The GEMstone

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NOTES FROM THE NSF PROGRAM DIRECTOR

GEM is having it's 20th birthday! Well, it's sort of problematical to identify when GEM really began, but the first planning workshop took place at the University of Washington in the summer of 1987. It's sobering to think that the students we will have at this summer's workshop were not even in school when GEM was first getting started. Those early science workshops were tremendously exciting but as the GEM program has grown it has – of necessity – changed. That's both worrisome and exciting. If we don't change we get stale, but are we moving in the right direction? I think we are, but only time will tell.

Helping GEM stay cutting edge and exciting was a primary concern of our outgoing Steering Committee Chair, Bob Strangeway. We heard from many sources that GEM was becoming like the AGU meeting. Now, I don't want to disparage the AGU meetings – they play a very important role in the space physics community - but a sequence of formal presentations with fixed time limits for discussion and no clear connection between one presentation and the next is not what we want of the GEM workshop. Bob articulated those concerns very clearly and he worked tirelessly with the session organizers to keep the workshop environment. As Bob hands over the reins to our new Chair, Jimmy Raeder, I want to take this opportunity to thank him for all the great – and hard – work he's put in to making GEM a success.

And now, of course, I want to welcome the new Chair of the Steering Committee, Jimmy Raeder. GEM is in the process of changing and Jimmy is going to have his hands very full for the next three years. As part of the effort to keep GEM fresh and vital we ended last summer's workshop with a long discussion on how to reorganize. We've covered all the regions of geospace over the nearly 20 years of GEM's existence, and one possibility was to declare GEM a success and close it down. But our primary goal, enunciated in the 1988 GEM Steering Committee report, was to create a "geospace environment GCM" (general circulation model), which we now refer to as the GGCM, and we have not achieved that goal yet. So it's premature to declare victory and go home. An alternative was to try and define a new campaign to replace the outgoing Inner Magnetosphere/Storms campaign and we had a number of excellent suggestions for new

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GEM Homepage URL

http://www-ssc.igpp.ucla.edu/gem/

campaigns. In the end we opted for a more radical change to the structure of GEM by replacing the campaign structure with a selection of Focus Groups. The idea is to have a limited number of Focus Groups, each with a clearly defined and limited set of goals and each with a campaigns. In the end, we opted for a more radical change to the structure of GEM by replacing the campaign structure with a selection clearly limited lifetime. By having a small number of clearly defined goals we hope that each FG will find it easier to maintain the workshop mode of operation that has been so important to GEM's success. By having a continuous turn-over of the Focus Groups, we hope to broaden interest and participation in GEM without growing too large. It's an experiment and maybe it won't work out. But I have high expectations and I hope we will all give this new structure a chance to show what it can do. GEM is facing another major change. Frank Toffoletto, with the very able and enthusiastic help of Umbe Cantu, has been at the helm, organizing the workshops for over six years. He has finally decided it was time to take a (well deserved) rest and let someone else take the reins. We are in a transition year with the organization of the summer workshop being shared between Frank at Rice University and Bob Clauer at Virginia Tech. Luckily for us all, and particularly for the students, Umbe will continue to play a major role in making the arrangements for the venue, student housing and student support. I want to express my gratitude to Frank and Umbe for all that they've done for the GEM program. In yet another change, this summer we will be enjoying a new location, Zermatt, Utah (sorry, not the other Zermatt), and I'm looking forward to seeing what it's like. Perhaps it will become our new home.

So GEM is in a time of change, but I predict that the Geospace Environment Modeling program will continue to be at the cutting edge of research devoted to the magnetosphere and the interactions of the magnetosphere with the solar wind and with the ionosphere. And somewhere, off in the distance is the yet to be realized goal of a robust GGCM.

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Notes from the Chair

Outgoing GEM Steering Committee Chair's Report

I wish to begin my final report to the GEM community as Steering Committee Chair by again thanking Frank Toffoletto and Umbe Cantu for all the incredible hard work they have done throughout the years in making the annual GEM Summer Workshop the highlight of the geophysical year. I also want to welcome incoming Steering Committee Chair Jimmy Raeder, and wish him all the best as he charts a new course for GEM.

On looking back over the last three years there have been both high points and low points. While it had its problems, I thought that the joint CEDAR/GEM workshop last year was very productive, and highlighted some of the features that make GEM unique. That the GEM Summer Workshop tries as much as possible to stay in workshop mode, even as it continues to grow in size, was noted by some of our CEDAR colleagues, and is indeed one of GEM's strengths.

Maintaining the workshop mode of GEM was originally facilitated by the structure of GEM, where campaigns of finite duration organized working groups that in turn organized workshop sessions. The campaigns fulfilled a valuable function of providing cohesion between the working groups. However, one of the drawbacks of the campaigns was quite simply terminating

them. It has also been difficult to devise new campaigns that aren't just old campaigns revisited. One could ask why an old campaign can't be revisited, and indeed if GEM had stayed with its original structure this question was worth addressing. The most recent campaign, the Global Interactions campaign, also demonstrates the difficulty in formulating new campaigns. This campaign was a forced marriage of two proposed campaigns, neither of which, in my opinion, had sufficient support within the community to proceed on its own. Sometimes forced marriages work, but even with the best of intentions and hard work of the campaign coordinators and working group chairs, the campaign struggled to achieve any cohesion. I accept a large portion of the responsibility in choosing the new campaign. In hindsight, the attempt at a compromise was a mistake, and also probably fed some of the desire to move away from the campaign-mode structure of GEM.

The other difficulty over the last few years was terminating the Inner Magnetosphere/Storms (IM/S) campaign. The campaign coordinators did an excellent job in wrapping the campaign up in as timely manner as possible. But this was not done without resistance. Again in the spirit of compromise it was suggested that some of the IM/S working groups may be allowed to continue if a new "sponsor" could be found. This also put pressure on the campaign structure of GEM.

Last, finding a new campaign to replace the IM/S campaign proved to be difficult. Some ideas were solicited for the Summer workshop. But they became moot in light of the new GEM structure, proposed by incoming Steering Committee Chair Jimmy Raeder, whereby campaigns and working groups no longer exist, but instead we have focus groups. Under Jimmy's guidance this idea has been fleshed out so that the focus groups are now assigned to different research areas.

Thus the campaigns have been replaced by research areas, which are in effect standing campaigns, and the working groups have been replaced by focus groups. I do have some concerns with the new structure, but with strong guidance from the steering committee and the research area coordinators these may be obviated. The campaigns, with all their flaws, forced some degree of turnover and at the same time provided cohesion between the working groups. Under the new structure the turnover is at the focus group level. There is the risk that the focus groups will operate entirely independently of each other. The other risk is that the focus groups will not in fact terminate, but instead be reinvented to continue under another guise. I fear that without strong guidance the new GEM structure will result in many independent, non-interacting focus groups, and much of the appeal of GEM may be lost. My purpose in raising this concern is to sensitize the Steering Committee and the research area coordinators to the need to ensure that the focus groups are part of a cohesive program and have finite duration.

In closing, it was an honor to be Steering Committee Chair for the last three years, and I was deeply touched by the thanks the GEM community expressed to me on the last day of the Summer Workshop. I wish you all the best as you continue on under the GEM umbrella.

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A few Notes from the Incoming Chair

For one and a half decades now, GEM has been an extraordinary successful program in the space sciences. Centered around the annual summer workshop, GEM engages scientists and students unlike any other program. Surprisingly, that

success came not from the infusion of large amounts of money but from the grass-roots efforts of many people and GEM's unique structure.
The periodic renewal of scientific foci, by starting new campaigns while closing down old ones, has ensured that new people and fresh ideas kept coming to GEM.

However, lately some cracks started to show in GEM's foundation. Because past campaigns had covered most of magnetosphere's regions, it had become difficult to find themes for new campaigns. Ongoing campaigns appeared to have difficulty staying focused and felt the need to restructure their working groups. And successful campaigns, such as the tail/substorm and the inner magnetosphere/storms campaign, felt that not all of their work had been done and that it would make sense for them to continue their activities, be it outside of GEM if necessary. An overhaul of the GEM structure appeared to be called for.

At the 2006 summer workshop participants and the steering committee discussed the issues and proposed changes that would make working groups, now called Focus Groups, more independent and the basic organizational element of GEM. The Focus groups would be (i) proposed by the community to keep the grass-roots aspect of GEM, (ii) selected and instituted by the steering committee to ensure continuity and cohesion, (iii) time limited to 5 years to ensure periodic renewal like in the past, and (iv) overseen by research area coordinators, who essentially replace the campaign coordinators. Instead of campaigns there would be 4 standing research areas, each with 2 coordinators. Some of the Focus Groups, which should number about 12 at any given time, would be carried over from existing working groups, and 3-4 new ones would be selected to start at the 2007 summer workshop. There would be no changes to the organization of the summer and pre-AGU workshops.

These changes were thoroughly discussed by the steering committee during late summer and fall, written up as a new set of bylaws (http://terra.sr.unh.edu/wiki-gem-org/index.php?n=Main.GEMBylaws), and passed by the steering committee as GEM's new structure. Some final polishing of these bylaws will occur at the pre-AGU steering committee meeting. Kile Baker has just appointed the research area coordinators: Jeff Hughes and David Murr for MIC, Frank Toffoletto and Mike Henderson for the tail, Mike Liemohn and Rainer Friedel for IM/S, and David Sibeck and John Dorelli for the dayside. A call for proposals for new Focus Groups, to be selected by the steering committee went out before the Fall AGU meeting. (http://terra.sr.unh.edu/wiki-gem-org/index.php?n=Main.FGProposals2006).

There are, of course, still challenges ahead: The summer workshop keeps growing in attendance, which makes organizing the meeting more difficult. We continue to plan for joint meetings with our sister organizations, CEDAR and SHINE, which raises the question of how much overlap there should be, between what is essentially two meetings running in parallel. We will continue to struggle to find venues for the summer workshop; while coming back to Snowmass every year has its advantages, there are also good reasons for meeting at other places. The biggest challenge, however, is to keep the GEM summer workshop a true workshop.
There seems to be a trend that too many sessions are run 'AGU style'. Focus group chairs and area coordinators are called upon to ensure that open discussions receive priority over structured talks.

As the incoming steering committee chair I am thankful for the help that I have received to make these changes, and I am looking forward to many more years of a vibrant GEM program.

Jimmy Raeder

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Next GEM Workshop
June 17-22, 2007
Zermatt, UT

The GEM Workshop Website is now open for meeting information, preliminary schedule and registration forms.

http://gem.rice.edu/~gem/gem2007

Note the following Deadlines:

Hotel: May 25 Use the group code GEM when making reservations.

Registration: May 31
(A late fee will be charged for registration after May 31)

GEM can provide support for a limited number of graduate students to attend the workshop. To apply for support, visit the Website for application instructions.

Tutorial Talks

It is traditional to collect the tutorial presentations from the GEM tutorial speakers and make them available on the web. This year is no exception and you may access these presentations (generally in power point or pdf files) at

http://www-ssc.igpp.ucla.edu/gem/tutorial/index.html .

Tutorials from previous years are also available at this site.

2006 WORKING GROUP REPORTS

Magnetosphere Ionosphere Coupling Campaign

No report was prepared by the Magnetosphere-Ionosphere Coupling Campaign this year.

Inner Magnetosphere/Storms Campaign

This was the final year for the Inner Magnetosphere/Storms Campaign at the GEM Workshop. It was a lively and active year, nonetheless, and the IM/S Campaign held 8 breakout sessions and sponsored 2 plenary session tutorials. All of the sessions were held jointly by the three IM/S Working Groups (Plasmasphere and Ring Current, Radiation Belts, and ULF Waves) with no parallel IM/S sessions, allowing everyone to participate in all of the IM/S discussions.

The two plenary session tutorial presentations were Kazue Takahashi of Johns Hopkins University's Applied Physics Laboratory and Mike Liemohn of the University of Michigan. Takahashi gave a review of magnetoseismology, a technique of extracting magnetospheric mass density by analyzing the transit times for ULF pulsations to propagate from the magnetopause to the ground along various paths. Liemohn presented highlights of research results during the IM/S campaign regarding the plasmasphere and ring current. In addition to these two plenary session tutorials, Richard Thorne gave the student-sponsored tutorial on the physical processes governing the radiation belts, in particular focusing on the advancements during the IM/S campaign.

Regarding the IM/S Assessment Challenge, 20 papers were submitted to the special section of the

Journal of Geophysical Research. Online publication of these papers should begin any time now, and the print version of the special section will appear in the November 2006 issue. Please have a read through these papers as they appear online and in print with JGR.

Below are individual summaries for each of the 8 sessions held at the GEM Workshop. A big thanks of gratitude is extended to all of the conveners, who devoted time to the organization, running, and summarizing of their sessions. The IM/s Campaign is now officially over, but the
inner magnetospheric research community hopes to remain an integral and active part of the GEM program, and we hope to continue to have a presence at future GEM Workshops.

Session 1: Inner magnetospheric M-I Coupling (joint with MIC Campaign)
Conveners: Dennis Gallagher and Jeff Hughes

IM/S breakout #1 was a joint session between working group 1 and the Magnetosphere-Ionosphere Campaign (MIC) on the topic of inner magnetosphere coupling. Only a few talks were presented, however there was considerable discussion. A new theoretical treatment of Alfvèn wave propagation was presented by Bob Lysak and Jesse Woodroffe. This represents a new opportunity for using more sophisticated tools to interpret mixed mode coupling of low frequency waves to the ground. Local time dependent plasma sheet injection and the coupling between region 1 and 2 current systems were shown to be unresolved issues by Yihua Zheng, who presented a detailed region 2-ring current modeling discussion, involving strong polar cap potential, ionospheric conductivity, and plasma sheet density dependencies. A connection between energetic precipitating particles and the formation of nitric oxide and its possible influence on lower altitude ozone and atmospheric climatology was discussed by Dan Baker. While this magnetospheric-atmospheric connection is not new, the discussion emphasized the need to pursue this unresolved relationship. Observations from the IMAGE spacecraft instrumentation are still providing new results
in spite of its December 2005 “failure to communicate”. One such new tentative result is the ability to determine two-dimensional thermal plasma flow velocities from the extreme ultraviolet imager (EUV), discussed by Dennis Gallagher. If the analysis technique proves out, it will be possible to determine flows and hence electric fields broadly throughout the inner magnetosphere whenever a series of good EUV observations are available. The assembled group discussed at length whether is s desirable to continue to discuss mid-latitude/inner magnetosphere MI coupling within GEM and if so how to do this. The MIC campaign has not focused on this region because until now it has been covered by the IM/S campaign. Since the IM/S campaign is ending, the group expressed a strong interest in extending the MIC to include inner magnetosphere-ionosphere coupling. No clear preference was given on how to do that, but adding a new working group to MIC and making use of focused discussion groups were both considered viable options.

Session 2: Inner-outer magnetosphere coupling (joint with GI Campaign)
Conveners: Margaret Chen and David Sibeck

The main consensus of this session was that the connection between the inner magnetosphere and the plasma sheet and its sources is very important. There were talks on the relationship between the plasma sheet and ring current (B. Lavraud, M.-C. Fok, V. Jordanova). Plasma sheet characteristics such as density, temperature, and their variation with magnetic local time (MLT) affect the strength and morphology of the ring current. For example, it was shown that a cold dense plasma sheet tends to produce a more intense ring current. There were a few speakers

(G. Reeves, M.-C. Fok, Y. Shprits) who elucidated the relationship between the plasma sheet and the radiation belt. Substorm injections,
MLT-variations of the plasma sheet distribution, and field-line stretching affect radiation-belt dynamics. The relationships between
the solar wind, plasma sheet ions, and the ring current was discussed by C.-P. Wang who summarized his statistical analysis of GEOTAIL data. It was found that high solar wind density leads to higher density in the two flanks and a lower temperature. It is expected that this would lead to an enhancement of the ring current plasma pressure in the post midnight sector. On the other hand, high solar wind speed leads to a higher plasmasheet temperature and lower density. One would expect that this would lead to an enhancement of the ring current in the pre-midnight sector. E. Burin des Roziers talked about the relationships between the solar wind, plasma sheet electrons, and the radiation belt from analysis of Cluster data. He found no correlation between solar wind density and the density of 10's keV plasmasheet electrons. However, he found a positive correlation between solar wind velocity and density of 10's keV plasma sheet electrons. Finally, the role of global fields on the inner magnetospheric dynamics was discussed (P. Toivanen, M.-C. Fok). The ring current tends to more sensitive to the electric field and its variation while the radiation belt tends to be more responsive to the magnetic field and its variation.

Session 3: ULF Wave Index for Inner Magnetospheric Studies
Conveners: Brian Fraser and Ian Mann

Recent studies have highlighted the role of ULF waves in inner magnetosphere dynamics, including the response of the MeV electrons in the outer radiation belt. This session was devoted to discussion of ULF wave studies that are contributing to the development of ULF wave indices that may be used to describe the wave state of the inner magnetosphere and radiation belt environment. Of particular interest in this session were ULF wave studies which provide information about the characteristics of ULF waves with a strong radiation belt esponse. The ultimate aim is to arrive at indices that may be used in statistical or space weather studies, for example, relating to the energisation of electrons to MeV energies by ULF wave processes. Informal presentations of recent results from data analysis or theoretical modeling of the ULF wave-MeV electron interaction, or of prototype ULF indices, were given.

Session 4: Plasmaspheric density from ULF wave observations
Conveners: Mark Moldwin and Dennis Gallagher

The session described highlights of recent results that use ULF resonance techniques and other complementary techniques that have contributed to our understanding of the distribution of heavy ions and mass density in the magnetosphere. Emphasis was placed on combining the ULF resonance estimates of mass density with other independent measurements (TEC, radio sounding, IMAGE EUV, in situ observations) to both validate the technique and extend the observations to provide information on the mass composition of the inner magnetosphere. Reports from new arrays (McMAC and SAMBA) and the effect of including the most recent magnetic field models were also discussed.

Session 5: Radiation Belt Source Processes
Conveners: Richard Thorne and Brian Fraser

This session was devoted to a discussion of the relative contribution of various source processes for the radiation belts, including radial diffusion and local stochastic acceleration. Informal presentations of recent results were presented of

both theoretical modeling and data analysis.

Session 6: Radiation Belt Losses Session
Conveners: Geoff Reeves and Paul O'Brien

Radiation belt losses have been an important topic throughout the IM/S campaign and this session tried to capture and summarize what has been learned through the campaign, what the current cutting edge science questions are, and how research on radiation belt losses might be kept vibrant over the next few years. Lively discussion occurred regarding radiation belt losses in the contexts of sources, acceleration,magnetosphere/ionosphere/atmosphere coupling, wave-particle interactions, measurement techniques, and other related areas. Results were presented from theory, modeling, and observations from satellite, balloon, rocket, and ground-based instruments.

Session 7: IM/S Challenge Results and GGCM Coupling Issues (joint with GGCM)
Conveners: Mike Liemohn and Jimmy Raeder

Results for the two phases (WG1 and WG2 storm selections) of the IM/S Assessment Challenge (IMSAC) were presented in this session by numerous contributors to the JGR special section. Rather than standard presentations of findings, however, the discussion was focused on scientific and numerical issues relating to inner magnetospheric modules within the context of a larger Geospace General Circulation Model (GGCM). Presentations were given on science results that highlight the need for and difficulties of code coupling.

Session 8: Diagnosis and prognosis of the IM/S Campaign
Conveners: Mike Liemohn and the WG chairs

This session was the final official IM/S session of GEM. Discussions were held about where we have been, where we are going, and the near- and long-term future of inner magnetospheric research. A few recap presentations were given, but most of the time was spent discussing how to continue the momentum and cohesion of the IM/S Campaign now that it is ending as a formal campaign within the GEM program. The debate of Focus Groups vs. Campaigns was extensively discussed, and opinions differed among the crowd about how to proceed. Many good ideas for follow-on campaigns or focus groups were mentioned, and hopefully these suggestions will become reality sometime in the near future. The thought of adapting one or more AGU sessions into a GEM-style format was also discussed, and is presently being pursued for the Spring AGU meeting. The concept of our own inner magnetospheric workshop was discussed, but not immediate action items resulted from that idea. It was concluded that we should try to remain within the GEM structure, and either Campaign mode or Focus Group mode will allow us to do that.

Final Note from the IM/S Campaign Chair

I would like to thank all of those who have served as leaders within the IM/S Campaign structure. Specifically, I thank the present working group chairs (Dennis Gallagher, Margaret Chen, Richard Thorne, Reiner Friedel, Mark Moldwin, and Brian Fraser), the past IM/S Campaign chairs (Mary Hudson and Anthony Chan), and the past working group chairs (Geoff Reeves, Janet Kozyra, Jim Horwitz, and Dan Baker). Finally, I would like to thank the National Science Foundation, and in particular the Magnetospheric Physics program director, Kile Baker, for continued support of the GEM program.

Global Interactions

Global Interaction Campaign Report

This year's meeting of the Global Interactions (GI) Campaign in Snowmass, Colorado was divided into 8 sessions:

(1) Inherent and Upstream-Induced Time-Dependent Reconnection at the Magnetopause (Omidi)
(2) Inner-Outer Magnetosphere Coupling (organized jointly with the Inner Magnetosphere Campaign, led by M. Chen, and summarized elsewhere)
(3) Component Versus Antiparallel Reconnection (Berchem)
(4) The Cusp (Trattner)
(5) Heavy Ion Effects on Tail Dynamics and Magnetic Reconnection (joint with the Magnetosphere-Ionosphere Campaign, led by R. Winglee, and summarized elsewhere)
(6) Mechanisms and Efficiencies for Solar Wind Plasma Entry {Lavraud and Otto)
(7) Transport Paths and Time Scales to the Plasma Sheet (Onsager and Wing)
(8) Magnetotail Event Selection and Near-Term Goals (Wing, Lavraud, Onsager, and Otto)

The campaign invited two speakers to give plenary review talks: K. Trattner from Lockheed-Martin and Tom Moore from GSFC. Attendance was generally high and lively discussions persisted throughout all the GI sessions. This document summarizes the presentations and discussions in each session, as well as the invited talks.

1. Time-Dependent Reconnection (Omidi)

(Monday morning)

Omidi began the session by presenting his own talk plus results from T. Phan, J. Drake and J. Huba who could not attend the meeting.

Phan et al. [2004] examined Cluster observations of the magnetopause and boundary layer during steady southward IMF conditions. Even during intervals of steady solar wind parameters, plasma blobs generated on the low latitude magnetopause move poleward to high latitudes. Accelerated flows in the boundary layer exhibit the characteristics expected for steady state reconnection at the magnetopause. Phan et al. suggested that the plasma blobs result from time-dependent reconnection rates.

Omidi showed results from 2.5-D global hybrid simulations during periods of steadily (and purely) southward IMF. FTEs marked by density enhancements and considerable variations in size and speed form on the low latitude dayside magnetopause and move poleward. When they reach the cusp, the density enhancements diminish and the events ultimately disappear. The interaction of FTEs with the cusp involves secondary reconnection and is quite complex. It may be an important means by which solar wind plasma enters the magnetosphere. The reasons for time-dependent reconnection at the simulated magnetopause remain to be established. Using local hybrid simulations, Omidi showed that the interaction of a magnetosonic pulse with a current sheet can initiate reconnection and therefore it is conceivable that some of the time dependency is tied to magnetosheath turbulence.

Drake and colleagues have used full particle 2-D simulations to examine the nature of time-dependent reconnection. They find that when a guide field is not present both the location of the x-line and the reconnection rate remain steady. However, when a guide field is present the location of the original x-line no longer remains steady and secondary magnetic islands form. According to these results, antiparallel reconnection should be steady state, but component reconnection should be time-dependent.

Huba obtained results from the first fully three-dimensional Hall MHD simulation of forced magnetic reconnection. In the absence of a guide field, reconnection extended along the current direction with asymmetric accelerated flows. Although the current layer shows some dynamic behavior, the overall reconnection process seems steady state with no FTE formation.

Gosling discussed observations of magnetic reconnection in the solar wind and its exhaust region. Observations show that reconnection events tend to occur for low solar wind thermal plasma β (typically less than 0.1). Their properties are consistent with some but not all predictions of Petschek's steady state reconnection model. Specifically, the plasma exhaust or jet occurs behind a boundary with properties similar to slow shocks where density and temperature increase and the magnetic field decreases. Examination of ion velocity distribution functions shows that the increase in temperature results from the presence of cold counter-streaming, ion beams. Nor are the electrons heated as they cross the boundary. The absence of dissipation and heating means that event boundaries are not true slow shocks. Observations provide no evidence for plasmoids or time-dependent reconnection.

Russell reviewed the history of reconnection theory and spacecraft observations. He then discussed the motion of FTEs along the magnetopause surface and how multiple spacecraft observations can be used to determine the nature of this motion. Observations indicate that FTEs generally move away from local noon. Russell concluded that neutral points and not current sheets are the key to understanding reconnection. Reconnection enables (but does not guarantee) rapid energy release. Reconnection through topology changes enables momentum coupling between flowing plasma and obstacles. Coupling is not necessarily steady: flux transfer events and bursty bulk flows recur without obvious triggers. Geometry is important in determining event size and occurrence frequency. A large statistical scatter and the strength of By effects suggest that an interpretation in terms of a single subsolar merging line is not correct. The guide field appears to control onset of collisionless reconnection. This controls where reconnection occurs, results in a half-wave rectifier effect and dipole tilt control, and enhances the semi-annual variation of geomagnetic activity.

Fear used Cluster observations to present an analysis of FTE motion during northward IMF. The emphasis was on post-terminator FTEs, which can result from a tilted equatorial x-line or from magnetic reconnection near the cusp. The observations were more consistent with reconnection near the cusp. Observed velocities generally agree with the model of Cooling et al., [2001]. It was also suggested that the locations, polarities and velocities of the observed FTEs are in general agreement with a long, component merging x-line originating from a region of high magnetic shear on the lobe. Although the events could be mapped back to high shear regions, not all the observed velocities were consistent with a near 180^{o} shear.

(Tuesday morning)

Wang used Cluster observations and global MHD simulations to study the dependence of FTEs on geophysical parameters and solar wind conditions. He reported that FTE occurrence may depend upon dipole tilt, that FTE amplitudes may increase with magnetic latitude, that there is solar wind trigger (e.g. north/south fluctuations), and that more events occur for IMF $Bx > 0$. Combining the Kawano and Wang data bases may provide more statistically significant information about FTEs and transient magnetopause reconnection. Without simultaneous observations in the magnetosheath, it is hard to identify the effects (if any) of magnetosheath fluctuations on FTEs.

Raeder used a global MHD model to simulate an event in which both Cluster and DS1 observed FTEs during an interval of strongly dawnward IMF orientation. At Cluster, deep within the magnetosphere, nearly monopolar magnetic field signatures normal to the magnetopause and density pulses were observed. Raeder noted that global MHD simulations do not predict FTE formation unless the resolution suffices to suppress diffusion. The objective of the study was to establish model limits and parameter dependencies and to investigate FTE formation and evolution. The simulation generally predicted the characteristics of the observed FTEs, suggested a subsolar origin, but more detailed analysis of the simulation data and comparisons with spacecraft data is planned for future (in particular speed, size, origin, recurrence times).

Dorelli, used the same global MHD simulation to look at FTE formation. He also stressed the need for sufficient grid resolution in order to see FTEs to form, and noted that there was no dependence of occurrence rates on dipole tilt. His results indicate the formation of poleward-moving FTEs at low latitudes during periods of steady southward IMF orientation. When they encounter the exterior cusps, the FTEs generate pressure enhancements that move along field line into the interior cusp. This suggests that FTE interaction with the cusp is important for solar wind plasma transport into the magnetosphere. During periods of northward IMF orientation, the simulation provided evidence for steady reconnection.

Winglee showed results from global multi-fluid simulations during southward IMF. Concentrating on the dayside magnetopause, he demonstrated the ability of the model to produce current layer thicknesses as low as about ion skin depth. The results show no evidence for time-dependent reconnection or the formation of FTEs, while the accelerated flows are consistent with steady state reconnection. Only a small amount of the plasma entering the dayside LLBL enters via the cusp.

Kuznetsova showed results from the BATS-R-US MHD code during southward IMF. She demonstrated that when the resolution of the simulations is high enough, FTEs form at the low latitude magnetopause and travel to high latitudes. The FTEs are associated with an enhancement in pressure similar to the results shown by Dorelli. Upon encountering the cusp the pressure enhancements travel into the interior cusp. On the flanks, she found tailward-propagating vortices and both strong velocity and magnetic shears.

(Wednesday morning)

Newell examined the ability of 19 solar wind-magnetosphere coupling functions to predict geomagnetic activity (including storms), as measured by 10 characterizations of the magnetosphere (Dst, AE, Kp,…). The two coupling functions that consistently work the best are based on the "intermediate" coupling function described by Wygant, Akasofu and Vasyliunas (E_{WAV}) with the best corresponding to $(E_{WAV})^{2/3}$. Newell concluded that the global merging rate can be approximated reasonably well by vB_T times a function of the IMF clock angle. Also, the dependence of global merging on magnetic shear is intermediate between a half-wave rectifier and the Kan-Lee electric field.

Borovsky discussed the effects of plasma from plasmaspheric drainage plumes reaching the dayside magnetopause. He argued that this plasma could reduce the rate of reconnection at the subsolar magnetopause. The reason for this reduction is due to change in the local Alfven speed caused by the presence of heavier magnetospheric ions. MHD simulations indicate rate reductions up to 50%. The effect can only occur following a southward IMF turning in which the IMF then remains strongly southward.

Birn used local MHD simulations to examine the effects of asymmetries on the reconnection rate. The asymmetry considered was due to the presence of heavier plasma (reduced Alfven speed) on one side of the current layer. This is similar to the effect discussed by Borovsky due the presence of plasmaspheric plumes at the magnetopause. The results of the simulations show a reduction in the reconnection rate. The high speed flows occur on the low density side.

Reiff showed results from Cluster observations of an x-line at the high latitude magnetopause. Using data from the 4 Cluster spacecraft, the inflow and outflow of electrons and ions at the x-line was examined and compared to the currents calculated from the magnetometer data. The x-line seems to be in a steady state, however, some of the flow patterns observed at the x-line seem more complex than a simple inflow-outflow. The y-component was enhanced at the X-line, and the derived current sheet was thicker than that drawn by Birn.

Singh showed results from 3-D, full particle, electromagnetic simulations that examined the stability of a current sheet. The magnetic field geometry corresponded to anti-parallel configuration, i.e. no guide field. No initial perturbations were introduced to generate an x-line. The results of the simulations show that current sheet evolution is associated with the formation of substructures (many islands) in the current sheet profile. Similarly, spiky electric fields with length scales of the order of electron Debye length are generated which were compared to Mozer's observations of electric field by Cluster. The results also show electron acceleration associated with the reconnection process.

3. Component Versus Antiparallel Reconnection (Berchem)

The program for this session resulted from discussions at the mini GEM meeting held just before the last Fall AGU in San Francisco. There a small group of modelers agreed to focus on large-scale properties of 3D dayside reconnection. One of the targeted themes was to revisit the "component versus antiparallel merging" issue, though the participants acknowledged that it might not be the best way to describe the problem. Two sets of comparisons were planned. First, a comparison of code results for idealized inputs for fixed solar wind input (n = 7 cm^{-3}; V = 400 km s^{-1}; B = 5 nT; P = 4 nP) for three generic clock angles (45°, 90° and 135°) and no dipole tilt, leaving the other parameters (e.g., resolution, simulation domain size, resistivity model) free. Second, there would be comparisons of model output with actual events. Proposed events to simulate were a) 03/18/2002 originally discussed by *Phan et al.* for which *Wendel et al.* [PRL, in press, 2005] claim that Cluster passed through the ion diffusion region and skirted the edge of the electron diffusion region; b) 07/25/2001 studied by *Trattner et al*. [2005] who used ion velocity distributions, the T95 model, and a time-of-flight analysis to calculate the location of the reconnection site on the magnetopause and thereby discriminate between component and antiparallel merging.

The session started with two presentations of recent kinetic simulations. Michael Hesse examined whether macroscopic conditions impact microscopic reconnection. He showed that the presence of a guide field (or component merging) slightly favors the formation of islands, however he noted results from Huba indicating that the guide field reduces the reconnection rate because it makes the system less compressible. He also presented recent results from M. Swisdak showing that pressure asymmetries result in diamagnetic drifts on the magnetopause that suppress reconnection. A recent study with Joe Borovsky found that the reconnection rate depends on a hybrid Alfven speed when such asymmetries are present. He also pointed out studies by Horiuchi, which indicate that kinetic

reconnection can be highly time dependent for a wide range of driver profiles. Homa Karimabadi presented some results of kinetic simulations showing the linear and nonlinear evolution of the tearing mode as a function of the guide field. He found that guide field tearing is competitive with anti-parallel merging at the magnetopause. There is a continuum of solutions ranging from component to antiparallel. He showed also some results from a related study (Daughton and Karimabadi, 2005) that indicate that a new regime, which he called the intermediate regime, forms with mode properties that are a mixture between anti-parallel and strong guide field. This regime occurs at relatively small values of guide field (~7%). From these results, he suggested that one should expect to observe reconnection at various guide field strengths at the magnetopause, and that this would generally take the form of component reconnection for most conditions. Homa criticized the concept of a single stable x line, noted that multiple lines eventually become unstable, and remarked that the electron diffusion region is small and doesn't control the overall configuration. He was examining island coalescence and jets perpendicular to the current sheet.

The session continued with presentations of results from global models. Jean Berchem started by showing results from global MHD simulations using idealized inputs. He showed that for a 135° shear angle, the simulation indicated simultaneous antiparallel merging at high latitudes and component merging in the subsolar region. However he pointed out that isosurfaces of non-vanishing parallel electric field indicated that the component reconnection was patchy and limited to a relatively small region of the subsolar magnetopause, and that he could not identify a clear merging line as predicted by simple geometrical constructions.

Dorelli investigated the dependence of dayside magnetopause reconnection topology on the IMF clock angle. He considered two cases: a) clock angle = 45° and b) clock angle 135°. For case a), he found that the reconnection topology was consistent with steady state separator reconnection; for case b) that reconnection was time dependent, with flux ropes forming at the subsolar magnetopause and propagating into the cusps.

Wiltberger et al. used LFM simulations of the magnetosphere to study the reconnection configuration during IMF clock angles of 45, 90, 135, 180. By combining pathline traces with magnetic field lines they were able to track the motion of flux tubes into reconnection sites. While the analysis is still ongoing its clear that the reconfiguration of the magnetic field is significantly more complicated than the classic 2-D pictures of x lines.

Aaron Ridley showed BATS-R-US MHD results for conditions on October 24-25, 2003, when the IMF pointed strongly northward. The model results compared quite well with observations by many different spacecraft, implying that the model had captured the essential physics. The model predicts the times and characteristics of magnetopause crossings well, and the trends but not the magnitude of Dst (pressure variations), but did not predict the degree of stretching that was observed in the magnetotail. Wind missed seeing the magnetotail, perhaps because it was short and torqued or compressed and deflected. There was a strong indication that the reconnection site was poleward from the cusp, with no reconnection occurring in the equatorial region. This indicated that the model favored anti-parallel rather than component reconnection. Because the only resistivity in the model is numerical resistivity, there is a need to examine how results might change for different resistivity models.

Tom Moore explored simulations of steady NBz, EBy, and SBz conditions, examining flow streamlines that would radiate from the

subsolar point in the absence of Maxwell stresses produced by reconnection. Moore concluded that the LFM simulations contain an extended Z or S shaped "X curve" that crosses the subsolar equator (with active component reconnection) and loops up around each cusp (crossing the antiparallel reconnection region), as suggested by himself and coauthors [Moore, Fok, and Chandler, 2002 JGR].

There was not enough time left to present results from the simulations of actual events. The session concluded with a general discussion between the participants. It appeared that a small (but vocal) fraction of the audience was skeptical about determining the three-dimensional configuration of reconnection at the magnetopause using global MHD models and that kinetic models were needed. It was agreed that pursuing kinetic studies was fundamental to understanding the physics of magnetic reconnection at the magnetopause, however it was clear that local simulations are too dependent on boundary conditions to provide reliable macroscopic predictions. To resolve this issue it was proposed that the group should check consistency between global and kinetic, Hall-MHD etc models. The following iterative approach was suggested:

1) Run generic kinetic simulations to determine the response to various parameters (e.g., pressure asymmetry)
2) Run global MHD simulations for a set of different IMF conditions
3) Identify dayside reconnection sites
4) Determine, from global models, MHD parameters in neighborhood of reconnection site(s)
5) Use these conditions as input/initial conditions for Hall-MHD, and kinetic models
6) Compare MHD reconnection with results from Hall-MHD, kinetic models

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Geospace General Circulation Model Science Steering Committee

Report from the GEM GGCMSSC (Geospace General circulation Model Science Steering Committee)

The GEM GGCMSSC continued its efforts to work closely with other campaigns in fulfilling GEM's ultimate goal of a creating global model for Geospace. In addition to our own working groups (WG) we worked closely with the Inner Magnetosphere/Storms (IM/S) and Magnetosphere Ionosphere Coupling (MIC) campaigns.

Under the direction of Dr. David Murr (Dartmouth College) MIC-WG3 held a breakout session to discuss global scale MIC joint with the GGCMSSC. At this session results from the major global scale numerical models for three intervals with modest driving occurring at different seasons with varying levels of EUV ionization where presented. In addition, observations from a variety of sources including SuperDARN, DMSP, Iridium, etc, where discussed. This session laid the foundation for a GEM Challenge for simultaneous simulation and measurement of ionospheric convection pattern, field aligned currents, and conductance in the high latitude polar cap.

Drs. Michael Liemohn (U Mich) and Joachim Raeder (UNH) coordinated a breakout session of the IM/S campaign and GGCMSSC to present the results of the IM/S Assessment Challenge. Instead of focusing mainly on a presentation of the results from these model runs they concentrated on a discussion of how results

from this challenge could be used in the development of modules for the GGCM.

The GGCMSSC has created a Metrics, Verification, and Validation working group under the direction of Dr. Aaron Ridley (U Mich) and Dr. Masha Kunetsova (GSFC) which held its first session at the summer workshop. The main goal of this working group is develop procedures and methods that will help with implementation of GEM challenges identified by other campaigns. At the first session discussion on various metrics and assessment tools currently in use by groups thought the community where presented.

The second GGCMSSC working group deals with Modeling the Magnetosphere on Multiple Scales and is lead by Dr. John Dorelli (UNH) and Dr. Michael Shay (U Del). This group focused its efforts on the global modeling of reconnection and two main topics; 1) Is global MHD up to the task of modeling fast reconnection, and 2) How do the results of the kinetic GEM reconnection challenge scale up to the large scales needed for global modeling. Two possible challenge problems where discussed to address these questions. First a study to investigate the scaling of resistivity models currently used in global models. This investigation must deal with the challenge of assessing resistivity in models that have different numerical sources. A second possible study focuses on the effect of system size on the length of reconnection region in kinetic simulations. The main challenge of this investigation is the problem of implementing open boundary conditions. Initial results from both problems will be presented at the 2007 summer workshop.

At the 2005 summer workshop the GGCMSSC had two plenary presentations. In the first session on Thursday two speakers discussed how to use GEM related Models at the Community Coordinated Modeling Center (CCMC). Dr. Robert Strangeway (UCLA) lead a demonstration on his experiences using the CCMC including how to submit runs on request for a specific event and generation of visualization using the web interface. Dr. George Siscoe (BU) presented a discussion on ways the results from the general purpose model runs available from the CCMC can be used for both research and educational purposes. After these presentations they and the CCMC staff where available to answer questions about the interface and provide assistance to new users. On Friday morning, Dr. Michael Hesse (GSFC) presented a informative discussion on how kinetic processes and MHD models can work together to meet the needs of the GEM community.

Michael Wiltberger, Chair
wiltbemj@ucar.edu

2006 GEM Student Report

No separate student report was filed this year. See item 12 of steering committee minutes.

GEM Steering Committee Minutes

Minutes from the June 2006 Snowmass GEM Steering Committee Meeting

Friday June 30, 4:00 – 6:30 PM

Present

1. Baker, Kile B. <kbaker@nsf.gov>
2. Byers, David <david.bysers@afsor.af.mil>
3. Ergun, Bob <ree@lasp.colorado.edu>
4. Fraser, Brian <Brian.Fraser@newcastle.edu.au>
5. Hesse, Michael <michael.hesse@nasa.gov>
6. Hughes, W. J. <hughes@bu.edu>
7. Jordanova, Vania K. <vania@lanl.gov>

8. Kawano, Hideaki <hkawano@geo.kyushu-u.ac.jp>
9. Liemohn, Mike <liemohn@umich.edu>
10. Moretto Jorgensen, Therese <TJorgens@nsf.gov>
11. Peter, Bill <wpeter@stanford.edu>
12. Raeder, Jimmy <J.Raeder@unh.edu>
13. Russell, Christopher <ctrussel@igpp.ucla.edu> - SHINE
14. Shepherd, Simon < simon@yhayer.dartmouth.edu>
15. Sibeck, David <David.g.Sibeck@nasa.gov>
16. Singer, Howard <Howard.Singer@noaa.gov>
17. Strangeway, Robert <strange@igpp.ucla.edu>
18. Toffoletto, Frank <toffo@rice.edu>
19. Wiltberger, Michael <wiltbemj@hao.ucar.edu>

1.Workshop Postmortem

Some concern was raised about the preponderance of 'AGU-style' talks in the breakout sessions. The consensus was that all session chairs should be encouraged to urge speakers to use a more free-form, 2-3 slide, limited presentation style. Strangeway pointed out that many chairs are more comfortable with a more traditional style format and it may take a couple of years for people who are relatively new to GEM to switch to workshop mode.

Strangeway pointed out that the room used for the poster sessions at Snowmass this year was too small; many people noted that there were larger vacant rooms available and if GEM returns to Snowmass in 2007, every effort should be made to use a larger room for the poster sessions. An alternative suggestion was that posters could be spread over 2 days, but the GEM schedule is already very tight. The student representative, Bill Peter, requested that senior people should make the effort to visit student posters as the students would appreciate the feedback. One possibility would be to have a GEM poster competition, similar to CEDAR; however, by not having a poster competition it makes the student posters a more integral part of the GEM workshop.

The unstructured nature of the 2006 meeting, where each campaign was allowed to meet during any part of the week seemed to be well received. In addition, having extra room available allowed several of the sessions that overran their timeslot to finish.

2. Future meeting plans

Frank Toffoletto outlined plans for future GEM workshops. The 2006 Fall mini-workshop will be held the day before Fall AGU on the afternoon of December 10, 2006. Sine CEDAR will meet in 2007 the week of June 24, GEM will try to meet the week of June 17. The location is to be decided. Toffoletto pointed out that the Snowmass facility is in the process of being sold, and that it is not clear how that would change GEM's relationship with Snowmass. There will apparently be numerous construction projects ongoing in Snowmass in 2007, which may be disruptive. Several locations will be investigated and the final location will be decided by the steering committee.

Frank Toffoletto will step down as GEM workshop coordinator at the end of 2006, Bob Clauer has kindly agreed to take over this position. However during 2007, which is a transition year, Rice University and Umbe Cantu will continue to act as primary coordinator for meeting logistics including hotel organization and student travel. There was some discussion of a possible joint GEM-SHINE meeting in 2008; it would be especially advantageous if Umbe, who is now organizing the SHINE meeting, is still active in GEM organization during that time.

3. NSF

Kile Baker announced that he may be able to provide small grants or supplements to the campaign coordinators to attend the workshop; this would encourage the submission of annual reports and keep a record of the campaigns at NSF. Kile also announced that a request for additional funds from the GEO directorate allowed him to fund one more GEM proposal this year.

4. NOAA

Howard Singer's report started by mentioning that Tom Bogdan is now the SEC director. He described a very successful 2006 Space Weather Week and announced that the 2007 Space Weather Week will be held during the week of April 24-27 and will change its name to Space Weather Workshop. There will be another open meeting, called the Space Weather Enterprise Forum held in Washington D.C. on April 4 and 5. He also described NOAA spacecraft operations, including that GOES 10, currently located at 135 deg west geographic, will be moved out its current operational orbit and relocated east of the US for meteorological services. Perhaps some space environment data will be available from GOES 10. GOES 11 and GOES 12 will be the two main operational satellites. GOES 13 was recently launched with lower energy plasma data available than was ever available before, with energies down to 80 KeV for ions and 30 KeV for electrons. SEC had an opening for a transition scientist programmer; there have been many applications. He also reported that due to large cost overruns, many space environment instruments on NPOESS have been removed; however, the current POES energetic particle instruments are still planned for NPOESS, but with fewer orbit planes covered than available today with POES and DMSP.

5. AFSOR

David Byers of AFSOR announced that there may be an upcoming $1.5 M/year MURI competition. He mentioned that the space science group which used to be part of the Mathematics division is now part of Physics.

6. CCMC

Michael Hesse started by thanking all the CCMC users, collaborators and friends in their assistance in CCMC's successful completion of the senior review process. He expressed his pleasure about the successful CCMC demos at this years GEM meeting, spearheaded by George Siscoe and hoped that students were particularly interested. The CCMC has just obtained approval to add 2 more positions in FY08. One of the positions will be an ionospheric modeler and the other will be in solar physics. He also announced that the CMIT model will soon be available at CCMC. He noted that the CCMC is supporting the CAWSES program and that they would be very interested in supporting any future GEM focus group activity.

7. CEDAR

Simon Shepherd described the plans and status of the CEDAR community. In 2008 CEDAR plans to have their meeting in a close location to Boulder or Park City Utah, and plans to return to Santa Fe in 2009. He mentioned that there is a new conference center being built in Santa Fe that should be completed in 2009. In 2010, there is an interest in a joint meeting with GEM, location TBD. If a joint meeting is to be held, having the meeting at the same facility would be desirable; the Santa Fe conference center may be a good choice. He expressed the desire for any future GEM meeting locations to try to be as close to the location of the CEDAR meeting as possible. He also reported that Jeff Thayer is the new chair of the CEDAR steering committee. Shepherd briefly described the activities of the 2006 CEDAR meeting. The upcoming AMISR program was a big focus and the student tutorials focused on incoherent scatter radar. Other topics discussed at the meeting included the ground support for the upcoming THEMIS mission, SAPS, and the Cedar Frontier Session where the next campaigns are decided. Discussions included: Magnetosphere-Ionosphere-Thermosphere

Coupling, Validation/Assimilation, Global Views and Systems.

He also mentioned that the GEM input for the DASI Campaign is desired, specifically the question of which science topics should be addressed with DASI. Jeff Hughes proposed that Mark Moldwin be asked to be the GEM representative to DASI. Kile Baker pointed out that at some point someone has to put together a Major Research Equipment and Facilities Construction (MREFC) proposal, which is a major source of funding for large construction proposals, an example of which is the Advanced Technology Solar Telescope (ATST) that costs around $130M. This ATST is still several years off but is working its way to the top of the queue. He noted that a good example of a distribution of instruments that the science board has approved is the Earthscope project that consists of a dense array of geophysical instruments. This system could be the model for our community's approach to DASI. We should be working toward getting the definition phase as soon as possible, phase A studies could be done at the earliest around 2009.

7. SHINE
Chris Russell brought up the possibility of a joint GEM-SHINE meeting in 2008, while there is not a lot of enthusiasm amongst some members of the SHINE community for regular joint meetings with GEM, a meeting every 5 years would be viable.

8. Campaign reports – Coordinators
Global interactions (GI) – Dave Sibeck described his overall impression of the GI campaign activities at this years workshop, by noting that the meeting ran better than last year. There were several reasons for the improvement; including more preparation and more focused discussions. There was a lot of interest in discussions on the magnetopause. As far as future activities, the foreshock will be looked at again, and work on the magnetopause will continue. He noted that the Cusp sessions seemed to consist of people who were just talking at each other, and that there may be a need to broaden the group. It has been tentatively decided to broaden the discussion on the cusp. In the magnetotail, the sessions seemed to go well and had good attendance. It was noted that there is a need to identify more people to the campaign coordinator to assist David and that GEM should be actively pushing the meeting to workshop mode, perhaps by more active mentoring of people new to the GEM way. In addition, David pointed out his concern that the ground-based community has ceased to participate in GEM, which in contrast to the early days of GEM, and that steps should be taken to correct this. He pointed out that many of the topics covered by the GI campaign are directly relevant to ground observations and every effort should be made to make this community welcome. One suggestion would be to invite a THEMIS group to the GEM mini-workshop. Kile Baker also pointed out that GEM should also be working more closely with getting the Sondestrom community more actively involved.

Magnetosphere Ionosphere Coupling (MIC) – Jeff Hughes reported that the mass coupling working group has worked itself out and if the decision is made to move forward without a campaign that it would make sense to replace it with an inner magnetosphere lower latitude working group. A final report from that working group is in process. Because of the broad scope of Mervyn Freeman's campaign on complexity, he suggested that it should be pulled out from the MIC campaign and given a new home.

Inner Magnetosphere/Storms (IM/S) – Mike Liemohn reported that the campaign has ended but some aspects of the campaign may be revisited under the proposed new GEM structure.

General Geospace Circulation Model Science Steering Committee (GGCMSSC) – Michael Wiltberger reported that that metrics/validation

working group is moving forward. Aaron Ridley and Masha Kunetsova are in charge of this. He pointed out that in this working group there is a lot of concern and reticence about the activities of the working group and that small steps are the only way to make progress. GGCM is working with the other campaigns such as the MIC campaign. There are some issues that should to be addressed regarding the membership of GGCM. He also pointed out there is also a working group on modeling and novel techniques headed by John Dorelli and Michael Shay. Jimmy Raeder also mentioned that there is a GGCM Wiki which is a document that specifies what are the requirements for models for GGCM.

11. International reports

Japan - Hideaki Kawano (JAXA/ISAS) reported that, with the exception of the Japanese high-energy particle instrument on board GEOTAIL and the electric field instrument on board Akebono, both GEOTAIL and Akebono are still healthy. As a result of the senior review of the Sun-Solar System Connection proposals last year, the Deep Space Network will keep tracking GEOTAIL until 2008.

He emphasized that importance of the collaboration between THEMIS and GEOTAIL as important. For example, there will be cases in which GEOTAIL will cross the tail axis when the THEMIS satellites will be aligned along the tail axis. There will also be cases in which GEOTAIL will observe different regions such as the LLBL when the THEMIS satellites will be aligned along the tail axis. There will also be cases in which GEOTAIL can be used as a solar wind monitor much closer to the Earth than ACE.

He noted that the GEOTAIL data is open to public at a webpage called DARTS (at http://www.darts.isas.ac.jp/spdb/). The data includes: 3-second magnetic field data, 3-second electric field data, 12-second plasma moment data, all until the end of 2005. 16Hz magnetic field data (up until the end of 2005), and spacecraft potential data (up until the end of 2004), are also available through an FTP server (at ftp://ftp.darts.isas.jaxa.jp/pub/geotail/).

As the launch of THEMIS approaches, they are now finishing constructing a system to make quick-look data of GEOTAIL open to the public. He cautioned everyone that the quick-look data, which is data released less than two weeks after the data is received, cannot be used for papers. Any use GEOTAIL data that does not exist in DARTS in your paper can be obtained by contacting Prof. Nagai for the magnetic field, Prof. Hayakawa for the electric field, and Prof. Mukai for the plasma moment data. He asked that ISAS should be informed if anyone plans to use GEOTAIL data in a paper. The DARTS webpage shows to contact information.

He finished by noting that before the next senior review in August 2008, it is desirable that many papers be published with THEMIS-GEOTAIL collaborations, and use of GEOTAIL data would appreciated.

Australia - Brian Fraser mentioned that Australia operates the 2 TIGER SuperDARN radar systems, and that the newest station in New Zealand has been operating for about a year and the data from it is now coming online. He also noted that FEDSAT satellite is still operating successfully. However the Cooperative Research Centre for Satellite Systems that operated the satellite closed down in December 2005 after 7 years and the Australian Defense Department has taken over running the ground station in Adelaide. There is currently no funding for data analysis on FEDSAT. He described the resurgence of interest from the community, industry and government in trying to get a space program in Australia going. There has been discussion over the years that Australia would have a launch site but this has not eventuated. Within the Space physics community, a decadal plan is in process through a committee

led by Iver Cairns through the Australian Academy of Science. The plan is to get government interest in microsats, picostats and ground stations with the hope of creating a center of excellence in the next 5 years.

He mentioned the possibility of a Western pacific meeting in Cairns in June-August of 2008, it will be decided by the AGU after the 2006 meeting. Strangeway asked the question of the future of the COSPAR, Western Pacific and the Asia Oceania Geosciences Society's (AOGS) meetings. Fraser mentioned that Melbourne has put in a bid for the IUGG 2011 meeting.

12. Student report
Bill Peter from Stanford University reported on the activities of the GEM students for the 2006 meeting. He commented that the tutorials went well this year, with over 80 students supported this year which is a major increase from previous years. He suggested that the number of students may continue to increase. He noted that the room used for the tutorials this year was too small but the tutorials were well received. It was suggested that the tutorials be placed on the GEM website at UCLA, both in powerpoint and pdf format. Embedded movies continue to be a problem.

The new Student representative for 2008 is Dan Welling who is a 4th year student from the University of Michigan. He suggested that there be 2 student coordinators with a 2 year term, with a staggered turnover so that the new student-representative-elect could be trained. A GEM student webpage would also be useful. This year the students were used as session chairmen which was well received. Mike Wiltberger suggested that the students introduce themselves at the beginning of the session.

13. GEM communications
Chris Russell reminded everyone on the role of the communications methods within GEM including maintaining and distributing the GEM newsletter email list, the GEMstone newsletter and acting as a repository for GEM-related material such as the tutorial presentations and working group material. Howard Singer asked for the original GEM document be placed on the web.

14. GEM Organization: Working Groups versus Campaigns
As the new GEM steering committee chair, Jimmy Raeder introduced the idea of replacing the GEM campaigns with focus groups. After an extensive discussion and a vote was taken as to whether GEM should consider reorganization, the vote came out in favor with 7 for, 2 against and 5 abstaining. A vote to include the co-chairs as part of the focus groups came out with 12 in favor, 0 against and 1 abstaining.

Minutes recorded by Frank Toffoletto, October 2006

GEM Fall 2006 Steering Committee minutes

December 10, 2006, 6:00-9:00 PM, San Francisco Marriot Hotel
Present:

Bob Clauer <rclauer@umich.edu>
Brian Fraser <Brian.Fraser@newcastle.edu.au>
Christopher Russell <ctrussel@igpp.ucla.edu>
Craig Pollock, J. (HQ-DA000) <craig.j.pollock@nasa.gov>
Dan Weimer <dan-teri-weimer@att.net>
Dan Welling <dantwelling@yahoo.com>
David Sibeck <dsibeck@pop600.gsfc.nasa.gov>
Eric Donovan <eric@phys.ucalgary.ca>
Frank Toffoletto <toffo@rice.edu>

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Vania Jordanova <vania@lanl.gov>

1. Upcoming GEM meeting plans

Umbe Cantu discussed location options for the upcoming 2007 summer workshop. These were: Snowmass, CO., Telluride CO., and Zermatt, UT. Because Snowmass will be under construction in 2007 and the Telluride bid was quite expensive, the committee voted unanimously in favor of Zermatt location. The 2007 meeting will be held June 17-22, 2007.

For the 2008 meeting, CEDAR plans to meet in the second week of June (15-20) in Zermatt, and GEM voted to meet with SHINE in the 3rd week of June (22-27) (8 for, 1 against and 3 abstaining) possibly in Zermatt, but that was not firmly decided. Raeder noted that there was a possibility of a CAWSES meeting at the same time.

2. Discussion on bylaws and fine-tuning

There was an extensive discussion on whether to allow the workshop coordinator voting rights within GEM, the final vote was 9 in favor, 0 against, and 3 abstaining.

The proposal to convert the GGCMSSC to a research area also triggered extensive discussion. The concern expressed my many of the members of the committee was that GGCM should however remain a central focus of GEM and by making it just another research area there was a risk of diluting the original charge of GEM to build a GGCM. In the end, the final vote to convert the GGCMSSC to a research area was 8 for, 3 against and 1 abstaining. Mike Wiltberger will be the senior coordinator for the GGCM focus area. *[Note added in proof: Stanislav Sazykin has been appointed as the second GGCM research area coordinator.]*

The vote to convert the MIC campaign as a research area was unanimous (11 voting) in favor. A statement of work will be needed from the new MIC research groups.

There was also some discussion as to whether junior research area members should have a vote on GEM steering committee issues. The vote was 8 for, 2 against and 0 abstentions.

A motion to declare THEMIS science as important to GEM and to have a session within GEM beginning in 2008 was 14 in favor, 10 against and 0 abstentions. An invitation as part of GEM will be forthcoming.

How long a focus groups lasts will be determined on a case by case basis and will be reviewed. This issue will be revisited in 2007.

3. Open discussion and selection of New GEM Focus Groups - Raeder and Coordinators

Raeder pointed out that there are currently 9 focus groups, allowing room for 2 more groups to be added. After considerable discussion, a ballot vote resulted in the following focus groups being selected to start in 2007.

1. Near-Earth magnetosphere: plasma, fields, and coupling led by S. Zaharia, S. Sazykin and B. Lavraud

2. Space Radiation Climatology led by P. O'Brien and G. Reeves

Other proposed focus groups that were not selected were:

1. Diffuse Auroral Precipitation led by Richard Thorne and Joe Borovsky
2. Magnetotail Dynamics led by R. McPherron, V. Sergeev, T. Lui, M. Fujimoto, and V. Angelopoulos
3. Theory of Coupling Processes in the Inner Magnetosphere led G. Khazanov and N. Singh

It is likely that 1-2 additional focus groups may be added in 2007.

[Note added in proof: After the Steering Committee meeting it became clear that there are fewer than 9 existing focus groups. The SC decided via e-mail discussion and e-mail vote to accept the Thorne/Borovsky proposal as an additional new focus group starting in summer 2007.]

4. Agency and Liaison Reports

NSF

Kile Baker started out by describing the Upper Atmosphere Budget Outlook for FY07. The President's request for NSF (overall) was an increase of 7.8% and the initial house and Senate budget markups are reasonably consistent with the President's request. As a result of this, there were likely 2 possible scenarios.

The first option was a continuing resolution scenario for entire year that would imply a 0% increase. In the 0% increase case there would be $500K available for new GEM proposals, $80K for GEM postdoc and $300K for new Space Weather proposals. No money will be available for additional base program proposals.

The second option would be the maximum increase of 7.8% for NSF with a maximum increase for ATM programs of about 5%. In this scenario there will be $550K available for GEM, $160K for GEM postdoc (but only 1 proposal) and $300K for Space Weather with an additional $200K for the base program. The current situation with base program is that NSF has already received requests for about ~$3M in first year funding and they have already approved: ~$700K in first year funding and have about ~$800K still pending in proposals that have average ratings in the E/V range (8 proposals). This means that the 0% scenario with no additional awards in the base program would yield ~45% success rate while in the 5% scenario there would be 2 additional awards would result in a ~50% success rate.

For the GEM 2006 competition, 23 Proposals were submitted (22 projects) with requested 1st year funding $ 2,204 K. The distribution by campaign was: MIC: 6, GI: 14, GGCM: 2. The final results from GEM 2006 were that 4 proposals were funded (4 projects): M-I Coupling: Robert Lysak, U. Minn., Chris Chaston, UC Berkeley; GI: Jean Berchem, UCLA; GGCM (IMS), Yuri Shprits, UCLA The amount funded was: $ 440 K and the success rate was ~18% (down from 20% last yr).

For the CEDAR, GEM, SHINE Postdocs, 17 proposals were submitted to the CGS postdoc program, broken down as 10 CEDAR, 3 GEM and 4 SHINE The proposals were reviewed by a combined panel, 1 GEM award was for Jacob Bortnik, UCLA and 2 SHINE awards were also given.CEDAR used a separate panel and gave out 2 awards.

For the CEDAR, GEM, SHINE Postdocs for 2007, the deadline is Feb. 6, 2006, Kile expects to fund 1-2 GEM, 2-3 CEDAR, 1-2 SHINE postdocs. Grants.gov should be used and Kile urged everyone to submit their proposal to grants.gov no later than mid-January (~ 1 month

ahead of NSF deadline). He noted that in the previous year, of people who tried to submit a proposal through grants.gov, 58% were successful on the first attempt. However, some proposals were not successfully submitted through grants.gov and NSF allowed these proposals to be submitted through Fastlane.

For the Space Weather 2006 competition, which is a NASA/NSF/AFOSR Partnership for Space Weather Modeling, 18 proposals were submitted and 6 proposals were selected for funding. These are: Comprehensive Magnetosphere-Ionosphere Model, Aaron Ridley (U. Mich., Rice, UC Berkeley, LANL); Jimmy Raeder (U. NH, U. Colorado, NCAR, GSFC)
Corona and Ambient Solar Wind: Jon Linker (SAIC, Stanford, U. Colorado, LM-ATC, NSO, AFRL); Tamas Gombosi (U. Mich., U.C. Berkeley, U. Arizona)
Radiation Model: N. Schwadron (BU, & collabs) L. Strachan (SAO).

For the GEM 2007 competition there were 25 proposals submitted, consisting of 23 independent projects. The breakdown was GI: 15; MIC: 7 and GGCM: 1. The requested 1st year funding was ~$2.2M while the funding available: $520K (+0%) or $570K (+5%). Expected success rate will be ~25% (up from last year).

For the 2007 Space Weather competition, the proposals are due Jan. 16, 2007. Funds available: ~$800K (+0%), Kile noted that perhaps more projects will be funded if ATM gets the 5% increase. In this round, large-scale modeling is de-emphasized, while data analysis and modeling of past events are emphasized. There will be the opportunity for leverage funding by establishing collaborations with Russian scientists, with American funding from NSF and Russian funding from Russian Federation for Basic Research (RFBR). However there is no fixed amount set aside for Russian collaborations. Collaborative proposals will be reviewed along with all the other Space Weather proposals and RFBR will do it's own review of the collaborations.

NASA

Craig Pollock presented the news from the NASA Science Mission Directorate and Heliophysics Division. He started off by requesting help at headquarters for Geospace Science Program division, Phil Richards has left and Craig will be leaving in March 2007.

He lauded the success of the SOLAR-B and STEREO missions, and mentioned of the launch of THEMIS and AIM in 2007 and CNOFS in mid-2008. The next Explorer AO is anticipated sometime in FY 2008, with the announcement possibly in fall 2007. He expects it to be a MIDEX announcement.

For the Radiation Belt Storm Probe (RBSP) selection, there were 6 experiments chosen with 3 missions of opportunity selected for competitive phase A. He reminded everyone that the objective of the RBSP is to understand, ideally to the point of predictability, how populations of relativistic ions and electrons in space are formed or changed in response to inputs of energy from the Sun

He noted that there is a descope activity in progress for Magnetospheric Multiscale Science Mission (MMS). MMS as it is currently envisioned requires more resources than are currently available in the Solar Terrestrial Program, due to both severe cuts to the program and some growth in the budget. The latter is due to recommendations from an independent review team suggested some enhancements to the mission.

Craig mentioned that ROSES 2006 results G/GIP selection announcements were out. In all, 92 proposals were evaluated (46 in each of MAG & ITM) and 26 proposals were selected for funding (all of the Excellents or Excellent/Very Good and

80% of the Very Good). Selections among the Very Good were based on programmatic considerations. The Heliophysics Guest Investigator Program (HP/GIP) criteria include: centrality of the use of data from HP missions and use of data from multiple spacecraft on global system-scale problems; science strategic value and probability of contributions to future NASA missions and the provision of value-added data products to the community. He noted that $2.6M was available for new starts which was a factor of 3.6 over subscription. S&H/GIP selection announcements are either out or are imminent.

He also mentioned that the G/SR&T & G/LCAS competitive range announcements are out with 26 proposals in the competitive range (out of ~90 submitted). It is anticipated that all but 2-3 of these will be funded for 2007. The LWS/TR&T review process is still ongoing.

For the ROSES-2007, Craig expects a flat budget. The solicited Geospace Elements include: Geospace Supporting Research and Technology, Geospace Instrument Development, Geospace Low Cost Access to Space. Related Solicited Elements: Heliophysics Guest Investigator Program, Heliophysics Theory Program (The entire program will be competed this year and will have~ $3.3M available for competition), and LWS TR&T Program.

There is a new program to replace the NASA Earth and Space Science Fellowships, formerly known as Graduate Student Research Program (GSRP). The NASA Office of Education has divested itself of this responsibility. The SMD R&A program officers value this program sufficiently to adopt it, funding through a ~1% tax on R&A funds. There will be announcement in the ROSES 2007. He expects 1-2 Geospace selections.

Craig reported that the Planetary Physics Division will run a New Horizons data analysis competition focused on upcoming excursion down Jupiter's tail. Finally he noted that the Current Roadmap to Science Plan is "In Process".

CCMC

Michael Hesse gave a brief report on CCMC, specifically related to magnetospheric activities. He started off by saying that they have made upgrades to the OPEN-GGCM and BATSRUS. In August 2006 CCMC executed their 1000th run on request. There is now an open Open-DX 3D visualization tool that can also export VRML files. Michael reported that the CISM collaboration is going well, with the magnetosphere-ionosphere model undergoing testing. A real time space weather modeling framework is currently running in a course resolution mode. He commented that he is excited about the GEM focus groups and urged the participants to make use of the resources at CCMC.

NOAA

Howard Singer reported on the status of NOAA. He noted that the new director at SEC Tom Bogdan has a strong commitment to model transition. There are strong collaborations with the CISM program and other members of the community. On the topic of satellite monitoring, the European MetOp satellite which is in a polar orbit has a copy of the NOAA energetic particle instrumentation on board. GOES-13 was launched in May and the magnetometer and energetic particle experiments are working well with (with low energy measurements available for the first time). The spacecraft will be put into storage until a replacement for GOES 11 and 12 is needed. The NRC postdoc competition will be due Feb 1. Space weather week will be renamed Space Weather Workshop and will be held the week of April 24-27, 2007. The space weather enterprise forum will be held April 4-5 in

Washington DC to be held together with other space weather agency partners, the goal is to reach out to policy makers and industry partners. SEC will probably change its name to the Space Weather Prediction Center (SWPC). To prepare for the eventuality that we lose NASA's ACE real-time solar wind data, as that satellite ages, NOAA conducted a survey to evaluate customer need for solar wind data. The response was huge and clearly demonstrated the value that these data have for commercial, government, and educational sectors on a global scale. These results will help us as we work towards achieving the continuation of solar wind monitoring.

SHINE - GEM Liaison Report

Chris Russell described the status of the SHINE community. For the 2007 SHINE Workshop there were 3 possible sites under consideration: Alyeska, Prince Hotel, Alaska; Eagle Crest, Oregon and Zermatt, Utah. The possible dates for the workshop are July 29 – August 4 (favored) and July 22 – 27.

For the 2008 workshop he mentioned the possibility of a joint GEM/SHINE/CEDAR workshop where CEDAR would meet in Week 1 and GEM/SHINE in week 2. Zermatt is a likely location for this meeting possibly in the second half of June. He also noted that Pete Riley's term as chair ends summer 2007 and that the SHINE NSF awards have been selected but not made public.

He described results of a survey, taken to determine the SHINE community's research interests which split as ~52% solar, ~30% heliosphere and ~19% energetic particles. As regards the SHINE workshop: 63% found it extremely worthwhile, 30% very useful, 7% useful and 0% not interesting. He also gave further statistics on the overall meeting evaluation.

CEDAR –GEM Liaison Report

Simon Shepherd reported that Jeff Thayer is now the chair at CEDAR. He also described the recent AMISR science meeting and CEDAR database. The next major science topic will be the DASI initiative and will be discussed at the 2007 meeting, and GEM input is desired.

International Liaisons

Brian Fraser briefly reported on activities in Australia including that there is a Decadal plan in process, and that an Infrastructure grant is being considered of which some will be available for space science. The creation of a Space Weather plan through the ionospheric prediction service is underway. He noted that FedSat and the Tiger radar are both still operational.

Eric Donovan reported on activities in Canada. Orbtials satellite mission is in phase A, with Ian Mann as PI. University of New Brunswick received a $1M grant to install 10 GPS systems in the polar cap. There will be 17 new Riometers in all the CANMOS and the SUPERDARN sites. PolarDARN radar at Rankin Inlet is now running and Inuvik will be operational by November 2007. The ePoP mission is on track for a 2008 launch, and D. Knudesn has an instrument on the Joule-II rocket scheduled for a January 2007 launch. He also has an instrument on the ESA Swarm mission, Norstar which is a former component of Canopus, is headed by Donovan. He also mentioned that the Ravens has been completely absorbed into the Chinese Quafu mission.

5. Mini-workshop Status Reports

GI Campaign

David Sibeck reported briefly on the activities of the GI campaign at the mini-workshop. The GI campaign had 4 sessions: Dayside merging, led by J. Berchem where they are working to

determine the extent of merging on the dayside magnetosphere; Cusp Interactions led by N. Omidi and K. H. Trattner where the emphasis was on reconnection and the spatial and temporal properties of FTEs, including ionospheric and ground signatures; Solar wind plasma entry and global properties of the plasma sheet, led by S. Wing, A. Otto, and J. Johnson; and Plasma sheet transport and influence on the inner magnetosphere" led by: B. Lavraud and T. Onsager.

GGCMSSC

Mike Wiltberger briefly reported on the activities of the GGCMSSC at the mini workshop. The one session they had focused on GGCM modules and methods led by J. Dorelli and Mike Shay.

6. GEM student report

Dan Welling reported on student activities within GEM and possible improvements that could be made. He noted that since the number students over the past 5 years has doubled, a larger room for the student tutorials will be needed. Based on student feedback, he suggested other improvements to the tutorials which include adding more breaks, adding a student webpage. having tutorials sessions focusing more on open questions and adding more modeling talks. In order to foster student interactions, additional social events were also suggested.

7. GEM Communications

Chris Russell also gave a GEM Messenger Status Report. He started out by commenting that the GEM Messenger has published 25 issues this year, compared to the 60 issues published during the same period in 2005. The drop in the number of issues is mainly due to fewer announcement requests and grouping multiple submissions on the same day in one issue.
Announcements for GEM Messenger are distributed soon after they are received, usually within 2 days. The GEM Messenger focuses on the information and activities directly related to GEM, and messages on more general topics, such as job opportunities and announcements for other meetings, are forwarded to SPA Newsletter for publication. Announcement requests should be sent to Peter Chi at pchi@igpp.ucla.edu.

Ground Magnetometer Data Distributed by UCLA. The data of UCLA-made ground-based magnetometers are distributed through the UCLA Ground Magnetometer Data Center and several other web sites of magnetometer projects: The UCLA Ground Magnetometer Data Center web site at: http://www-ssc.igpp.ucla.edu/uclamag/data_center/
Containing data from IGPP/LANL array, SMALL array, CHIMAG and other individual magnetometer stations

Other sites of interest are: MEASURE web site at: http://measure.igpp.ucla.edu/ and the SAMBA web site at: http://samba.atmos.ucla.edu/, as well as the THEMIS ground magnetometer web site: http://www-ssc.igpp.ucla.edu/uclamag/themis_center/
McMAC web site at: http://www-ssc.igpp.ucla.edu/mcmac/ (under development)

Transcribed by Frank Toffoletto, March 21 2007
GEM Workshop Coordinator

For the GEM Messenger send any news items to editor @igpp.ucla.edu

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2006 GEM Structure	
GEM Steering Committee Chair: Bob Strangeway	
Inner Magnetosphere/Storm Campaign:	**Convener:** Mike Liemohn/Dennis Gallagher
Working Groups:	**Plasmasphere and Ring Current** - Dennis Gallagher and Margaret Chen
	Radiation Belts – Reiner Friedel and Richard Thorne
	ULF Waves – Brian Fraser and Mark Moldwin
GGCM Science Steering Committee	**Convener:** Mike Wiltberger
Magnetosphere-Ionosphere Coupling Campaign	**Conveners**: Jeffrey Hughes
Working Groups:	**Mass Exchange** - Bill Peterson and Robert Winglee
	Electrodynamics – Josh Semeter and Bill Lotko
	Global MI Coupling – David Murr and Mervyn Freeman
Global Interactions Campaign	**Conveners:** David Sibeck and Tai Phan
Working Groups:	**RCOL** - Jean Berchem and Nick Omidi
	PATM - Terry Onsager and Antonius Otto

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