be needed to exploit the full potential of HMI and every effort will be made to make such contributions possible.

URL: http://hmi.stanford.edu

SH52A-0495 1330h POSTER

Numerical Simulations of Solar Active Region Magnetoconvection

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Vigorous fluid motions associated with the observed patterns of supergranulation, mesogranulation, and granulation on the sun are likely to play a large role in the continual emergence, evolution, and redistribution of magnetic field within solar active regions. To investigate such non-linear dynamics, we have constructed numerical simulations of fully compressible magnetized fluids, each contained within curved, spherical segments nominally located near the top of the solar convection zone. Overturning motions having length scales comparable to that of solar supergranulation are driven by imposing a solar-like heat flux through the bottom of the domain.

We present recent results of several idealized active region simulations within thin spherical segments, each spanning $60^{\circ} \times 30^{\circ}$ in longitude and latitude and extending up to 0.04 $R_{\odot}$ in radius. We are able to investigate the analogs of both plage and active regions by varying the amount of magnetic flux that permeates the layer. Simplified field-line extrapolations into the volume above the spherical segments are then used to assess how the corona might respond to the structure and evolution of magnetic field emerging through the solar photosphere.

This work was supported by NASA through grant NAG 5-3077 to Stanford University and by Lockheed Martin Independent Research and Development funds.

URL: http://www.lmsal.com/~derosa

SH52A-0496 1330h POSTER

Phase Sensitive Detection for the SORCE Total Irradiance Monitor

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The Total Irradiance Monitor (TIM) on the SOlar Radiation and Climate Experiment (SORCE) will measure the total solar irradiance (TSI). The TIM will report four TSI measurements daily, continuing the current 24-year record of solar irradiance through SORCE's goal 5-year mission life. This instrument was designed to achieve a relative standard uncertainty (1 σ precision) of 100 parts per million (ppm) and a precision and long-term uncertainty of 10 ppm/year.

The major innovation the TIM brings to spaceborne TSI measurements is phase sensitive detection. This new instrument was designed from the ground up with the primary consideration being low-noise performance at the shutter fundamental, minimizing parasitic effects at and in-phase with the instrument's shutter. The DSP-controlled thermal balance and this phase sensitive detection method reduce sensitivity to thermal fluctuations and noise, enabling the instrument's high precision. We describe in detail here the phase sensitive detection algorithm used for the TIM.

URL: http://lasp.colorado.edu/sorce/

SH52A-0497 1330h POSTER

Comparison of Recent Total Irradiance Measurements

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Total solar irradiance has been measured since 1978 from various satellites. Since the absolute accuracy of the current irradiance measurements is about 0.2%, one needs to compile composite irradiance time series to study long-term changes and to establish whether there are any secular variations over the last two and half decades. In this paper we compare the UARS/ACRIM II and SOHO/VIRGO total irradiance data as well as the SOHO/VIRGO and ACRIM III total irradiance. Our main goal is to validate the newly processed ACRIM II total irradiance. Comparison of the SOHO/VIRGO and ACRIM III data will also help to establish whether the high total irradiance values for the maximum of solar cycle 23 represent real solar, rather than, instrumental events.

SH52A-0498 1330h POSTER

Visualizing and Interpreting Very High Resolution Solar Movies

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Benefiting from advances in detector technology, image compression, and data storage capacities, current and upcoming solar instruments, especially the Solar Dynamics Observatory (SDO) due to be launched in 2007, will produce immense amounts of data in the form of movies with individual images in the 2048×2048 (4 Mpixel) to 4096×4096 (16 Mpixel) range. This is beyond the capability of most contemporary computer or video displays but several are now becoming available. In order to develop concepts and software for working with existing and future data sets, we have been working with a 9 Mpixel IBM T221 LCD display driven by an SGI Octane 2 workstation. This is a desktop display with a 22 inch diagonal screen. We will demonstrate our prototype system using several combinations of movies from the Swedish Vacuum Solar Tower (SVST) at La Palma, and the TRACE and SOHO satellites and discuss some approaches for the more challenging SDO data products.

SH52B MCC: 124 Friday 1330h

Particle Populations Upstream of the Earth's Bow Shock: Observations, Theory, and Simulations II *(joint with SM)*

Presiding: **A Posner,** University of Kiel**; H Kucharek,** University of New Hampshire

SH52B-01 1330h

Gyrophase-Restricted 70 keV–1 MeV Ion Beams Near the Foreshock Boundary

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We report on gyrophase-restricted ion beams up to energies of 2 MeV seen by Wind in the Earth's distant foreshock ($\sim$65 $R_{\rm E}$). These distributions are characterized by unexpected properties: they retain phase coherence over many gyroperiods of travel and in the absence of waves with sufficient power to trap them; the observed gyrophases are nearly constant in spite of variations in the estimated shock distance that are several gyroradii in scale; and they often have two peaks $\sim$180° apart in gyrophase. The dispersion observed in particles of differing energies, and good agreement with model calculations suggest that these were likely produced by the shock drift acceleration of a pre-existing energetic seed population. The emergence of two-sided distributions at lower computed θ_{Bn} values is consistent with the remote sensing of a thin ion foreshock layer. In this instance, gaps in gyrophase distributions would indicate incident directions for particles that have their guiding centers situated outside of the foreshock layer.

URL: http://sprg.ssl.berkeley.edu/~wilber/papers/foreshockGRL

SH52B-02 1345h

Polar Upstream of the Bow Shock

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The Cluster and Polar spacecraft have their apogees close in local time and in April 2001 these spacecraft were traversing the pre-noon regions. On 13 April, 2001 Polar's apogee was near 25 deg. magnetic latitude and it traversed the dayside plasma sheet and entered the magnetosheath and even the solar wind near apogee. The Cluster satellites were upstream of the bow shock during the 0400-1200 UT interval of interest. The event occurred during the recovery phase of a magnetic storm. An interplanetary shock was observed at ACE near 0705 UT and reached Earth near 0735 UT on this day. At the initial shock arrival, the solar wind pressure increased by a factor of three and the solar wind speed increased from 590 to 760 km/sec, but Polar stayed inside the plasma sheet. Near 0935 UT the solar wind density and pressure rose by an order of magnitude and Polar passed from the plasma sheet into a magnetosheath like plasma. As the event continued, Polar passed into the solar wind. During this interval the Cluster satellites observed a very intense and hot solar wind population and the interplanetary field turned strongly southward. Polar observed a burst of hot plasma and energetic particles near 1020 and 1040 UT as the field became less southward. Polar reentered the magnetosheath near 1100 UT as the dynamic pressure dropped rapidly and the IMF turned northward. Polar experienced a second short transition into the solar wind near 1245 UT, and returned into a magnetosheath-like plasma for the next few hours. While in the solar wind, Polar observed transitory fluxes of very energetic ions which may be bow-shock associated, leakage from the compressed magnetosphere or possibly hot flow anomalies. We will discuss the combined Polar-Cluster observations during this event with emphasis on the source of the energetic ions observed upstream of the bow shock.

SH52B-03 1400h

Cyclic and Sub-Cyclic Self-Reformation of Quasi-Parallel Shocks in PIC Simulations

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Self reformation of quasi-parallel shocks is analyzed with the help of full particle simulations. Present results fully recover the formation of cyclic self-reformations of the shock front previously evidenced with hybrid simulations by Scholer (1993). In addition, it is shown that, within one main cyclic period, (i) shorter-time subcycles are identified and are characterized by a strong emission of whistler precursor from the ramp, (iii) these precursors are steepened over spatial scale less than one ion inertia length, and (iii) intermittent (short-time life) spiky electrostatic field are emitted within one subcycle. These processes are shown to have a strong impact on the local ion reflection and on the shock self-reformation.

SH52B-04 1415h

High Frequency Waves and Associated Electron Heating in the Foot of Quasi-Perpendicular Collisionless Shocks

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We have studied the dynamics of ions and elelctrons in the foot and ramp of almost perpendicular shocks in the supercritical Mach number regime by particle-in-cell (PIC) simulations.In the past, nonrealistic ion to electron mass ratios have been used in such simulations in order to reduce the computational strain. It is found that when a realistic mass ratio is used oblique whistler waves are generated in the foot region via the interaction of incoming and reflected ions with the solar wind electrons. The linear instability has been investigated by three-fluid analysis and exhibits a growth rate which increases strongly with the mass ratio. Since low beta shocks exhibit a cyclic reformation process this instability has not yet been seen in low mass ratio PIC simulations. We have analyzed the nonlinear development of the instability and the associated parallel and perpendicular electron heating.

SH52B-05 1430h

Simulation of Foreshock Strcutures at the Bow Shock

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A 2-D global hybrid simulation is carried out to study the kinetic structure of the bow shock. In the simulation, the bow shock is formed by the interaction between the supersonic solar wind and the geomagnetic field. The simulation domain contains the dayside plasma regions from the geocentric distance of $r = 5R_E$ to $30R_E$. Strong temperoal electromagnetic wave activities are found in the shock transition and foreshock regions due to reflected ions at the bow shock. Later, spatial structures with alternate temperature increases and decreases develop around quasi-parallel shocks, where reflected ion beams and diffuse ions are present in the foreshock regions. These structures are elongated along field lines, both upstream and downstream of the bow shock, some with a high temperature and low ion density, magnetic field, and flow speed, and others with a low temperature and high density, magnetic field, and flow speed. Those with temperature increases and density, magnetic field, and the flow speed decreases appear like weak hot flow anomalies (HFAs), but without strong flow deflections. While HFAs can be generated by the arrival of external, interplanetary discontinuities at the bow shock, the existence of these foreshock cavities are due to the internal kinetic processes in the bow shock. The structure of the foreshock cavities are investigated and compared with that of HFAs. The ion velocity distributions around the foreshock cavities are examined. The relation between the foreshock structures and the upstream ion beams and associated waves is also discussed. The simulation results will be compared with recent satellite observations of the foreshock.

SH52B-06 1445h

Energetic Ions and Foreshock Cavities

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Kinetic processes within the foreshock greatly perturb solar wind plasma and magnetic field parameters shortly prior to their interaction with the bow shock and magnetopause. Although few in number, Fermi accelerated ions exert pressures comparable to those of the ambient interplanetary magnetic field (IMF) and solar wind thermal plasma. The ions excavate cavities of depressed magnetic field strength and density on bundles of magnetic field lines connected to the bow shock. We use observations from Wind?s perigee passes to quantify the magnitude of these perturbations as functions of radial distance, local time, and ion flux levels outside the Earth?s bow shock. The perturbations first become noticeable some 60 RE upstream from Earth, while their effects are pronounced (factor of 2-3 variations) immediately outside the bow shock. As ion fluxes are bounded, the resulting density and magnetic field strength perturbations are most pronounced during intervals of low solar wind density and magnetic field strength, corresponding to high solar wind velocities. The foreshock cavities are an important (perhaps the most important) source of transient events in the outer dayside magnetosphere and high-latitude ionosphere.

SH52C MCC: 124 Friday 1515h

Toward an Integrated Solar-Terrestrial Data Environment II

(joint with A, SA, SM)

Presiding: **T G Onsager,** NOAA Space Environment Center**; G D Reeves,** Los Alamos National Laboratory

SH52C-01 1520h INVITED

Planning for the Future: The Decadal Survey as an Expression of Community Data Needs

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The members of the Committee and of the Panels of the just-completed Solar and Space Physics Decadal Survey found, both in their numerous dialogs with the research community and in their deliberations, that a strongly integrated and innovative data environment will be required to make the next leaps in scientific understanding from the data and in practical applications of the data. Further, together with an increasingly integrated data environment, new emphasizes must also be placed on such infrastructure matters as the support and operations of guest investigator programs for both ground-based and space-based national research facilities. There is considerable optimism that the coming decade will see numerous innovations in the integrated handling of data and of their use for new science and new applications. This talk will outline the conclusions and related recommendations for solar and space physics data from the Decadal Survey for the coming years.

SH52C-02 1540h INVITED

The State of the Solar Terrestrial Data Environment

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The data from space missions are national treasures. Many of these data are irreplaceable. In solar terrestrial physics data from current missions provide us with state of the art observations with which to address the complex problems of space plasma physics while data from older missions help us place current observations in perspective by providing continuity through time. Data that are prepared so that outside scientists can readily use them have a better chance of being useful years from now than data prepared just for the investigation team. In this talk we will evaluate the state of space physics data activities from the perspective of scientists who were not involved with the data collection. We have asked whether the data meet the needs of scientists today and whether they meet the requirement to provide a long lasting archive. We have evaluated the data from solar terrestrial missions against 4 criteria: 1.) Accessibility- is it easy for scientists to identify and locate the data needed for a given study? Once the data have been located are they readily available to the scientific community? Are they available online or on distributable media? Is needed calibration data readily available? 2.) Documentation- are the data documented so that knowledgeable scientists who are not instrument experts can use them? Does the documentation adhere to recognized standards? Does the documentation explain how the data were collected, and how they were processed as well as the format of the data? Is data quality including sources of contamination carefully documented? 3.) Preservation- is a system in place to assure that the data are not lost? Are the data archived to long lasting media? Are there copies of the data? Is there a program to test and refresh media? 4.) Scaleability- are the technologies being used meeting the demands of today's users? Are the current data system technologies scaleable to planned data rates from future missions? How are the data systems addressing anticipated data demands?

SH52C-03 1555h INVITED

The Right Amount of Glue: Technologies and Standards Relevant to a Future Solar-Terrestrial Data Environment

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In order to meet the challenge of developing a new system science, we will need to employ technology that enables researchers to access data from fields with which they are at least initially unfamiliar as well as from sources they use more regularly. At the same time, the quantity of data to be obtained by missions such as the Solar Dynamics Observatory demands ease and simplicity of data access. These competing demands must in turn fit within severely constrained funding for data analysis in such projects.

Based on experience in only a single discipline but with a diversity of data types and sources, we will give examples of technology that have made a significant difference in the way people do science. Similarly, we will show how adoption of a well-dcoumented data format has made it easier for one community to search, reduce, and analyze data. We will also describe a community-supported data reduction and analysis software tree with useful features.

We will attempt to generalize the lessons learned in these instances to features the broader, solar-terrestrial community might find compelling, while avoiding overdesign of a common data environment.

URL: http://umbra.nascom.nasa.gov/

SH52C-04 1610h INVITED

The Roles and Needs of Models in the Future Solar-Terrestrial Data Environment

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We have recently embarked on two projects to model the Solar Terrestrial environment through linking the regional codes together. We discuss here, from the perspective of our projects, the characteristics of the individual codes. These are well known and respected in the SPA community: the SAIC corona code, the NCAR solar wind code, the LFM magnetosphere code, the Rice RCM, and NCAR ITM code (TING). We further discuss the issues important for coupling of these codes, and explore briefly the methods from the computational and computer sciences that may help address them.