtooth with or without ion outflow. They need a substorm to start the process, as this generates Alfvenic power, causes ions to flow outward, and leads to sawtooth oscillation. **Lynn Kistler** examined the impact of O^+ on sawtooth events using superposed epoch analysis of oxygen content. She found Oxygen increases before sawtooth events, and did not see similar increase for isolated substorms. During storm main phase no preference for sawtooth vs substorm. Slight preference for sawtooth during recovery and increased ion density. **Grant Stephens** modeled the nightside magnetic field during SMCs using Tsyganenko during SMC. They found in one case, a deep minima in the near Earth region, consistent with previous modeling results of Sergeev. **Gina DiBracchio** presented recent results on magnetospheric convection from Mercury using MESSENGER data. There is some evidence for SMC like behavior in Mercury's magnetotail, enabling comparative studies of modes of response in differing magnetospheres. Finally, **Delores Knipp** examined the effect of the Russell-McPherron effect on neutral density.

Substorm Expansion Onset: The First 10 Minutes Focus Group

Co-Chairs: Vassilis Angelopoulos, Kazuo Shiokawa, Shin Ohtani, and Andrei Runov

Editor's Note: The presentations of this Focus Group are summarized in the "Substorm-Onset Matrix" posted at the Focus Group website at http://aten.igpp.ucla.edu/gemwiki/index.php/FG12._Substorm_Expansion_Onset:_The_First_10_Minutes .

2013 GEM Student Workshop
(Photograph provided by Xia Cai)

MIC Research Area Report

Coordinators: Bill Lotko and Marc Lessard

Scientific Magnetic Mapping and Techniques Focus Group

Coordinators: Robyn Millan, Elizabeth MacDonald, and Eric Donovan

The Scientific Magnetic Mapping and Techniques focus group held three sessions at the recent GEM meeting, including one joint session with the Substorm Expansion Onset focus group.

The first session focused on recent mapping-related results from newer missions, including the Van Allen Probes and BARREL. Several speakers discussed an event that occurred on November 14, 2012. **Toshi Nishimura** used observations of pulsating aurora to map the location of the two Van Allen Probes during this event. **Liz MacDonald** discussed observations from the HOPE instrument which indicate when the Van Allen Probes crossed into the lobe. **Mei-Ching Fok** used the BATSRUS and CRCM models to try to explain the observed lobe crossings. An injection event on February 2, 2013 was also discussed by several speakers. **Alexa Halford** presented an overview of the BARREL balloon campaign and showed observations of precipitation observed near the footpoints of the Van Allen Probes during this deep injection on Feb 2. **Joe Fennel** showed MagEIS observations of the injection for this event. Finally, **Joe Baker** gave a presentation about SuperDARN and measurements at the low altitude footprints of the Van Allen Probes.

The second mapping session included a potpourri of mapping techniques. **Mike Henderson** showed examples of phase space density matching using Van Allen Probe data in order to test magnetic field models. Following that talk, we discussed how this kind of information could be used as input to improve the models. **Yue Chao** discussed a 3D force balance magnetic field model, and Mike Schulz reviewed some of his previous work on source-surface mapping of open closed boundary. **Jone Peter Reistad** presented on global auroral imaging of both auroral ovals as a tracer of true conjugate regions. **Shasha Zhou** also discussed the open-closed boundary and compared coupled models with observations. Finally, **Asher Pembroke** discussed using spherical barycentric coordinates in magnetic field modeling, and **Lutz Rastaetter** led a discussion of CCMC current and future mapping services.

The third magnetic mapping session was joint with the Substorm Expansion Onset focus group. **Matina Gkioulidou** presented RBSPICE observations of the same February 2 deep injection event discussed in our first session. **Eric Donovan** and **Tetsuo Motoba** both discussed identifying conjugacy between the ground and satellites during onset. **Robyn Millan** presented **Phil Erickson**'s slides on comparisons between in situ and ground-based measurements of electric fields during substorms. **Xiangning Chu** discussed magnetic perturbation of the substorm current wedge. The session was concluded with a discussion about future plans.

The plan going forward is for the magnetic mapping focus group to focus on 2 events and have an old-fashioned GEM Challenge. We'll come together at mini-GEM to discuss the first results. The two challenges are:

- "Who's afraid of the OCB (open-closed boundary)?" coordinated by Liz MacDonald, featuring the storm-time lobe crossing events of Nov 14, 2012 as seen by both RBSP spacecraft.
- "More fun than a BARREL of monkeys" coordinated by Robyn Millan, featuring the quiet-time BARREL-RBSP wave and precipitation conjunctions for 2/2/13.

If you'd like to participate, please register here: http://bit.ly/gem_challenge. All of the GEM presentations for the mapping focus

group are also posted on our wiki http://bit.ly/gem_mapping.

The Storm-Time Inner Magnetosphere-Ionosphere Convection (SIMIC) Focus Group

Co-Chairs: Jo Baker, Stan Sazykin, Mike Ruohoniemi, Peter Chi, and Mark Engebretson

The 2013 GEM Summer Workshop saw the initiation of a new Focus Group examining "Storm-Time Inner Magnetosphere-Ionosphere Convection" (SIMIC). The overarching goal of the SIMIC Focus Group is to bring together experimentalists, theorists, and modelers to synthesize a new understanding of coupled magnetosphere-ionosphere dynamics during geomagnetic storms. Two breakout sessions were held late in the week to maximize the likelihood of attracting participants from the CEDAR community. Both sessions focused on reviewing the current state-of-the-art in: (1) self-consistent physics-based modeling of the coupled inner magnetosphere-ionosphere system, and (2) instrumentation suitable for examining storm-time dynamics over large spatial scales and validating simulation results. Twenty speakers gave talks that collectively touched on the following three broad topic areas:

1. Capabilities to monitor storm-time magnetosphere-ionosphere dynamics provided by recent spacecraft missions, such as, Van Allen Probes [**J. Baker**, **M. Gkioulidou**, **J. Zhang**], Cluster [**S. Ohtani**], AMPERE [**H. Korth**] and C/NOFs [**G. Le**]; as well as ground-based instrumentation, like mid-latitude SuperDARN radars [**J. Baker**, **S. Zou**], ground magnetometers [**J. Rigler**, **P. Chi**], ISRs [**G. Lu**, **S. Zou**] and GPS-TEC measurements [**S. Zou**]. Specific features of interest included plasmaspheric density depletions, the sub-Auroral Polarization Stream (SAPS), ring current dynamics, and plumes of Storm Enhanced Density (SED).
2. Recent improvements in physics-based models and how they can be used to analyze important physical processes and features during storms, such as, subauroral ionospheric convection [**S. Sazykin**]; time evolution of magnetospheric current systems [**M. Liemohn**]; inner magnetosphere shielding and inflation [**J. Raeder**]; the role of inductive electric fields [**V. Jordanova, S. Ohtani**]; and electric fields versus the neutral wind dynamo during SAPS [**N. Maruyama**] and penetration electric field events [**G. Lu**]. Specific models discussed included RCM, RAM, HEIDI, CIMI, CTIP, BATS-R-Us, OpenGGCM, and TIME-GCM.
3. Controlled numerical experiments and/or model-data comparisons to better understand important processes, such as, the accuracy of an updated electron precipitation loss model [**C. Lemon**]; identifying which factors control the ring current injection rate [**J. Yang**]; using self-consistent versus empirical electric fields [**M.-C. Fok, V. Jordanova, M. Liemohn**]; different specification of outer boundary conditions [**M. Liemohn**]; how best to reproduce "trunk" structures in dynamic ion spectra [**J. Zhang**]; or examining how inner magnetosphere ion composition affects storm dynamics [**R. Ilie**].

In addition, a short presentation drew attention to synergies with the new SPeCIMEN (Specification and Prediction of the Coupled Inner Magnetospheric Environment) program which was recently approved by the Scientific Committee on Solar Terrestrial Physics (SCOSTEP) for a five-year term (2014-2018) [**J. Bortnik**].

Open discussions during the two breakout sessions centered on articulating an appropriate scope and emphasis for the Focus Group as it moves forward. There was general agreement that a challenge of some sort should be formulated as soon as possible in order to focus the research efforts of modelers and data providers on a few recent event periods of common interest. This idea will be further elaborated upon at the 2013 AGU Mini-GEM.

GGCM Research Area Report

Coordinators: Slava Merkin and Frank Toffoletto

Mertrics and Validation Focus Group

Co-Chairs: Tim Guild, Lutz Rastaetter, and Howard Singer

The GGCM Metrics and Validation Focus Group held three well-attended sessions at this past GEM workshop in Snowmass, CO, on Thursday and Friday, June 20-21, 2013. The sessions represented a wide range of community contributions on all aspects of model/data comparisons, understanding model/data discrepancies, and new validation studies and metrics. The sessions included varied presentations from 18 attendees, representing 13 institutions and 3 countries. The detailed agenda was posted to the GEM wiki in advance (http://aten.igpp.ucla.edu/gemwiki/index.php/FG:_Metrics_and_Validation).

The first Metrics and Validation (M&V) session was entitled "New Validation Results and Methods." It solicited short presentations focusing on all aspects of data-model comparisons. We welcomed themes which included geospace model validation using regional ground magnetometer indices, model responses to dynamic magnetopause boundaries, long-term "climatological" model validation, using multi-variate metrics to assess model performance, or any related contribution. This session included contributions from 9 research teams (**F. Toffoletto, L. Rastaetter and H. Singer, A. Glocer, V. Veibell and R. Weigel, G. Facsko, R. Katus and M. Liemohn, H. Korth, J. Rigler, and A. Pembroke**) discussing the state-of-the-art validation results from MHD/Ring current coupled models, calculation and comparison of ground magnetic perturbations from global simulations, data/model comparisons from climatological-scale simulations (months-to-years), and multi-variate techniques for global validation studies. We also had a presentation offering a new, unique dataset of precipitating particle properties, ready for use in validation of global MHD models. The session was so well subscribed that presentations from this session overflowed into the follow-on sessions, in order to enable adequate discussion time and participation from the audience.

The second session sponsored by the M&V focus group was titled "How Validation Studies Guide Model Improvements." This solicitation gets at the heart of the M&V focus group, attempting to understand data/model differences from validation studies to improve the underlying physics of geospace models, and thus enabling a more complete GGCM with improved prediction efficiencies. In this session we had contributions from **H. Singer, D. Welling, M. Chen, A. Samsonov, S. Merkin**, and **L. Rastaetter**. The session was initiated with a presentation on the lessons learned from solar wind research regarding the merits of ensemble forecasting that can provide confidence bounds and uncertainties on model solutions. We also heard about model performance related to the GEM Dst Challenge and the GEM Magnetopause Challenge, the influence of polar wind on *Dst*, and the need for a multi-fluid approach in MHD models where each fluid has separate densities, velocities and temperatures. The role of uncertainties in model results that can be attributed to boundary conditions rather than missing physical processes was discussed, as well as vortices in the inner magnetosphere and the influence of inner magnetosphere boundaries on the creation of these structures. We discussed new opportunities for data-model comparisons, including results from comparisons between MHD models and the Active

Magnetosphere and Polar Electrodynamics Response Experiment (AMPERE) observations.

The last session organized by the M&V focus group was titled "Validation of MHD models coupled with other modules such as the Ring Current and Polar Outflow." It solicited recent advances in the development of coupled models of the magnetosphere, inner magnetosphere, the plasmasphere/polar wind, and the ionosphere/thermosphere. In this session modelers presented recent advances in coupled models: **J. Raeder** (OpenGGCM-RCM), **M. Wiltberger** (multi-fluid LFM) and **B. Zhang** (LFM, studying polar outflow and polar cap position). Wrapping up the M&V sessions, we began a discussion on studying the magnetopause position in a future metrics and validation study. The role of statistical models in lieu of actual observations during an event (which are sparse) was debated. More discussion is planned for the mini-GEM in San Francisco in December.

One recurrent theme within the three sessions of the M&V focus group this year was the organized, validation of GGCM component models subject to uncertain initial and boundary conditions. A technique to quantitatively understand model behavior subject to these conditions, ensemble modeling, was recently borrowed from the tropospheric weather modeling community for quiet time solar/heliospheric modeling [*Riley et al.*, 2013, doi:10.1002/jgra.50156]. Many presentations at this year's GEM workshop echoed this theme in one way or another. After discussion in the focus group sessions, it was decided that ensemble modeling was a worthwhile method for the focus group to investigate, and could potentially illuminate model shortcomings in a more rigorous and less biased way than is currently done. We plan to continue this theme in upcoming workshops.

Ionospheric Source of Magnetospheric Plasma — Measurement, Modeling and Merging Focus Group

Co-Chairs: Rick Chappell, Bob Schunk, and Dan Welling

The focus group held four sessions at the GEM 2013 meeting in Snowmass Colorado in June. There were 30-40 participants in each of the sessions which included a session on current mysteries in measuring and modeling the effects of ion outflow, a session on modeling the magnetosphere with and without ion outflow, a general session on measurements, modeling and merged modeling and a planning session. The talks that were given are listed in the appendix below.

There was an excellent interaction between the participants in all of the sessions which led to a developing interest in collaborative research activities that address the focus group goals. In particular, discussions in the planning session led to the creation of an initial schedule of cooperative modeling and measuring over the upcoming year. This schedule reflects the thoughts of those who were participating, and we are anxious for the collaborative modeling and comparisons with measurements to include the involvement of all groups that would like to be part of this effort. Modelers who were present included **Bob Schunk** (USU/PIC), **Bill Lotko** (UNH/LFM), **Mike Wiltberger** (NCAR/LFM), **Alex Glocer** (GSFC/BATS-PWOM), **Dan Welling** (UM/BATS), and **Vahe Peroomian** (UCLA/LSK). There were a variety of measurers present representing spacecraft missions such as Cluster, Polar, Akebono, Fast as well as ground-based observers.

Our goal is to work toward merged ionosphere outflow and magnetosphere plasma models which can be tested against actual data for an idealized storm period initially

and then followed by a couple of specifically chosen storm timeframes in which spacecraft and ground-based data can be brought together for comparison with modeling results. We are actively soliciting your participation in these modeling/measurement comparison activities. Please take a look at the schedule below and contact us regarding how you would like to participate.

GEM Update on Merged Modeling & Measurement Activities: 2013-2014

November 14, 2013

The following is an update to the schedule for the merged modeling and measurement activities of the GEM Ionospheric Source of Magnetospheric Plasma Focus Group. It reflects the completion of several steps and the addition of more detail in the modeling and measurement elements.

- Beginning with results from earlier ion outflow modeling of an idealized storm using the USU/PIC code, Abdallah Barakat/Bob Schunk at Utah State University have developed a regular, latitude-longitude grid of the outflow results at 2.5 RE. The outflow results are provided at a specified time interval before, during and after the idealized storm. The associated convection, precipitation and conductivity patterns are also provided for the simulation period. These are now available to magnetospheric modelers for input to their codes and can be found at: http://sw08.spaceweather.usu.edu/~eccles/Polar_Wind/index.html. The solar minimum-winter case should be used.
- Dan Welling at the University of Michigan has derived the upstream solar wind drivers for this idealized storm which match the convection patterns derived from BATS with those used for the USU/PIC run. These drivers are available to magnetospheric modelers at: http://www-personal.umich.edu/~dwelling/imf_ideal.dat
- Runs of the magnetospheric models for the idealized storm using ion outflow model results as input will be completed by the end of the calendar year, with possible initial results shown at the mini-GEM meeting at AGU**.** Our Ionospheric Source Focus Group session will be held in the Franciscan II room from 12:00-1:50 on **December 8th**.
- Selection has been made of the first of two specific storm event time periods in the 2000-2005 timeframe where Cluster, Polar, Akebono, FAST, etc satellite and ground based data are available. The first storm event is October 1, 2002 (Sept 27th through October 4th). Measurements for the first storm time period will be compared at the mini-GEM meeting and the second storm period will be selected—**December 8th**
- USU/PIC and other ion outflow modeling of the first storm period will begin in November with preliminary results (perhaps just a few single trajectories) shown at the mini-GEM meeting in **December 8th.**
- Merged modeling results for the **idealized storm** will be presented and discussed at the Yosemite MIC Chapman Conference—**February 10-14, 2014**
- Run of the USU/PIC and other ion outflow models for the first of the two selected storm events will be completed, compared, and available to modelers—**March, 2014**
- Run of magnetospheric models of the first storm event (BATS, LFM, LSK, Ion Trajectory) using the USU/PIC and other ion outflow model results as input will be completed and presented—**GEM meeting, June, 2014**
- Comparison of merged modeling results with each other and with measurements will be carried out—**GEM meeting, June, 2014**
- Completion and comparison of the ion outflow modeling results of the second storm event ion outflow—**GEM meeting, June, 2014**

Appendix
Focus Group Sessions at GEM 2013

Session 4-1: Observational and Modeling Mysteries—June 19, 10:30am, Salon D

- **Bob Schunk**--Neutral Polar Wind Mysteries
- **Rick Chappell**--The Low Energy Invisible Plasma Mystery
- **Bill Lotko**--Issues, Challenges and Advances Required for Outflow and Magnetospheric Modeling
- **Joe Borovsky**--The Plasma Cloak: Where It Comes From, How Often It Occurs, and Its Impact On Dayside Reconnection.
- **Dan Welling**--Outflow Effects on CPCP
- **Naritoshi Kitamura**--The Effect of Photoelectrons on the Polar Wind
- **Vahe Peroomian**--How much outflow? (Short Talk)
- **Elizabeth MacDonald**--Van Allen Probes Outflow Observations (Short talk)

Session 4-2: The Magnetosphere-Ionosphere System With and Without Outflow — June 19, 1:30pm, Salon D

- **Dan Welling**--Outflow versus No Outflow: Difficulties of Excluding Outflow
- **Schunk/Barakat**--Escape of Plasma and Neutral Gas from the Earth's Upper Atmosphere
- **Lynn Kistler**--Relationship Between Sawtooth Events and O+ in the Plasma Sheet
- **Richard Denton, Jonathan Krall, Joe Huba**--SAMI3 Plasmasphere Simulations
- **Alex Glocer**--Superthermal Electrons and MI Coupling in Modeling Ionospheric Outflow
- **Roger Varney**--The Nature of Heat Flows Into the Daylit Polar Cap Ionosphere

Session 4-3: General Contributions in Measurements, Modeling and Merging — June 19, 3:30pm, Salon D

- **Yanhua Liu**--The Thickness of O+ Mediated Reconnecting Current Sheet
- **Dennis Gallagher**--Dynamics Explorer-1 Ion Densities and Temperatures
- **Eric Donovan**--Mechanisms of Energetic Mass Ejection Xplorer (MEMEX) Mission
- **Karimabadi Homayoun**--What Can We Gain By Coupling the Ionospheric Models To 3D Global Hybrid Simulations?
- **Vahe Peroomian**--The Geoeffective Outflow of O+ During Magnetic Storms
- **Thomas Immel**--Stormtime Enhancement of Ionospheric Plasma in the Cusp: Longitudinal Variation
- **Katie Garcia-Sage**--Global Modeling Comparisons With and Without Outflow
- **Vassilis Angelopoulos**

Session 4-4: Focus Group Planning Session—June 20, 10:30am, Salon D

- Suggestions, mini-presentations and discussion are encouraged to guide future focus group activities.

The Magnetic Reconnection in the Magnetosphere Focus Group

Co-Chairs: Paul Cassak, Andrei Runov, and Homa Karimabadi

2013 marked the first year for the focus group (FG) on Magnetic Reconnection in the Magnetosphere. Four sessions were convened, including one joint session with the Transient Phenomena at the Magnetopause and Bow Shock and Their Ground Signatures FG, one joint session with the Substorm Expansion Onset: The First 10 Minutes FG, and two independent sessions. Each session had a number of short contributed presentations to guide discussion, including presentations both on observations and on simulations and theory. Summaries of each session follow, with a discussion of future plans at the end.

Session 1 - Tuesday, June 18, 1:30-3:00pm (Joint Transient Phenomena/Reconnection session)

The broad topics of the joint Transient Phenomena/Reconnection session were (1) the production, evolution, and consequences of flux transfer events (FTEs), (2) plasma transport into the magnetosphere due to Kelvin-Helmholtz instabilities (KHI) and magnetic reconnection, and (3) the effect on reconnection rate and particle acceleration due to strong asymmetries such as those habitually at the polar cusps and transiently from plasmaspheric drainage plumes impacting the magnetopause.

There were two presentations on observational aspects of FTEs. **Karlheinz Trattner** (Lockheed Martin) showed observational evidence for a hemisphere effect for FTEs. **Yaireska Collado-Vega** (GSFC) presented Cluster observations showing FTE motion is strongly dependent on conditions in interplanetary space. Some FTEs move with a sunward component; most of these events had a strong By, which is consistent with predictions from Sibeck and Lin.

There were four presentations broadly on plasma transport through KHI and reconnection. **Binzheng Zhang** (Dartmouth) showed LFM simulations that included a nonzero By. He discussed the entry of electrons into the cusp due to dayside reconnection, and that there are two different populations. There was a discussion on the relative importance of reconnection and KHI. **Takuma Nakamura** (Los Alamos) showed results of 3D particle-in-cell simulations of secondary reconnection occurring during KHI, emphasizing the necessity of 3D. The reconnection can disturb the vortex and generate turbulence, which enhances mixing and transport. **Xuanye Ma** (University of Alaska) discussed the interaction of KHI and reconnection for large magnetic shear. In particular, each effect strongly impacts the other, with KHI limiting the reconnected flux and modifying the dissipation region structure. A guide field decreases the growth of KHI. Finally, **Shiva Kavosi** (University of New Hampshire) showed global magnetohydrodynamic simulations with Open GGCM of the KHI using parameters obtained from observations by THEMIS. She showed that results from Open GGCM simulations and THEMIS observations are consistent. She also showed that the frequency and amplitude of the KH waves depend on the solar wind driving velocity-larger driving velocities generate KH waves with higher frequencies and larger amplitude.

There were two presentations on reconnection affected by asymmetries in the cusp and due to plasmaspheric plumes. **Rick Wilder** (CU-LASP) showed Cluster observations of reconnection at the polar cusp, which is strongly asymmetric and has a significant shear flow. He observed the exhaust is predominantly on the magnetospheric side of the magnetopause, consistent with theoretical predictions of asymmetric reconnection. He also compared the observed outflow speed to theoretical predictions. **Sun-Hee Lee** (University of Alaska) presented observations of cold ions in magnetopause reconnection, which likely come from plasmaspheric plumes. The particles accelerate near the flow boundary, being picked up by the electric field and have a mass dependent energization. These particles are not seen on the magnetosheath side, indicating that they may play a very limited role in the reconnection process.

The results presented in this session are important for the role of reconnection in solar wind-magnetospheric coupling, magnetospheric convection, particle acceleration, and for plasma transport into the magnetosphere.

Session 2 - Wednesday, June 19, 10:30am-12:15pm (Joint Substorm Expansion Onset/Reconnection session)

In the joint session with the Substorm group, **Andrei Runov** (UCLA) began with a discussion of what observers want to know from theorists: Is reconnection in the magnetotail inherently bursty (in reference to flow channels and dipolarization fronts) and what determines the duration of magnetotail reconnection? Why is reconnection mostly duskward ($0 < Y < 8\ R_E$)? What is the relative role of reconnection and interchange? **Joachim Birn** (Space Science Institute) presented work on two related studies. The first addressed reconnection onset and energy conversion in a 2D magnetotail configuration in par-

ticle-in-cell (PIC) and magnetohydrodynamic (MHD) simulations. In each, external forcing produces two distinct current sheets which come together at onset, and the current in the y direction stretches to the earthward boundary and may be important for aurora. Entropy in the MHD sense is conserved well in PIC simulations during the growth phase and pressure is anisotropic in the PIC simulations. The second topic studied energy fluxes in same simulations. MHD over-predicts the energy fluxes and the dominant flux out of the reconnection site is enthalpy.

Reconnection in the distant tail was studied both observationally and numerically. **Stefan Kiehas** (Austrian Academy of Sciences) discussed observations of reconnection signatures near lunar orbit using the ARTEMIS spacecraft. Beams were observed going Earthward, bidirectionally, and tailward, suggestive that reconnection occurs tailward of ARTEMIS while a near Earth X-line also was reconnecting. **Yasong Ge** (University of New Hampshire) showed plasmoids in the distant tail in global simulations. The plasmoids kick the far reconnection site out of the magnetotail.

The structure of magnetotail transients was also addressed. **Jim Drake** (University of Maryland) argued that a pressure anisotropy disallows Petschek slow shocks in kinetic systems such as the magnetotail. Also, a model for the observed dip in *Bz* in dipolarization fronts as caused by the finite size of the front in the cross-tail direction was presented. Numerical tests using 2D PIC were presented, but 3D is necessary. **Misha Sitnov** (Johns Hopkins University) presented new 3D PIC simulations in a magnetotail configuration. These simulations produced flapping, reconnection, interchange, and the lower hybrid drift instability. These results underscore the importance of 3D in magnetotail dynamics. In a second presentation, it was shown that PIC simulations revealed slippage, which gives rise to a quadrupolar Hall field (unlike results from MHD).

Session 3 and 4 - Wednesday, June 19, 1:30-3:00pm and 3:30-5:00pm

The two general reconnection sessions were far-reaching. The first session focused on dayside reconnection, with important physical questions related to its impact on solar wind-magnetospheric coupling and its observational signatures in the runup to the Magnetospheric MultiScale (MMS) mission. **John Dorelli** (NASA-GSFC) discussed global magnetospheric simulations including the Hall effect. It is prohibitive at this time to use realistic parameters for Earth, so the simulation parameters were appropriate to Ganymede. He found that the Hall effect has profound effects on magnetospheric convection, field aligned currents, and magnetopause structure when compared to MHD simulations. He also showed flux ropes near the cusp can have significant effects on dayside reconnection. **Joe Borovsky** (Space Science Institute) called for a better understanding of the local physics of reconnection for potential implementation into solar wind-magnetospheric coupling models. There was an interesting discussion on how to incorporate both local and global effects into such coupling functions. **Colin Komar** (West Virginia University), the CCMC Student Research Contest winner for magnetospheric research, discussed how to locate dayside reconnection sites by finding magnetic separators and determining which, if any, of many existing models explains where reconnection occurs.

Interesting results were reported on how reconnection is changed in the presence of asymmetries that are common on the dayside. **Michael Hesse** (NASA-GSFC) presented results on changes to the dissipation region during reconnection including a surprising increase in the reconnection rate in the presence of a guide field. He also presented initial studies on the dissipation region physics in asymmetric reconnection where the electron pressure gradient is small, which differs from symmetric reconnection. **Kittipat Malakit** (Mahidol University) discussed the presence of a new electric field that only appears in asymmetric reconnection and may be measurable at

the dayside. The electric field is due to finite Larmor radius effects when the dissipation region substructure is smaller than the Larmor radius. **Stefan Eriksson** (CU-LASP) discussed observations of a reconnection event in the solar wind that displayed a tripolar Hall magnetic field structure instead of the standard bipolar structure. This may be the result of having multiple nearby X-lines, and could presumably happen at the dayside. **Brian Walsh** (NASA-GSFC) discussed the effect on dayside reconnection of plasmaspheric drainage plumes, showing slower outflow when plume material is present. These studies are important for understanding observational signatures of reconnection expected to be measured when the MMS satellites are on the dayside.

The overarching theme of the second session was kinetic scale physics, especially at the electron scale (in anticipation of MMS), though a number of other topics were discussed. A very interesting and important discussion arose on the subject of how electrons are heated in reconnection sites. **Tai Phan** (University of California-Berkeley) showed observations that electron heating in magnetopause reconnection events is proportional to the asymmetric outflow speed squared. This could explain why little heating occurs in the solar wind and why a lot of heating appears in the tail. In a collaborative study, **Mike Shay** (University of Delaware) showed simulations are consistent with the observations, with the cause being electrons that are accelerated by magnetic field lines slinging out of the exhaust. An alternate model of electron heating due to pressure anisotropy was presented by **Jan Egedal** (MIT). In this model, electrons are accelerated by a trapping potential. The scaling of the predicted heating is different in these two models, so whether or when either mechanism is dominant remains a topic of future study.

On other topics, **Joachim Birn** (Space Science Institute) discussed magnetotail transients, including a study of how particles get accelerated in dipolarization fronts. Particles do not have to be right at the reconnection site to be accelerated. **Amitava Bhattacharjee** (Princeton) discussed the production of plasmoids during magnetotail reconnection, specifically the distribution of their sizes and their relation to plasmoids in other settings. **Lars Daldorff** (University of Michigan) discussed an effort to couple particle-in-cell (PIC) simulations with global magnetospheric simulations with BATS-R-US. A lively discussion on the challenges of accomplishing this goal ensued. **Gabor Facsko** (Finnish Meteorological Institute) discussed how disturbances in the solar wind can force magnetotail reconnection and can generate plasmoids. Finally, **Yanhua Liu** (University of New Hampshire) discussed how oxygen affects magnetotail reconnection, including the observations of counter streaming heavy ion distributions in PIC simulations and Cluster observations. Oxygen is accelerated by the out of plane electric field.

Future Directions

As can be seen from the breadth of topics discussed in the Reconnection FG sessions in 2013, both fundamental reconnection physics and applications continue to make strong contributions to the GEM community. In the second year of the Magnetic Reconnection in the Magnetosphere focus group coming up in 2014, two topics will be emphasized. One is dayside reconnection and solar wind-magnetospheric coupling. In particular, observational results and quantitative theoretical/numerical assessments of the impact of dayside reconnection on solar wind-magnetospheric coupling are encouraged. The second topic is kinetic signatures of reconnection in the runup to MMS, which is expected to take place not long after the 2014 GEM meeting. Electron scale physics, including heating and particle acceleration will be a topic of great import, as well as furthering knowledge on the observational signatures expect to be seen by MMS.

Workshop Coordinator Report

Bob Clauer

GEM Steering Committee Minutes
Snowmass, Colorado
June 21, 2013

Attending:
David Sibeck, Marc Lessard, Jacob Bortnik, Eric Donovan, Katarina Nykyri, Elizabeth MacDonald, Bill Lotko, Joe Borovsky, Yihua Zheng, Magaret Chen, Slava Merkin, Jaejin Lee, Ian Cohen, Roxanne Katus, Ray Walker, Bob Clauer, Xia Cai, Howard Singer, Chi Wang.

Future Meeting Planning

- Clauer mentioned that GEM 2014 Summer Workshop will be held during June 15-20, 2014 at Portsmouth VA. They have already signed the contract with Renaissance Portsmouth Waterfront Hotel.
- GEM 2015 Summer Workshop will be coordinated with CEDAR. GEM will be held adjacent to CEDAR. Clauer also pointed that 2014 will be the last year for him to coordinate GEM meeting. So NSF will look for new proposals to coordinate GEM. Ray Walker added that the opportunity would be open for more than one proposal. Xia Cai expressed interested in submitting proposals since she had helped Clauer coordinate the meeting since 2012.
- For GEM 2013 Mini-Workshop, Clauer's group also reserved meeting rooms at the Westin San Francisco Market Street. It would be similar to that in year 2012.
- For GEM 2014 Summer Workshop, the deadline for student support applications will be set earlier than typical to decrease airfare thus to support more students.
- Discussion of coordinate with GEM-CEDAR in 2015. The dates and locations of CEDAR 2015 and 2016 have been decided. So the choices of GEM to be hold in the same place are limited. Clauer's group will investigate the possible options. There is also a desire to come back to Snowmass for future GEM Summer Woskshop. For GEM 2016 Summer Workshop, collect proposals from Snowmass, Seattle and Sante Fe. Another option is to choose a place within 3-4 hours driving distance to Seattle, for example, Portland in Oregan. A telecon should be arranged in one month for further discussions.

Discussion of GEM White Paper and communications

- Lotko talked about comments he received.
- Ray emphasized the two purposes of the White Paper. The first is to help us organize ourselves. The second is show that we thought through how we are going to proceed these problems. It does not need to include detailed science plan. The success of GEM is that given a broad science goal and within that view the community develops a series of approach to achieve the goals.
- Discussion followed.
- Research Council, research coordinator, Steering Committee?

Review of the current meeting
From students:

- They still need to get schedule for each session in order to plan attendance. Although some FG put schedule on door this year, they suggest that FG leader putting a slide of potential speakers and the discussion topics in the advertisements after plenary sessions. Post schedule on posterboard indicating who will speak in this session.
- Limit presentations to single talk/single poster per person. Sometimes you see the same person showing the same slides again and again.
- Talks were too short and had little introduction.

General Discussion:

- What is GEM? GEM is becoming too formal feeling like AGU, there is a concern that there were fewer discussions.
- 278 participants this year and seems to be growing.
- Suggestions: One option is to limit the number of FGs.
- A unique feature this year is there were joint sessions between focus groups.
- Limit numbers of slides and stay on topic.
- GEM is for magnetosphere group. RBSP should go to NASA program manager to have their special meeting.
- Simple way to organize session. Use Google accounts (you could input session titles, discussion, abstract submitted as spread sheet).
- Is it possible to see abstract? At present abstracts are not submitted.
- From students: do not know the names of scientists. Conveners of FGs should give discussion topics.
- Concern was raised that all student applicants did not receive support this year.
- Bob Clauer explained how students are chosen for support.
- A lot of requests are received so we have to come up with a way to prioritize. A balance between institutions. Lot of requests from big institutions and a few requests from small institutions. So we do not want money all to go to big institutions and eliminate small institutions. We also encourage first time attendees. Want to support all first year students, try to support second year students, reduce priority for 3rd and 4th students. It is a matter of prioritizing. Higher priority for graduates over undergraduates. We have fully supported some students and partially support until no money left. This year we also have additional cost to support students for GEM-CEDAR joint workshop. 64 fully supported + 21 fully supported GEM-CEDAR. Registration fee waived for 18 students and several young scientists. NSF does not provide money to support the meeting. Snacks, meeting room, break, coffee all come from registration.
- Roxanne: It may be of interest to change the priority given to new students rather than students presenting work. I mean, It is very important for 3rd and 4th year students to present their work but it is harder for them to get funded.
- Clauer: We could change rules to change priority to senior students who are presenting material.
- At present: Students giving tutorials will get funded. Roxanne indicated that they turn down a lot of requests because the spots are limited. If we continue to have meeting at the same place such as Colorado or west coast or Sante Fe, fewer students from east coast, such as Boston, may not come to the meeting due to expensive air ticket. However, students from Boulder could come because of short and cheap travel. This might be an issue when choosing meeting site.
- Request title and abstract from students.
- Poster are judged now so we will request abstracts.
- Request judgment from advisor to obtain support.
- (Send title and abstract of presentations when submitting requests.)
- Criteria: students passing their qualifiers? No. Too late !
- In the email to advisor: ask whether this student is really to come to GEM.
- Could request student application to ask about goals and reasons that student should attend.
- Ray: There is a perception that up till this year every student will get some levels of support. This year it is not possible. It is necessary to change rules. In a newsletter to clearly tell students that not every one will be selected. For those selected, provide necessary information to justify how they will be selected.
- 45 students posters this year

New members were elected to steering committee. Current list of members listed on GEM Wiki.

Students reports

- Roxanne: Good week; 78 students compared to 74 students last year; 30% total attendee; first day, introduce things on their own, tutorial; Second day, research area group meeting before dinner, recommend postdocs to join, recommended the similar type of meetings for future workshops; enjoy doing the introduction of speakers in the plenary sessions. Chairs showing up at the end of students tutorials are well received and appreciated; Feedbacks of poster evaluation sent to students; Talk time, duration is too short, no good introduction, got lost easily; did not hear questions and answers (repeat questions); students poster judging is a great thing.
- Confusions about logistics. Lack of communications. Hotel / transportation / roommates

We should post names of student poster competition winners on GEM Wiki.

Liaison Reports were presented.

Meeting Concluded.

Student Representative Report

Roxanne Katus

The GEM students had a great week in Snowmass. This year we had 78 students, which made the students nearly 30% of the total attendees. The week began with student day on Sunday. We had an early morning icebreaker. Then several students presented tutorials. There were many great tutorials but the best student tutorial award went to Christine Gabrielse. Student day closed with a visit from the incoming and outgoing chairs of the steering committee, David Sibeck and Eric Donovan. Several students commented that they really enjoyed the informal meet and greet with them and hope that that continues in future years.

On Monday we had a research area based discussion group before the student dinner. The students really appreciated this new gathering. The time allowed people to ask questions and discuss science with their peers. This encouraged students to practice talking about their research and meet people who work in the field during the student dinner.

The students gave a lot of good feedback. They really enjoyed doing the introductions to the plenary. The slots filled up very quickly. They also liked the new poster award. In particular they appreciated getting feedback on their posters. Thank you everyone who took the time to judge the student poster contest. The only complaint that students had was that the talks were very short.

Finally, welcome new student representative Ian Cohen.

NOAA Agency Report: Highlight of Activities

Howard J. Singer, NOAA Space Weather Prediction Center (SWPC)

Howard Singer reported on NOAA topics relevant to the GEM community. Considering the importance of upstream solar wind observations for both space weather operations and the GEM community's science, he provided an update on the Deep Space Climate Observatory (DSCOVR). DSCOVR is being readied for a November 2014 initial launch capability to L1. NASA has transferred the satellite and sensors to NOAA, and with NOAA funding, the satellite and plasma-magnetometer sensors have been refurbished. The USAF will launch DSCOVR on a Space-X Falcon 9, co-manifested with Sunjammer (a NASA solar sail demonstration mission going to L1 and beyond that includes NOAA participation). NOAA continues to examine options for an L1 mission to follow DSCOVR.

The rise to solar maximum is following predictions to be below average intensity. However, unless activity increases significantly, we may have already seen this solar cycle's peak in February 2012 at about 67 (rather than the predicted 90). It is important to keep in mind that, historically, some of the largest geomagnetic storms have occurred during weak solar cycles. In spite of the recent low activity, there is huge growth in new space weather customers. One indicator, NOAA SWPC's subscription service, has grown to near 35,000 subscribers as of June 2013 (10,000 more than last year). In addition, international interactions continue to flourish with over 19 Nations represented at this year's Space Weather Workshop. Also, there is a growing visibility for space weather at the highest levels in the US Government, including agreements with partners in many nations. Furthermore, space weather is now included in the Strategic National Risk Assessment from the Department of Homeland Security. These examples are not only important for NOAA, but demonstrate the importance of the work being carried out by the entire space science community.

SWPC, benefiting from work by the scientific community and many other partners, has transitioned to operations the Wang-Sheeley-Arge Enlil model for predicting the background solar wind and the arrival at Earth of coronal mass ejections (CMEs). Of particular interest to the GEM community, SWPC is working with modelers and the CCMC to evaluate Geospace model (s) for transition into operations. The model (s) selection should be announced this fall.

This year's Space Weather Workshop, carried out in partnership with NASA and NSF, had 233 registered attendees in spite of government travel limitations. Next year's meeting is scheduled for April 8 to 11, 2014 in Boulder. With regard to NOAA satellite data, used by many GEM scientists, the geosynchronous satellites GOES-13 and -15 are operational, with GOES-14 in storage and ready to be called up when needed. The next series of GOES spacecraft, beginning with GOES-R, is scheduled for a 2015 launch. The low-altitude, polar-orbiting POES satellites, NOAA - 15, 16, 18, and 19 are currently operational, along with METOP- A and-B, European satellites with NOAA energetic particle sensors. METOP -C is in development. The follow-on to the POES satellites, NPOESS, is now the Joint Polar Satellite System (JPSS) for NOAA, but these satellites will not carry space environment monitors. Many of the functions for GOES and POES satellites that were carried out in the past by NOAA SWPC have been transferred to NOAA's National Geophysical Data Center where one can obtain satellite data. Janet Green is the point of contact for the POES data that can be found at: https://www.ngdc.noaa.gov/stp/satellite/poes/dataaccess.html. In addition, NOAA is enhancing its support for understanding and resolving satellite anomalies caused by space weather. The NOAA Space Weather Prediction Center provides real time measurements of space radiation intensity and issues alerts,

warnings and watches. And the NOAA National Geophysical Data Center complements this effort by providing additional data, products, and expertise for post-satellite anomaly assessment and improved satellite design.

Space Weather Prediction Center is one of the National Centers for Environmental Prediction within the National Weather Service. In the past year, Dr. Louis Uccellini, former director of NCEP and acting Director of SWPC, was named NOAA's Assistant Administrator for Weather Services and Director of the National Weather Service. Soon after that, he appointed Mr. Brent Gordon, Acting Director SWPC.

CEDAR Liaison Report

Joshua Semeter

The 2013 CEDAR summer workshop was held at the Millennium Hotel, Boulder, CO. The overarching objective of the meeting was to move the community toward the implementation stage of the new CEDAR strategic plan (CEDAR: The New Dimension: http://cedarweb.hao.ucar.edu/wiki/images/1/1e/CEDAR_Plan_June_2011_online.pdf). This document represents a departure from previous strategic plans, in that the focus is on methodology (the system science approach) rather than specific science topics. This approach is strongly synergistic with developments emerging from the GEM community. Initiatives involving distributed sensing, data assimilation, and statistical inference were emphasized in the plenary talks and workshop sessions at the meeting. The meeting also included a highly-successful joint CEDAR-GEM meeting over the weekend between the two workshops.

The 2014 and 2015 CEDAR Workshops will be held University of Washington in Seattle, WA on 22-26 June 2014 and, nominally, 21-26 June 2015.

SHINE Liaison Report

Joseph Borovsky

SHINE has gone through some changes this last year. Ilia Roussev is the new person at NSF overseeing the Solar-Terrestrial and SHINE programs (the Ray Walker equivalent) from Paul Bellaire who retired from NSF. Ben Chandron of University of New Hampshire is the new Steering Committee Chair (the Eric Donovan equivalent) taking over from David Alexander. Noe Lugaz of University of New Hampshire is the new SHINE Coordinator (the Bob Clauer equivalent) putting together the SHINE Conference. Noe took over for Ilia, who moved to NSF. Umbe Cantu still oversees the SHINE Conference Administration.

SHINE held its 2013 conference outside of Atlanta Georgia the week after the GEM Summer Workshop in Snowmass. SHINE does not have long-running focus groups, rather grass-roots-organized session topics at the conference change from year to year. Sessions of interest to the GEM community were on the production of energetic particles by the Sun, on the extreme CME of July 23, 2012, and on the trailing edges of CIRs. Proposals for new sessions are being accepted by Ben Chandron; the due date is January 15, 2014.

The GEM steering committee has reached out to SHINE for interest in a future joint meeting.

ESA Liaison Report

Benoit Lavraud (IRAP, Toulouse, France)
and Vincent Maget (ONERA, Toulouse, France)

This report concerns news regarding space plasma missions in Europe. There are only very few news overall compared to last years. Some are:

1 - Large-size call L1 selection
The Jupiter JUICE mission is planned for launch in 2022. The payload proposal was released and the selection made earlier this year. The particle package selected is PEP (PI: S. Barabash, Kiruna, Sweden). The wave package selected is RPWI (PI: J.-E. Whalund, Uppsala, Sweden).

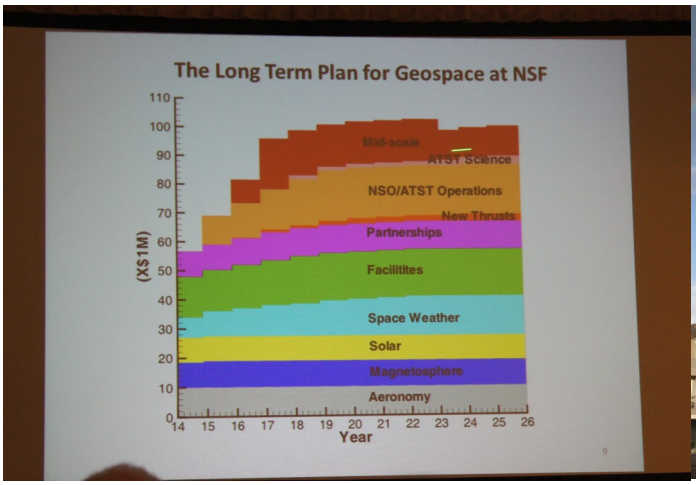
2 - Small-size call S1 proposals
None of the missions of interest to the GEM magnetospheric community (TOR, AXIOM-C, NITRO, SELMA) was selected. This is not surprising given the selected Solar Orbiter and JUICE missions are viewed as "plasma" missions. The selected mission is CHEOPS: an extra-solar planet mission led by Switzerland). Of the GEM-related mission, TOR was very positively evaluated.

3 - KuaFu-B mission
Despite the formation of a science study team by ESA to work on a concept for participation in the Chinese KuaFu mission (with provision of two magnetospheric spacecraft focussed on auroral imaging), this possibility was definitely abandoned at the ESA ministerial meeting earlier this year.

4 - ESA Space Weather Programme
Still ongoing but no significant new things compared to last report.

5 - European Union Space programme
A new "space" call was released this year. Final results are expected soon. Well related to GEM, it should be noted the european project FP7-MAARBLE (Monitoring, Analyzing and Assessing Radiation Belt Loss and Energization) has entered its second year. It focuses on advancing scientific research on radiation belt dynamics and enhancing data exploitation.

Snapshots of 2013 GEM Summer Workshop
(Photographs provided by Xia Cai)



China Liaison Report

Chi Wang

Updates on Space Physics and Space Weather Activities in China

1. Ground-based Observation Project

A ground-based geospace environment monitoring project, namely the Meridian Space Weather Monitoring Project (Meridian Project), was finished construction in Oct., 2012. It consists of 15 observing stations forming two orthogonal lines, one alone the longitude 120°E and the other along the latitude 30°N. This project has radio, optical, geomagnetic (geo-electric) field monitoring instruments, sounding rocket. The project began taking data in 2012 and will remain operational for at least 11 years. Most of the data are available through the Meridian Project website. Registration is required.

We proposed the International Meridian Circle Program (IMCP) on space weather, hopes to connect 120°E and 60°W chains of ground-based monitors worldwide. IMCP will help us grasp the physical nature of the basic space weather processes in near-Earth space that develop alone Meridian circle. This effort has got partial financial supports from the Chinese Academy of Sciences and the Ministry of Science and Technology of China. More activities are expected next year.

2. Space Missions

- *KuaFu Project*: KuaFu consists of 3 satellites, one located at L1 point (KuaFu A) and two at in Earth polar orbits (KuaFu B). It is a cooperative mission with international participations. However, ESA decided not to build KuaFu B satellites. New proposal to put KuaFu in L5 point is currently under discussion.
- *MIT Project*: The Magnetosphere-Ionosphere-Thermosphere (MIT) Coupling Constellation Mission (2 ionospheric satellites and 2 magnetospheric satellite in polar orbits) is designed to study the coupling between magnetosphere, ionosphere and thermosphere. The scientific objective of the mission is to focus on the outflow ions from the ionosphere to the magnetosphere. The mission is currently in Phase A study.

3. Research Funds

Chinese Funding Agencies, such as China National Science Foundation and the Ministry of Science and Technology of China, continue to support space physics and space weather studies, with annual increase of about 20% during past 3 years. However, this trend of increase stops this year.

South Korea Liaison Report

Jaejin Lee, Korea Astronomy and Space Science Institute

Korea Astronomy and Space science Institute (KASI) built a 7-m satellite tracking antenna to receive the space weather data from Van Allen Probes. The KASI has provided the VAP data to JHU/APL since March 2013. The summary plots produced by KASI are found in http://sos.kasi.re.kr/center/monitor_rbsp.php.

The KASI develops space weather monitoring system displaying 3-D magnetic field and energetic electron flux to service the space weather for satellite operators. To predict electron flux on geosynchronous orbit, the VAP data is used as inputs to run VERB code that is originally developed by UCLA.

KMA (Korea Meteorological Administration) and KARI(Korea Aerospace Research Institute) will issue an AO in October for the space weather instruments aboard

Korean meteorological satellite, GK-2A on the geo-synchronous orbit. The space weather instrument would consist of three detectors, energetic electron spectrometer, magnetometer and spacecraft charging monitor.

KAIST(Korea Advanced Institute of Science and Technology) develops space physics instruments, ISSS (Instruments for the Study of Space Storms) for microsatellite, NEXTSat-1 that is planned to be launched into polar orbit in 2016. The ISSS is an instrument suite consisting of five particle detectors, High Energy Particle Detector (HEPD), Medium Energy Particle Detector (MEPD), Langmuir Probe (LP), Retarding Potential Analyzer (RPA) and Ion Drift Meter (IDM). Prof Kyung-Wook Min is the PI of the science payload.

(5) The CINEMA (Cubesat for Ion, Neutral, Electron, Magnetic Fields) mission is planned to be launched in Fall 2013. This mission is developed by cooperation of Kyung Hee University, UC Berkeley and Imperial College London. Two identical CubeSats will carry two science instruments, the Supra Thermal Electron, Ion and Neutral (STEIN) and magnetometer. The PI of CINEMA mission is Prof. Dong-Hun Lee.

Taiwan Liaison Report

Lou Lee

The space science community in Taiwan is establishing a space weather forecast program, a collaborative effort built among Academia Sinica, Central Weather Bureau (CWB), National Space Organization (NSPO), National Central University and National Cheng Kung University. The "Space Weather Research Office" has recently been established at the Institute of Earth Sciences of Academia Sinica. This office will serve as a center for development of space weather models, including prediction model of magnetopause location and ionosphere forecast models assimilating ground-based GPS and FORMOSAT-3/COSMIC observations provided by CWB and NSPO, respectively. The magnetopause prediction model will provide useful information for risk evaluation of geostationary satellites. The ionosphere forecast models include a global assimilative ionospheric model providing global, regional ionospheric total electron content (TEC) maps and three-dimensional ionospheric electron density, and a global scintillation model providing distribution of ionospheric S4 index.

FORMOSAT-3/COSMIC mission plays a marked role in the newly established space weather program and the six-satellite constellation launched un 2006 is currently providing 800-1200 ionospheric electron density profile through radio occultation. The follow-on mission, FORMOSAT-7/COSMIC-2, a collaborative mission among NSPO, NOAA and AFRL, consists of 12 micro-satellites equipped with GNSS radio occultation and additional science payloads. The first six micro-satellites is expected to be launched into circular orbits of 24-degree inclination at 500 km altitude in 2016, followed by the second launch taking the other six satellites into orbits of 72-degree inclination at 800 km altitude. The new constellation mission will provide 8,000 vertical profiles of both neutral atmospheric and ionospheric parameters.

GEM Steering Committee

NSF Program Manager
- Ray Walker

Steering Committee Regular Members (Voting Members)
- Eric Donovan (Chair, 2013-2015)
- Mike Wiltberger (Chair-elect, 2015-2017)
- Jacob Bortnik (2011-2014)
- Margaret Chen (2012-2015)
- Robyn Millan (2013-2016)
- Drew Turner (2013-2016)
- Research Area Coordinators (see below)
- Meeting Organizer (see below)

Steering Committee Liaison Members
- Joe Borovsky (Liaison to SHINE)
- Josh Semeter (Liaison to CEDAR)
- Mona Kessel (Liaison to NASA)
- Howard Singer (Liaison to NOAA)
- Teresa Moretto (Liaison to NSF)
- Masha Kuznetsova (Liaison to CCMC)
- Benoit Lavraud (Liaison to Europe)
- Robert Rankin (Liaison to Canada)
- Xochitl Blanco-Cano (Liaison to Mexico)
- Chi Wang (Liaison to China)
- Hedi Kawano (Liaison to Japan)
- Jaejin Lee (Liaison to Korea)
- Lou Lee (Liaison to Taiwan)
- Brian Fraser (Liaison to Australia)

Meeting Organizer
- Bob Clauer (2007-2014)

Student Represenatives
- Roxanne Katus (2012-2014)
- Ian Cohen (2013-2015)

Research Area Coordinators
- ◊ Dayside, including boundary layers and plasma/energy entry (Dayside)
  - Karl-Heinz Trattner (2009-2015)
  - Katariina Nykyri (2012-2018)
- ◊ Inner magnetosphere and storms (IMS)
  - Anthony Chan (2009-2015)
  - Scot Elkington (2013-2018)
- ◊ Tail, including plasma sheet and sub-storms (Tail)
  - Larry Kepko (2009-2015)
- ◊ Magnetosphere - ionosphere coupling, aurora (MIC)
  - Bill Lotko (2011-2015)
  - Marc Lessard (2012-2018)
- ◊ GGCM
  - Slava Merkin (2009-2015)
  - Frank Toffoletto (2012-2018)

Communications Coordinator
- Peter Chi (2009 - 2014)

GEM on the Internet

GemWiki:
http://aten.igpp.ucla.edu/gemwiki/

GEM Workshop Website:
http://www.cpe.vt.edu/gem/

GEM Messenger (Electronic Newsletter):
To subscribe GEM Messenger, send an e-mail to majordomo@igpp.ucla.edu with “subscribe gem” (without quote) in the body of your message.

List of Focus Groups

Focus Group	Duration	Co-Chairs	Associated Research Areas				
			Day-side	IMS	Tail	MIC	GGCM
The Magnetosheath	2010-2014	S. Petrinec K. Nykyri	•				
Transient Phenomena at the Magnetopause and Bow Shock and Their Ground Signatures	2012-2016	H. Zhang Q.-G. Zong M. Ruohoniemi D. Murr	•				
Plasmasphere-magnetosphere Interactions (PMI)	2008-2013	J. Goldstein M. Spasojevic J. Borovsky		•			
Radiation Belts and Wave Modeling (RBWM)	2010-2014	Y. Shprits S. Elkington J. Bortnik C. Kletzing		•			
Storm-time Inner Magneto-sphere-Ionosphere Convec-tion (SIMIC)	2013-2017	J. Baker M. Ruohoniemi S. Sazykin P. Chi M. Engebreston		•			
Substorm Expansion Onset: The First 10 Minutes	2008-2013	V. Angelopoulos S. Ohtani K. Shiokawa A. Runov			•		
Modes of Magnetospheric Response	2008-2013	R. McPherron L. Kepko			•		
Tail-Inner Magnetosphere Interactions	2012-2016	P. Brandt J. Lyon F. Toffoletto			•		
The Ionospheric Source of Magnetospheric Plasma	2011-2015	R. Schunk R. Chappell D. Welling				•	•
Scientific Magnetic Map-ping & Techniques	2011-2015	E. Donovan E. MacDonald R. Millan				•	
Metrics and Validation	2011-2015	T. Guild L. Rastaetter H. Singer					•
Magnetic Reconnection in the Magnetosphere	2013-2017	P. Cassak A. Runov H. Karimabadi					•

GEM Contact List

Contact	E-mail Address
Vassilis Angelopoulos	vassilis@ucla.edu
Jo Baker	bakerjb@vt.edu
Xochitl Blanco-Cano	xbc@geofisica.unam.mx
Joe Borovsky	jborovsky@lanl.gov
Jacob Bortnik	jbortnik@gmail.com
Pontus Brandt	Pontus.Brandt@jhuapl.edu
Paul Cassak	Paul.Cassak@mail.wvu.edu
Anthony Chan	aachan@rice.edu
Rick Chappell	Rick.Chappell@vanderbilt.edu
Margaret Chen	margaret.w.chen@aero.org
Peter Chi	pchi@igpp.ucla.edu
Bob Clauer	rclauer@vt.edu
Ian Cohen	icohen121@gmail.com
Eric Donovan	edonovan@ucalgary.ca
Scot Elkington	scot.elkington@lasp.colorado.edu
Mark Engebretson	engebret@augsburg.edu
Brian Fraser	brian.fraser@newcastle.edu.au
Jerry Goldstein	jgoldstein@swri.edu
Tim Guild	timothy.guild@aero.org
Homa Karimabadi	homakar@gmail.com
Hedi Kawano	hkawano@geo.kyushu-u.ac.jp
Roxanne Katus	rkatus@umich.edu
Larry Kepko	Larry.Kepko@nasa.gov
Mona Kessel	Ramona.L.Kessel@nasa.gov
Jenni Kissinger	Jenni.Kissinger@nasa.gov
Craig Kletzing	craig-Kletzing@uiowa.edu
Masha Kuznetzova	Maria.M.Kuznetsova@nasa.gov
Benoit Lavraud	Benoit.Lavraud@cesr.fr
Jaejin Lee	jaejinlee@me.com
Lou Lee	louclee@gmail.com
Marc Lessard	marc.lessard@unh.edu
Bill Lotko	william.lotko@dartmouth.edu

Contact	E-mail Address
John Lyon	John.G.Lyon@dartmouth.edu
Liz MacDonald	macdonald@lanl.gov
Bob McPherron	rmcpherron@igpp.ucla.edu
Slava Merkin	Slava.Merkin@jhuapl.edu
Robyn Millan	Robyn.Millan@dartmouth.edu
Therese Moretto	TJorgens@nsf.gov
David Murr	murrdl@augsburg.edu
Heidi Nykyrik	nykyrik@erau.edu
Shin Ohtani	Shin.Ohtani@jhuapl.edu
Steve Petrinec	petrinec@spasci.com
Robert Rankin	rrankin@ualberta.ca
Lutz Rastaetter	lutz.rastaetter@nasa.gov
Andrei Runov	arunov@igpp.ucla.edu
Michael Ruohoniemi	mikeruo@vt.edu
Stan Sazykin	sazykin@rice.edu
Bob Schunk	schunk@aa.usu.edu
Josh Semeter	jls@bu.edu
Kazuo Shiokawa	shiokawa@stelab.nagoya-u.ac.jp
Yuri Shprits	yshprits@atmos.ucla.edu
David Sibeck	david.g.sibeck@nasa.gov
Emma Spanswick	elspansw@ucalgary.ca
Maria Spasojevic	mariaspasojevic@stanford.edu
Howard Singer	howard.singer@noaa.gov
Frank Toffoletto	toffo@rice.edu
Drew Turner	dturner@igpp.ucla.edu
Karl-Heinz Trattner	trattner@mail.spasci.com
Ray Walker	rwalker@nsf.gov
Chi Wang	cw@spaceweather.ac.cn
Dan Welling	dwelling@lanl.gov
Mike Wiltberger	wiltbemj@ucar.edu
Hui Zhang	hzhang@gi.alaska.edu
Q.-G. Zong	qgzong@gmail.com