Director's Corner

Steve Keil

It is again time for solar physicists to begin planning for the next decade and to provide inputs to the pending astronomy decadal survey. As a result of the 2000 decadal survey, the Advanced Technology Solar Telescope (ATST) is nearing the construction phase and has recently entered the NSF Major Research Equipment Facilities Construction program. Now that the next review is starting to get organized, the solar community needs to think carefully about the ground- and space-based projects and programs we would like pursue in the next decade. Development of Multi-Conjugate Adaptive Optics systems to fully utilize the field-of-view of ATST and other ground-based telescopes should certainly be a high priority for solar astronomy. I am sure there are many other ideas floating around, and we should ensure that they are considered in the upcoming decadal survey.

Speaking of reviews, several have been keeping NSO busy during the past quarter. The AURA proposal for the 2009-2014 cooperative agreement with NSF to operate NSO and NOAO was reviewed in March. and a decision from NSF is pending. As part of the follow-up to the NSF Senior Review, all NSF observatories are undergoing a cost review. NSO has provided written material for the review and will have on-site visits of the review committee in late June. ATST continues its series of system-level reviews of all aspects of the telescope in preparation for a final review this winter. The ATST science working group is meeting from May 13 – 15 to continue the development of experiments and observing sequences for ATST. During April, AFRL/RVBXS (the Air Force group) at Sac Peak was kept busy supporting an evaluation of the suitability of Improved Solar Observing Optical Network (ISOON) to be implemented as a multi-station network. The Air Force is also evaluating Global Oscillation Network Group (GONG) and Synoptic Optical Long-term Investigations of the Sun (SOLIS) as systems for meeting their need for monitoring of solar conditions.

The University of Arizona–NSO Solar Physics Summer School will be held the week of June 16. The school provides an intensive one-week course in topics related to the physics of the Sun for advanced undergraduates and beginning graduate students. The purpose of the school is to provide a basic introduction to solar physics. There will be approximately 15 – 20 lectures. Topics include solar radiative transfer, helioseismology, the solar interior (dynamo, convection zone), chromospheric and photospheric magnetic fields, solar magnetohydrodynamics, the origin and heating of the corona and solar wind, flares, CMEs, and high-energy charged particles. There will also be tours of the facilities and opportunities to observe the Sun directly.

At Sac Peak, some new instruments are arriving and some older instruments are departing. The High Altitude Observatory (HAO) has begun installing their Prominence Magnetograph (PROMAG) on the 16-inch″ coronagraph in the Evans Solar Facility at NSO/Sac Peak. PROMAG will map the vector magnetic field in prominences once it is completed this summer. The NSO Coronal One-Shot (COS), along with the HAO Coronal Magnetic Polarimeter (COMP), was removed from the Hilltop Spar and is being moved to Hawaii, where it will continue to make full polarizations measurements of coronal spectral lines. The University of Hawaii Facility Infrared Spectrograph (FIRS) is nearing completion at the Dunn Solar Telescope, after completing a successful engineering run this winter. The joint HAO/NSO SPINOR project made substantial progress this past quarter and should become available as a shared-risk instrument in the final quarter of the year.

At the McMath-Pierce, the NSO Array Camera (NAC) has expanded its operating modes by using single-frame reads from the camera to allow short (millisecond) exposures, and by upgrading the polarimeter control scheme to allow rapid (10 millisecond) liquid-crystal chopping. New infrared granulation movies have been produced with the use of single-frame read mode, and lower-noise vector magnetograms are expected from the polarimeter upgrade. Near real-time flat and dark image correction has made the NAC more user friendly.

SOLIS participated in support of the Whole Heliospheric Interval (WHI) during March 20–April 16. The WHI is an international coordinated observing and modeling effort to characterize the three-dimensional interconnected solar-heliospheric-planetary system during Carrington Rotation 2068. The specific goals of the WHI included the characterization of the 3D solar minimum heliosphere and tracing the effects of solar structure and activity through the solar wind to the Earth and beyond. SOLIS was one of 14 solar instruments participating, along with 19 heliospheric and 18 geospace instruments. SOLIS carried out investigations that involved observations of low-latitude coronal holes and observations of the quiet Sun near the Equator as a baseline for future observations of active regions.

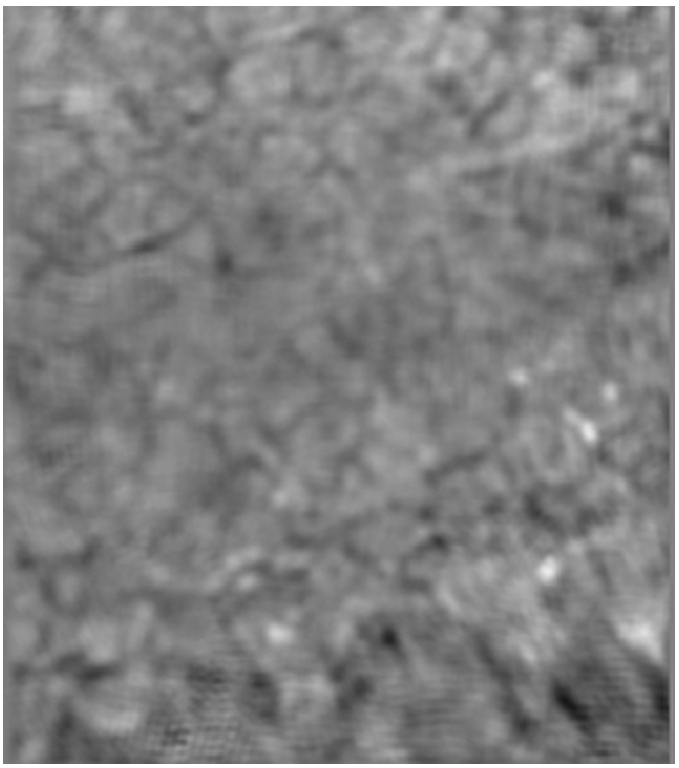
GONG is continuing to pursue space-weather research paths and is currently developing subsurface flows fields and farside imaging as predictors of surface activity. GONG is also improving the high-cadence magnetic field products, and evaluating the feasibility of installing a continuous, high-cadence H-alpha capability. Candidates for a new camera and data acquisition system are being studied.

NSO would like to extend our best wishes to Ed Carlton, who retired from working in the Sunspot Visitor Center;, Robert Radcliffe, who worked at the Dunn Solar Telescope as an instrument technician;, and well as David Salabert, who left the GONG program for the IAC in Tenerife. We would like to welcome Joan Henry, who will be working in the Visitor Center.

New High-Resolution Quiet-Sun Images at 4667 nm

Matt Penn, Claude, Plymate, &and Eric Galayda

New imaging observations have been made at the McMath-Pierce Solar Telescope on Kitt Peak using the NSO Array Camera. With a narrowband filter centered at 4667 nm, which includes several very strong CO absorption lines, very rapid exposures were taken during good seeing at the disk center quiet Sun on 21–23 March 2008. Individual exposure times on the order of 20 milliseconds were obtained using the single-frame read mode of the NAC camera. Adaptive optics was not used, but the atmospheric seeing was excellent during the observations. After extensive correction for background variation and flat-fielding, the raw images showed solar granulation, as well as bright features in the intergranule dark lanes.



The figure shows a reconstructed image from the center of the solar disk on 22 March 2008 produced with the multi-object, multi-frame blind iterative deconvolution (MOMFBD) procedure described in Noort, et al. (2005). The intensity is scaled between ± 2 percent around the mean intensity. Features at the telescope diffraction limit (0.8 arcsec) are seen in the image, which measures roughly 45 × 35 arcsec across. While the granulation contrast is low, the bright intergranule features (middle of image, right side) show contrast of 3 percent or greater. These features resemble the magnetic bright points seen in high-0resolution G-band images, and a time sequence from March 23 showing similar small-scale bright features reveals that they have a lifetime that far exceeds the granulation turn-over time; currently it is thought that they represent locally heated regions of high magnetic field where the CO molecule is dissociated and the absorption spectrum is absent.

An image of the solar granulation from 22 March 2008 taken with the McMath-Pierce telescope and the NAC at 4667 nm (which includes several strong CO absorption lines). The field measures 45 × 35 arcseconds, and details at the diffraction limit of the telescope (0.8 arcsec) are visible. The granulation has low contrast, but bright points in the dark intergranular lanes are visible near the right edge of the field. Time sequences from March 21 – 23 show similar small-scale bright points, which have long lifetimes and are thought to be similar to the G-band bright points.

SOLIS

Aimee Norton, Kim Streander, Carl Henney & the SOLIS team

The Solar Optical Long-term Investigations of the Sun (SOLIS) team supported Whole Heliospheric Interval (WHI) observing efforts from March 20 through April 16 by taking data simultaneously with other ground- and space-based telescopes.

WHI was an internationally coordinated, four-week observing effort designed, in part, to showcase 2008 as the International Heliosphysical Year. Observations and data analysis will be followed by modeling efforts to characterize the three-dimensional, interconnected, solar-heliospheric-planetary system.

The emphasis for each of the four weeks of WHI was: linking the corona to the solar wind as observed by the Ulysses spacecraft, the origin of the slow solar wind, understanding the coronal hole boundaries and low-latitude coronal holes and characterization of the quiet sun. The entire time period corresponds to solar Carrington Rotation 2068.

The Sun was cooperative, providing the desired solar features for our studies, (i.e., an equatorial coronal hole during the third week

continued

SOLIS continued

(see figure 1) and very little magnetic activity (i.e., without sunspots) during the fourth week). We look forward to the scientific advances made through these coordinated, collaborative efforts.

Six additional spectra from the SOLIS Integrated Sunlight Spectrometer (ISS) have been calibrated for spectral dispersion. The wavelength regions recently calibrated are the Ca II K, Ca II H, He I 1083.0 nm, CN 388.4 nm, C 538 nm and Mn 539.4 nm spectral bands, as seen in figure 2. Fluxes were normalized to reference values in the Fourier Transform Spectrometer flux atlas. The data are now publicly available on the SOLIS Web page. NL

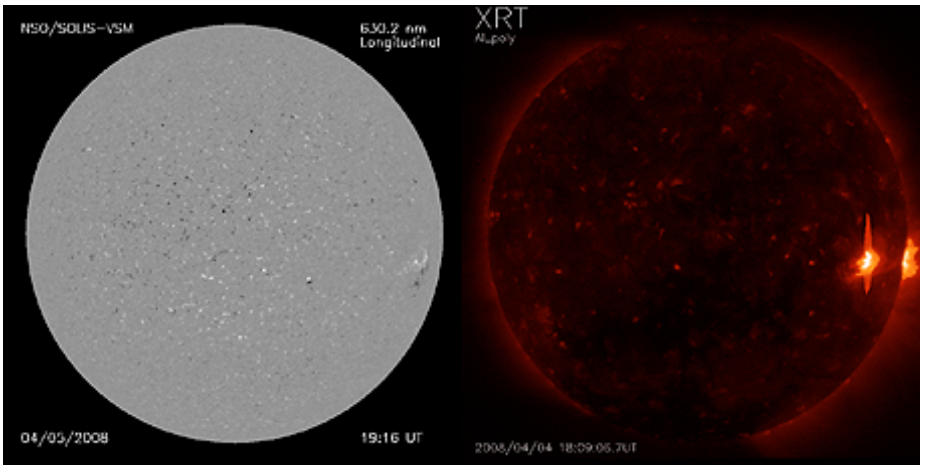


Figure 1: A SOLIS VSM full-disk solar image (left) and Hinode XRT X-ray image (right) for 5 April 2008. These represent only two out of a suite of ~30thirty participating instruments. SOLIS VSM image is depicted in grayscale indicating the line-of-sight magnetic flux as observed in the photosphere with the 630 nm Fe I lines. White/black indicate positive/negative polarity of magnetic fields. Hinode XRT image shows the X-ray intensity with visible coronal holes at the South Pole and another near 30 degrees southern latitude.

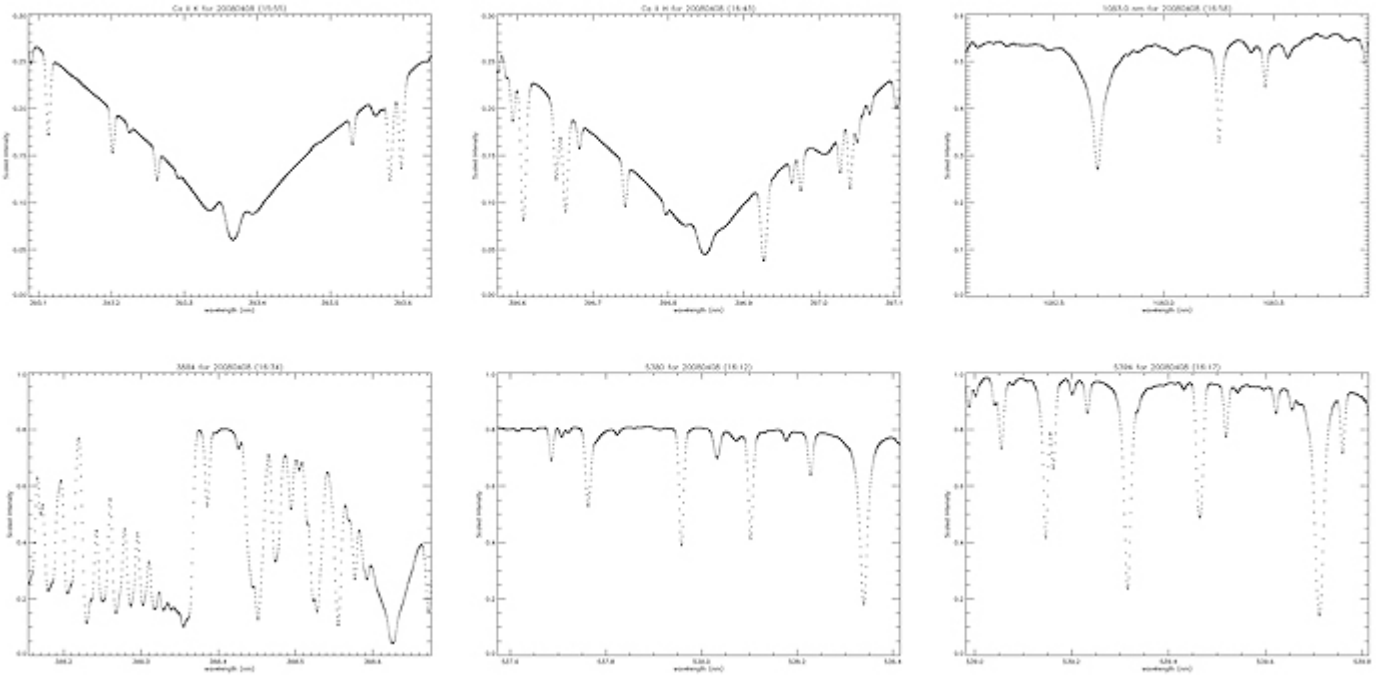


Figure 2: Sample spectra measured by the ISS. Shown are spectra from the (upper) Ca II K, Ca II H, He I 1083.0 nm, (lower) CN 388.4, C 538.0 and Mn 539.4 nm. The daily ISS program acquires numerous spectral bands, including the six shown here. Construction of the Full Disk Patrol continues, with the alignment being complete, excepting the objective lens and final beamsplitter.

GONG++

Frank Hill & the GONG++ Team

The Global Oscillation Network Group (GONG) continues to focus its efforts on new space-weather tools, applications, and data products. GONG's high-cadence magnetograms continue to capture the attention of the community and funding agencies, and are eliciting interest in wider participation in operational support of GONG. In addition, progress in the development of active-region prediction tools is sparking queries from additional potential partners.

Recently, we developed a calibration between the farside signal and the magnetic field strength and area of large active regions, which has enabled us to produce synoptic maps that incorporate an estimate of the farside field. These front-side "plus" farside synoptic maps should improve the field extrapolations and solar-wind predictions. Looking below the surface with one of GONG's standard helioseismic data products, a 16-degree across three-dimensional subsurface map of horizontal flow, we can now determine various fluid dynamics quantities that tell us how the plasma is moving apart (divergence) and the twistedness (vorticity) of the flows. A statistical study of some 400 active regions found that if the region is associated with a combination of high vorticity and high surface magnetic field, then there is a very high probability of strong flare activity. We now have a quantitative measure of flare occurrence probabilities, which is what space-weather forecasters really need for a timely warning, as shown below.

The GONG 2008/SoHO 21 meeting will be hosted by University of Colorado Atmospheric Research/High Altitude Observatory (UCAR/HAO) and held in Boulder, Colorado, 11-15 August 2008. As implied by the title, "Solar-stellar dynamos as revealed by helio- and astero-seismology," this meeting will cover all areas of helio- and astero-seismology, with emphasis on what these research topics have taught us about the dynamo generation of solar and stellar magnetic fields. For registration, abstract submittal, and general information about the meeting, visit *gongsoho08.ucar.edu/*.

continued

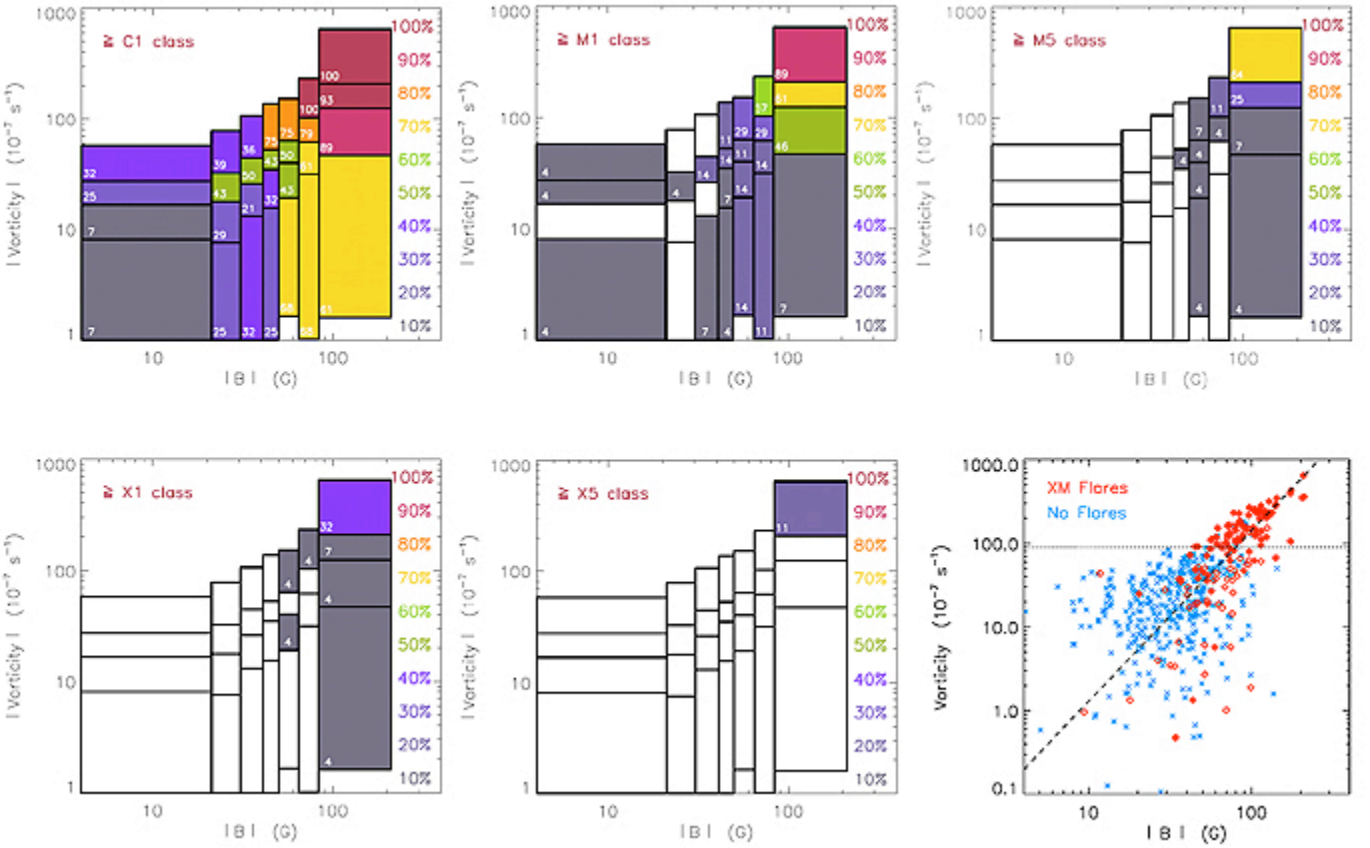


Figure caption: The lower right panel shows the surface magnetic field B and vorticity of approximately 400 active regions . Dark symbols indicate active regions that produced flares, while light symbols show active regions that did not flare. The preponderance of flares occur when the active region has high values of both B and vorticity. The remaining panels divide up the active regions so that each box contains an equal number of points. The numbers in the bins are the percentage of active regions with at least one flare with a magnitude above the indicated class. Grey scales indicate the probability levels in steps of 10%, white is 0%. It is clear that the strongest flares again occur when both B and vorticity are high. This suggests that measuring the subsurface vorticity will become a useful way to identify active regions that potentially could produce dangerous flares.

GONG++ continued

Science Highlights
Most of the GONG scientific staff attended the Solar Dynamics Observatory/Helioseismic and Magnetic Imager (SDO/HMI) team meeting in Napa, California March 24–28. With the launch of SDO—NASA's first international "Living With a Star" mission—only about one year away, a joint meeting was planned to unite co-investigator teams from the entire SDO mission and others beyond those core teams who are committed to actively participating in the science investigations. Discussion was mainly centered on planning those activities that need to be completed before launch and during the first two years of the mission. The agenda also featured a series of scientific and technical working groups to discuss how the SDO data will be best accessed, distributed, and analyzed, and what tools are needed to best stimulate scientific discoveries. Details of the meeting can be found at *hmi.stanford.edu/TeamMeetings/Mar_2008/*.

Congratulations to Rachel Howe, Rudi Komm, K.S. Balasubramaniam, and Gordon Petrie who have finished editing the proceedings for last year's NSO/Sac Peak Workshop, "Subsurface and Atmospheric Influences on Solar Activity," PASP Conf. Series 383, ed. R. Howe, R.W. Komm, K.S. Balasubramaniam, and G.J.D. Petrie, San Francisco: Astron. Soc. Pacific, 2008. The proceedings include nine GONG staff-authored papers.

Network Operations & Engineering
Most of the efforts so far this year have been directed toward preparing for a series of preventive maintenance (PM) trips to El Teide in March and Cerro Tololo Inter-American Observatory (CTIO) in April. The schedule was contingent on modifications and outcomes of tests of the CCD cameras.

With two cameras readied with time to spare, a trip to Big Bear observatory was undertaken to replace its camera, which was operating at a high temperature due to a failed cooling fan. The returned camera was repaired, tested, and readied for the CTIO trip. Unfortunately, problems with the existing CTIO camera appeared, and attempts to alleviate the trouble before the El Teide trip were unsuccessful. Having two neighboring sites down simultaneously would have seriously compromised the network duty cycle, so a quick trip to CTIO was needed to replace the ailing camera. Although there was some overlap in the work at the two sites, the CTIO camera replacement went quickly and allowed the site to provide coverage well before the completion of the El Teide PM, which was completed without a hitch. At the time of this writing, a team is visiting CTIO for its regularly scheduled annual maintenance.

In between planning for maintenance trips, various instrument problems have demanded some attention. One such problem began last fall when new air conditioning units were installed at Udaipur. The new units had larger capacity and drew more power than the original units. This resulted in a rapid discharge of the batteries. The problem prompted an upgrade to the UPS communications code, which facilitated enhanced monitoring and UPS programming capabilities that allowed the problem to be diagnosed and fixed remotely.

Long-term testing of the prototype clean-air system upgrade (now at 11+ months) continues at the Tucson engineering site. We hope for at least a year between required maintenance so that we can service the clean-air pumps during our annual site visits. The modification to the upgraded waveplate hardware (a small circuit board) has been running at Tucson and was installed at Big Bear last month. It appears that the modification is working properly, and should provide better noise immunity in the waveplate circuit. We have had some success with the prototype workstation, which replaced the ones currently operating at the sites. The workstation appears to operate properly, but we have had some difficulty implementing serial communications with the data and instrument chassis. We have ordered a serial card for the workstation, which is expected to solve this issue.

H-alpha images were collected on March 28 using a possible GONG replacement camera and a filter borrowed from the SOLIS/FDP instrument. The good news is the images were sufficient to prove that we are able to collect H-alpha images with the GONG instrument.

Data Processing, Software Development & Analysis
The GONG Data Archive Web page has a new look and GONG data users have a new interface for querying and downloading data products. Six terabytes of GONG products are available for immediate download from *gong2.nso.edu/dsds*. Your feedback is welcome as we try to improve the accessibility of GONG data products. Please check it out and let us know what you think.

The DMAC Software Maintenance and Development group continues to work on the near-real-time Magnetogram Pipeline. The spurious periodic variation of the polar magnetic field in our hourly synoptic maps has been traced to the method of correcting noise at the limb. Until a new "pixel tossing" algorithm can be developed, Gordon Petrie has developed a technique to fit and remove the periodicity and, along the way, has also improved our pole-filling routine. Using these modifications, we are reprocessing 18 months of data to replace all existing online magnetogram pipeline results. For additional information please see *gong.nso.edu/data/magmap*. Tom Wentzel is currently experimenting with a Fourier-transform technique to filter out the noise at the limb.

Processing to date includes time series, frequencies, merged velocity and rings for GONG Month 125 (centered at 13 August 2007), with a fill factor of 0.91.

Program News
David Salabert has departed for a new position at the Instituto de Astrofisica de Canarias in Tenerife, Canary Islands, Spain. David, with John Leibacher and Thierry Appourchaux, developed a new peak-finding method during his time with us that estimates the parameters of oscillation modes at low signal-to-noise ratios at low frequencies. The method has added about 30 extremely precise mode determinations to the set that can be fitted and has improved the precision of the inversions below the convection zone. The analysis was highlighted in the December 2007 issue of the NOAO/NSO Newsletter. We plan to continue testing the method, and to transition the development code into production software over the next six months or so. Congratulations and good luck to David in his new position.

In late April, we welcomed Rafa Garcia and Savita Mathur (CEA, Saclay) for an intensive 10-day course in GONG data acquisition and analysis with Irene Gonzalez Hernandez.

continued

GONG++ continued

They will pursue the elusive and much sought g modes, which Rafa has pursued for over a decade and were central to Savita's thesis.

The second year for GONG's International Research Experience for US Graduate Students to Study Astronomy/Astrophysics in India (IRES 2008) is off to a good start. Sponsored by the NSF Office of International Science and Engineering (OISE), the IRES program takes place in Bangalore, India, under the auspices of the Indian Institute of Astrophysics (IIA). We have four confirmed participants for the 2008 summer school: Andrea Kunder (Dartmouth College), Eric Larson (University of Colorado), Driss Takir (University of North Dakota), and Catharine Wu (New Mexico State University). We also have IIA mentors: Prof. S.P. Bagare, Prof. S. Giridhar, Dr. U.S. Kamath, and Prof. S.K. Saha. This year's school runs from June 11-August 6. For more information, visit the Web site at *eo.nso.edu/ires/*.

Left to right, Andrea Kunder of Dartmouth College, Erik Larson of the University of Colorado, Driss Takir of the University of North Dakota, and Catherine Wu of New Mexico State University.

Fourth Quarter Deadline for NSO Observing Proposals

The current deadline for submitting observing proposals to the National Solar Observatory is 15 August 2008 for the fourth quarter of 2008. Information is available from the NSO Telescope Allocation Committee at P.O. Box 62, Sunspot, NM 88349 for Sacramento Peak facilities (*sp@nso.edu*) or P.O. Box 26732, Tucson, AZ 85726 for Kitt Peak facilities (*nsokp@nso.edu*).

Instructions may be found at *www.nso.edu/general/observe/*. A Web-based observing-request form is available at *www2.nso.edu/cgi-bin/nsoforms/obsreq/obsreq.cgi*. Users' manuals are available at *nsosp.nso.edu/dst/* for the Sac Peak facilities and *nsokp.nso.edu/* for the Kitt Peak facilities. An observing-run evaluation form can be obtained at *ftp.nso.edu/observing_templates/evaluation.form.txt*.

Proposers are reminded that each quarter is typically oversubscribed. It is to the proposer's advantage to provide all information requested to the greatest possible extent no later than the official deadline. Observing time at the national observatories is provided as support to the astronomical community by the National Science Foundation.