NSO News & Announcements

ATST Awaits Final Decision

The ATST Team

The National Science Board (NSB) in early August "authorized the NSF Director, at his discretion, to make an award to the Association of Universities for Research in Astronomy (AURA) for the Approval of Construction Funding for the Advanced Technology Solar Telescope (ATST)." Pursuant to the relevant federal environmental and historic preservation statutes, the issuance of the award is contingent upon the publication by the NSF of a Record of Decision (ROD) authorizing the construction. Congress has appropriated construction funds that included $146 million in funds from the American Recovery and Reinvestment Act of 2009 (ARRA), and $7 million in FY 2009 funds. We now are awaiting the final Record of Decision by the NSF Director.

The ATST Science Working Group (SWG) met Sept. 9–11 in Boulder, CO, to review the project and discuss instrumentation development. The SWG also reviewed the development of all of the instrumentation, the procurement of detectors, a preliminary operating plan including observing modes and telescope allocation, and an adaptive optics requirement for observing prominences above the solar limb; they also started looking ahead to second-generation instruments. The SWG is considering reshaping itself to have a "core SWG" that meets more frequently to address issues in real time as construction ramps up.

GONG H-alpha System Passes Prototype Design Review

Frank Hill & The GONG Team

The US Air Force-funded H-alpha project passed a significant milestone in September with the successful completion of its Prototype Design Review. The review committee (Dave Jaksha and John Britanik from SOLIS, and Rob Hubbard from the ATST) concluded that:

> "The committee was impressed by the overall simplicity and robustness of the design, and the demonstration of the fully functioning prototype system. It is obvious that great care and attention to detail has persisted at all levels of the effort, and we expect that the final deployed systems will perform to specification."

Representatives of the Air Force Research Laboratory and the Air Force Weather Agency also participated in the review. Given the favorable outcome, we have begun the fabrication of the mechanical components of the system. All of the optics, filters, and cameras are in-house. Deployment is scheduled for the spring of 2010 and will be completed at Udaipur in the fall.

Second Quarter 2010 Proposal Deadline

The NSO/Sac Peak Telescope Allocation Committee

The current deadline for submitting observing proposals to the National Solar Observatory is 15 February 2010 for the second quarter of 2010. 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 at *www2.nso.edu/cgi-bin/nsoforms/obsreq/obsreq.cgi*. Users' Manuals are available at *nsosp.nso.edu/dst/* for the SP facilities and *nsokp.nso.edu/* for the KP facilities. An observing-run evaluation form can be obtained at *ftp://ftp.nso.edu/observing_templates/evaluation.form.txt*.

Proposers are reminded that each quarter is typically oversubscribed, and 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 National Observatories is provided as support to the astronomical community by the National Science Foundation.

2010 International Research Experiences for Students (IRES) Program in India

The GONG Team

Sponsored by the National Science Foundation (NSF) Office of International Science and Engineering (OISE), and administered by the National Solar Observatory (NSO)/Global Oscillation Network Group (GONG), the main goal of the program is to expose potential researchers to an international setting at an early stage in their careers. The program will take place in Bangalore, India, under the auspices of the Indian Institute of Astrophysics (IIA). The IIA is a premier national center devoted to research in astronomy, astrophysics, and related physics, with its headquarters in Bangalore and laboratories located at Kodaikanal, Kavalur, Gauribidanur, Hanle, and Hosakote.

The program will support four full-time summer research positions for eight weeks between 8 June and 2 August 2010. For each participant, the program will provide round-trip air-coach travel to and from Bangalore, India, a stipend of US$500 per week, accommodation, miscellaneous travel (field trips) and incidental expenses, and

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2010 IRES program in India continued

medical expenses. During their stay in India, participants will work and study in close collaboration with an IIA scientific staff mentor on a specific research project. Professional experiences will be enhanced by interactions with other IIA staff, affiliates, and visitors and field trips to other facilities. At the end of the program, participants will submit a detailed report on the results of their research projects and a report on their overall Indian experience.

Eligibility and Requirements: Applicants must be US citizens or permanent residents, age 21 years or older, and have a passport; be registered and in good academic standing in an Astronomy/Astrophysics (or related field in physics or applied math) graduate program in the US; and possess an adequate knowledge of computer programming and data analysis techniques. Further information and application material can be found at the program Web site at: *eo.nso.edu/ires/*. Applications will be accepted until 26 January 2010.

SOLIS/VSM

Kim Streander & The SOLIS Team

Development Update

SOLIS has recently made a number of important upgrades to both the hardware and the data processing software. First, improvements to the control electronics of the calibration motors have been made, resulting in higher reliability, repeatability of positioning, and overall image quality. Secondly, the data processing hardware on Kitt Peak is being brought up to the latest version of the operating system, resulting in faster and more reliable data processing performance. Finally, the development of the 10830 fringe removal code has been finished, and the code is now being installed in the processing pipeline. The next major steps are to finish the fringe removal for the Sarnoff cameras, install the cameras, install a new modulator to enable chromospheric vector magnetograms, and install the guider.

The first meeting of the Vector Magnetogram Comparison Group (VMCoG) was held October 27–29 in Tucson. The purpose of this group, which was formed at the June meeting of the Solar Physics Division of AAS, is to analyze and compare vector magnetograms from all sources to understand systematic effects and the differences between the measurements. This will provide better understanding of the data, improve the reliability of the science based on these observations, and prepare for the data that will be produced by the Helioseismic and Magnetic Imager on the Solar Dynamics Observatory. Data sets from SOLIS, Hinode, the Michelson Doppler Imager on the Solar and Heliospheric Observatory, and the University of Hawai'i Facility InfraRed Spectropolarimeter have been collected and will be compared during the meeting.

Science Snippet

Solar activity has recently been at a level lower than has been seen for a century. This is an extraordinary opportunity to study the quiet sun and the development of solar activity at a pace much slower than normal. SOLIS produces daily images of the Sun's line-of-sight magnetic field component with excellent sensitivity. These images are combined into charts of the Sun's radial magnetic flux every day and every solar rotation. These charts can further be adjoined to show the time variation of magnetic flux along a strip in latitude about one day wide at the central meridian from pole to pole. Figure 1 shows preliminary results of this exercise from May 2006 to October 2009 in terms of total magnetic flux. Time runs from left to right and sine latitude from bottom to top; the equator is the center row.

Bright features are locations of active regions, i.e., magnetic flux eruptions. They frequently may be seen on successive solar rotations. The

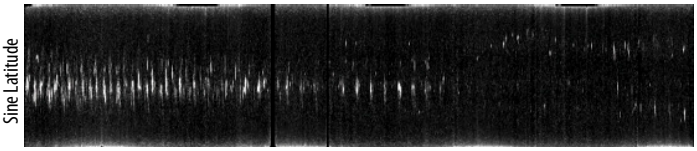

Figure 1: Five year display of total radial magnetic flux showing the transition from Cycle 23 to 24.

dying part of cycle 23 is seen near the equator strongly in the southern hemisphere. The very slowly developing new solar cycle 24 is seen as small bright features particularly at high latitudes in the northern hemisphere. The reason for this strong asymmetry is not known. Also of interest is a negligible variation of the background quiet sun flux back to the beginning of SOLIS observations in 2003.

Inversions

> *Editor's Note: The figures for the first section of the SOLIS article in the September 2009 Newsletter were misidentified in the text and incorrectly sequenced (the online electronic version was corrected), thus the remainder of this article largely reproduces this portion of the September article with the text and figures corrected.*

The recent (since April 2009) release of inverted vector magnetic field data from the Synoptic Optical Long-term Investigations of the Sun/Vector Spectromagnetograph (SOLIS/VSM) has initiated constructive critiquing among the solar community. In particular concerns were expressed regarding: 1) apparent "rings" around active regions when displaying the line-of-sight field inclination, 2) a need to adjust the gray scale when displaying the Milne-Eddington full disk images on the Web, and 3) a desire to see a comparison between data taken with the VSM and Hinode, the "gold standard."

The "rings" around active regions (shown in figure 2 "Original cubic convolution") were a by-product from applying an IDL interpolation scheme used in SOLIS data for, among other operations, slit correction and P-angle rotation. The SOLIS Milne-Eddington (ME) procedure inverts only those pixels where the percent polarization is above a computed threshhold, and non-inverted pixels are set to zero. This threshholding caused the existing cubic convolution interpolator to produce incorrectly skewed values whenever there were zero values in the 16-point interpo-

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SOLIS/VSM continued

lation neighborhood, because these zero values are treated as real data. This resulted in artificial rings around the islands of data after interpolation, which can be seen most clearly in the inclination plots.

The solution (shown in figure 3 "Hybrid") was to use a hybrid cubic/bi-linear interpolation algorithm written by John Britanik that used the usual cubic convolution when all 16 points in the interpolation neighborhood are non-zero, and gracefully degraded to a bi-linear interpolation otherwise. The bi-linear interpolation algorithm considers only the surrounding four points in the interpolation neighborhood. It gracefully degrades, such that if one neighbor is zero, a triangular form of bi-linear interpolation is used. If two neighbors are zero, then the simple linear interpolation is used, and if three neighbors are zero, then the non-zero neighbor is used as the "interpolated" value. The interpolated value is set to zero if all four neighbors are zero. The resulting output is free of the

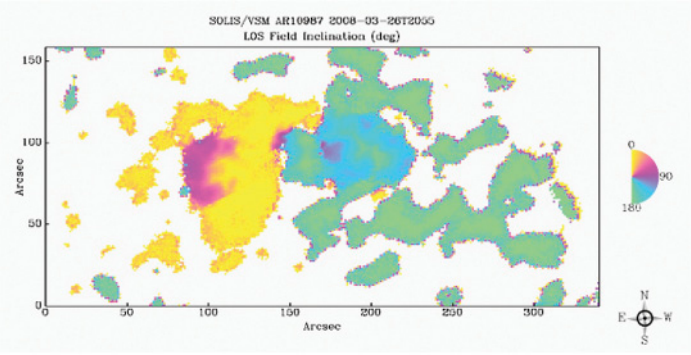

Figure 2

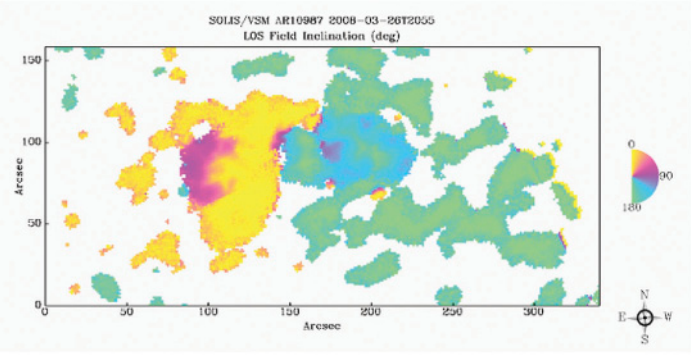

Figure 3

artificial rings.

Recent improvements to the Milne-Eddington inversion and plotting routine have greatly improved the appearance of the full-disk ME images on the Web (see figure 4). The field strength estimate returned by the ME inversions was improved in areas outside sunspots by using the quick-look field estimates as an initial guess, instead of a constant value of 1200 gauss, which had resulted in field strengths that were too high in regions outside of sunspots. The current code removes a non-linear scaler previously used to emphasize plage (but which resulted in saturation around areas of high magnetic field strength), applies a filling fraction, and computes the minimum and maximum with a 0.6 multiplier to enhance contrast so that

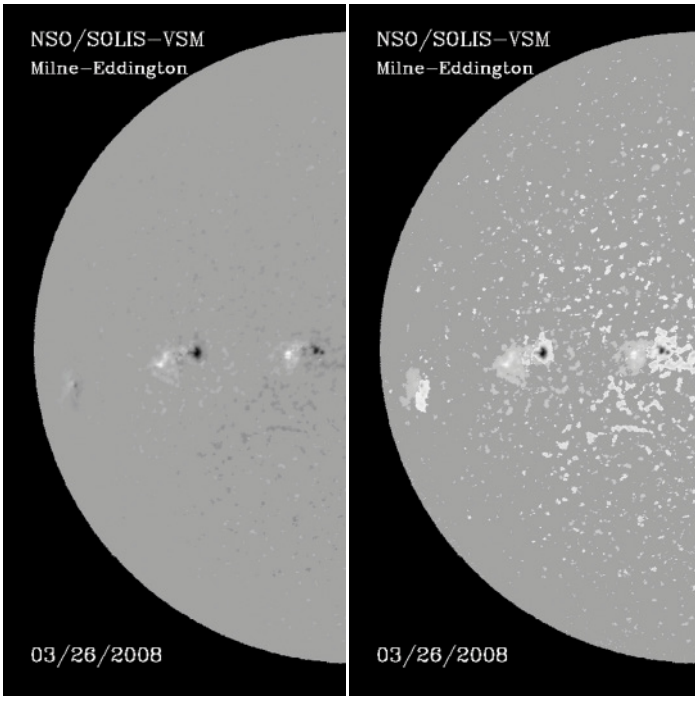

Figure 4: Current Web display (partial).

Figure 5: Previous Web display (partial).

the ME images look more like the quick-look images (compare with the previous processing of the same data in figure 5). We have since received favorable comments from the solar community for the improved appearance of the ME data on the Web.

At the suggestion of the National Solar Observatory Users Committee, Jack Harvey found an existing data set that could be used for comparing inversion techniques between the SOLIS VSM and Hinode. Hinode is a Japanese mission developed and launched by ISAS/JAXA, with NAOJ as domestic partner and NASA and STFC (UK) as international partners. It is operated by these agencies in cooperation with ESA and NSC (Norway). A preliminary comparison between the two data sets (figure 6) shows remarkable similarities when considering the different image resolutions and an approximate 6.5-hour time difference. Additional data sets and analyses will be compared over the next several months.

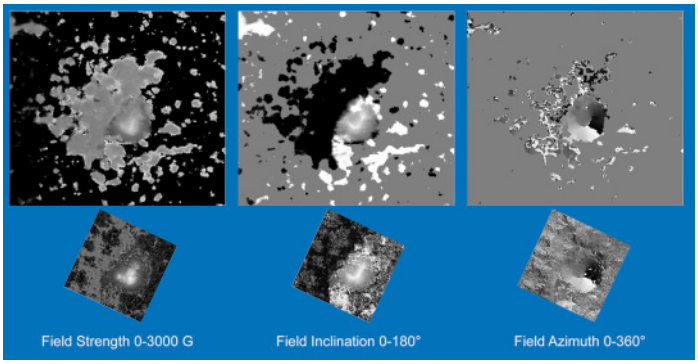

Figure 6: Milne-Eddington inversions of Stokes spectra taken 2 May 2007 with the SOLIS/VSM at 20:32 UT (upper row, 1.125" pixels in poor seeing) and with the Hinode SP in fast scan mode at 14:00 UT (lower row, 0.32" pixels). Azimuths have been disambiguated for the 180-degree ambiguity.