



NSO

National Solar Observatory

From the NSO Director's Office

Steve Keil

Plans are being made to operate the National Solar Observatory as an independent observatory that would report directly to the NSF through AURA. NSO and NOAO will continue to share resources to support programs on Kitt Peak and in Tucson, but NSO will conduct its planning, resource allocation, and reporting functions separately from NOAO. NSO will continue operating its current facilities, in support of user and staff research, which are being enhanced with increased capabilities through completion of SOLIS, enhancement of GONG, and—in conjunction with the solar community—development of an Advanced Solar Telescope. Your comments and opinions both on the separation, and on the current and future facilities and capabilities that NSO should provide the user community, are welcome and can be sent to me at skeil@noao.edu.

SOLIS is well into its construction phase and beginning to take delivery on instrument and telescope components. A brief update on the project appears later in this section. NSO recently completed the third RISE/PSPT (Precision Solar Photometric Telescope) instrument and will begin operations at NSO/Sac Peak. The PSPT is designed to measure and identify the sources of solar irradiance changes and to study the solar interior. All three telescopes have been completed. The first was installed in Rome and the second in Hawaii. For an overview of the instrument and

design drawings visit www.sunspot.noao.edu/PSPT, and for information about the sunRISE program and access to the data visit rise.hao.ucar.edu.

The NSO low-order adaptive optics system is now available for observations at the Dunn Solar Telescope (DST). Two NSO scientists, Thomas Rimmele and Christoph Keller, recently collaborated with John Seldin and Richard Paxman of the Environmental Research Institute of Michigan (ERIM) to obtain very high resolution movies of the vector magnetic field in active regions. The data were obtained by combining NSO's adaptive optics and ZIMPOL polarimetry systems with phase-diversity techniques developed at ERIM. The combined system permits polarimetry at the diffraction limit of the DST. To see some results from the observations, visit our WWW site at www.noao.edu/noao/staff/keller/aopds. A nice movie of convection motions in and around a pore is available at www.noao.edu/noao/staff/keller/aopds/pds1802.gif. If you download the movie, watch in particular how the bright point in the upper right is pushed around by granulation.

Eric Tatulli has joined the NSO staff to work with Thomas Rimmele for the next 15 months on the adaptive optics program. Eric comes from ONERA in France with Jean-Marc Conan.



SOLIS

Jack Harvey

The SOLIS project is approximately half completed. Design activities are becoming less dominant as construction ramps up. The mounting has taken form at a local commercial shop. Optics for the vector spectromagnetograph (VSM) are arriving. The primary and secondary mirrors have been generated and are on track. The main entrance window was delivered ahead of schedule and it exceeds specifications.

Mechanical parts for the VSM are being built in our shops in Tucson and Sac Peak, as well as at numerous outside vendors. Off-the-shelf optics for the full disk patrol are being ordered. The integrated sunlight spectrometer (ISS) was delivered and is nearing a first sunlight test. Software development is concentrating on use of the ISS as the first of the three major instruments of SOLIS. The code developed and proven with that instrument will transfer immediately to the others. A storage area network for capturing data from SOLIS was delivered and brought into operation.

Kitt Peak Vacuum Telescope to the Max

Harry Jones

Observers at the NSO/KPVT continue to use the NSO/NASA Spectromagnetograph to support observing campaigns, spacecraft operations, and other special observing programs although they were limited by this summer's vigorous and extended monsoon season. Recent examples include H. Jones' 1083-nm line asymmetry and EUV line shifts guest investigator program with SoHO and GSFC's SERTS 99 rocket flight in June, ongoing support of various TRACE programs, a continuing study of

prominences initiated by D. Rust, and several campaigns (Max-Millennium, Whole Sun Month, MEDOC, etc.). Usually such support is undertaken after the standard synoptic data have been obtained by the observer, who takes into account weather and instrument conditions as well as the various e-mail and web announcements. For special scheduling or observing requirements, contact Harry Jones (hjones@noao.edu) or Jack Harvey (jharvey@noao.edu).

The McMath-Pierce FTS is Alive and Scanning

Mike Dulick

The NSO has been awarded an additional three years of funding by the NSF Division of Chemistry, as well as three years of funding from the NASA Upper Atmosphere Research Program, to continue to make the high-resolution

Fourier transform spectrometer (FTS) on Kitt Peak available for laboratory spectroscopy. The NSO FTS has capabilities for laboratory spectroscopy that are not available anywhere else in the world. Its total spectral coverage is 550–45,000 cm^{-1} . It

continued

simultaneously achieves high resolution (0.0025 cm^{-1} at 1000 cm^{-1} and 0.01 cm^{-1} at 3000 cm^{-1}), excellent signal-to-noise ratio (500:1 for 1-hour integration), and wide bandpass (1000 cm^{-1} to 3000 cm^{-1} for a single spectrum). This means that high-quality measurements of line positions, strengths, and widths can be obtained readily.

Over 120 visiting scientists have used the NSO FTS in their research. A very wide range of projects has been carried out, including high-resolution spectroscopy of free radicals and molecular ions, spectroscopy of atoms, atmospheric spectroscopy, long-term monitoring of atmospheric constituents,

and laboratory astrophysics. The following visiting investigators have had long-standing research projects that utilize the NSO FTS and are co-investigators on the proposals that were funded: Peter Bernath (Waterloo); Sumner Davis (Berkeley); James Lawler (Wisconsin); Leah O'Brien (Southern Illinois); Curtis Rinsland, Mary Ann Smith, and co-workers (NASA/Langley); Linda Brown, Robert Toth, and co-workers (JPL); Charles Chackerian and co-workers (NASA/Ames); D. Chris Benner and V. Malathy Devi (William and Mary); Don Jennings, Dennis Reuter, and co-workers (NASA/Goddard).

What's New at the Sunspot Astronomy and Visitor Center

Ray Smartt

The Sunspot Astronomy and Visitor Center was formally dedicated in April of last year, the culmination of several years of planning by the principal partners in this project: the National Solar Observatory, NOAO, the Apache Point Observatory, New Mexico State University, and the staff of the Lincoln National Forest. Considerable assistance in different aspects of the development of the Center has also been provided by the New Mexico State Departments of Tourism, Highway and Transportation, and Cultural Affairs, with technical assistance also from the local International Space Hall of Fame. Initial funding was obtained from the State of New Mexico, with matching funds from the Federal Highway Administration (the initiative was eligible for consideration for FWA/ISTEA construction funds since it lies at the terminus of a National Scenic Byway).

The Center has a conference room, gift shop, and exhibit area. The ongoing development of science exhibits emphasizes educational value, especially for school-age children, but also for the general public. The overall scheme reflects the different areas of scientific interest of the two observatories and of the US Forest Service, with principal emphasis on solar astronomy. Educators stress the value of interactive-type exhibits and, where feasible, exhibit designs are of this type.

Visitors first encounter a five-foot-diameter, extremely accurate sundial and a solar light-feed for a spectrograph within the building (this light feed was originally used as a solar telescope at the South Pole for solar oscillation measurements). Inside, the story line starts with things of some familiarity (the day-night cycle from the Earth's rotation, including the identification of the tropic

continued

latitudes; the relationship of the sizes of the Sun and the Earth; the reason for blue skies and orange sunsets; the seasons; measurement of the Sun's brightness; and the concept of the precession of the Earth's axis). The full range of the electromagnetic spectrum is also presented, which emphasizes the wide spectral coverage of modern astronomical systems, while other exhibits provide an elementary introduction to some of the tools of astronomy. Some of the properties of light as they relate to astronomical methods are also illustrated. Two panels will discuss early astronomical observations in the Americas, as well as key ideas and discoveries in the history of astronomy. The solar system is then presented with a variety of exhibits, including one or more meteorites. This leads the visitor to solar astronomy, featuring NSO and space observations. This part of the sequence of exhibits includes a virtual walking tour of Sac Peak and a spectrographic presentation of the solar spectrum with a solar disk

image. This is followed by the study of the planets, stars, and galaxies as illustrated in the Apache Point Observatory exhibit, which includes a diorama of the 3.5-m telescope facility. Finally, the visitor walks through the USFS exhibit that illustrates the difference in forest plant species according to north- and south-facing slopes, other phenomena associated with the level of insolation, and the sensitivity of the immediate forest environment to climate variations and human activities.

Throughout the exhibit, backlit panels and video presentations illustrate various aspects of the story line. While some of this work is being carried out through external contracts, the development of most of the exhibits continues to rely principally on the technical expertise and direct involvement of various members of the NSO/SP staff, some of whom have carried out different tasks on a purely volunteer, after-hours basis.

20th NSO/Sac Peak Summer Workshop

Michael Sigwarth

The 20th NSO/Sac Peak Summer Workshop, scheduled for the second week of September 2000, will focus on recent progress made in the investigation of solar magnetic fields and on future projects within the framework of solar polarimetry and modeling of solar magnetic fields.

The development of new polarimetric instruments in the last decade has provided a steady stream of high-quality polarimetric data, leading to new insights in solar magnetism. Spectropolarimetric measurements in the visible and IR with unprecedented precision and resolution permit the investigation of small-scale and weak magnetic fields, as well as a detailed study of active region developments. Adaptive optics systems are about to

usher in a new era of ground-based, high-resolution solar observation. Measurements of scattering polarization and the Hanle effect have opened a new field of research. Space-based observations greatly enhanced the possibility of long-term studies, as well as joint observations with ground-based instruments. Direct measurements of magnetic fields in the chromosphere and the corona are challenging us to explore and understand the outer solar atmosphere. At the same time, advanced modeling and numerical simulations of active region development and the formation and behavior of small scale flux tubes have opened new perspectives. Radiative transfer calculations, based on such models, and sophisticated inversion techniques applied to observational data have become an indispensable interface between theory and observation.

continued

Despite this progress, further qualitative steps are necessary to address basic questions in solar polarimetry:

- A substantial increase in spatial and temporal resolution, as well as sensitivity of polarimetric measurements, is needed in order to arrive at a clear understanding of the physics of photospheric flux concentrations.
- Models, simulations, and inversion techniques have to be improved and redesigned, especially to include higher layers of the solar atmosphere.
- Precise polarimetric measurements in the chromosphere and corona are necessary for understanding coronal heating and activity.
- The interpretation of scattering polarization is still in a preliminary phase, and many of its aspects have to be clarified in order to have a good diagnostic of the weakest magnetic fields.
- Synoptic measurements of the vector magnetic field are needed to understand and predict solar activity and variability.

The solar magnetic field and polarization community are invited to Sunspot, New Mexico to review the latest achievements, to present breaking news, and to discuss the next steps in Advanced Solar Polarimetry.

The meeting will comprise invited reviews, selected oral contributions, and poster papers. During the workshop, recent progress made in theoretical modeling, observations, and instrumentation will be reviewed. There will be discussions on new approaches in theory and observations, such as upgrades of existing instrumentation that may include use of adaptive optics; new UV, IR, and 2D polarimeters (ground- and space-based); and advanced instrumentation for synoptic observations. The workshop will also provide for discussions on the polarimetric techniques being used in different instruments and the sensitivity that these techniques have provided so far. This will be important in the context of future large solar telescopes and their polarimetric capabilities in the visible and IR.

The meeting will be held in the Sunspot Astronomy and Visitor Center and the Sunspot Community Center at the National Solar Observatory at Sacramento Peak. There are plans to publish the presentations made at this meeting.

Registration: Please submit your abstract and registration information as soon as possible and no

later than 30 June 2000. The second announcement will be issued soon and will include detailed information on lodging and transportation. The total number of participants will be limited to the capacity of the meeting facilities (approximately 80). The registration fee is \$80. Partial support to help defray travel and housing costs will be available to those with demonstrated need.

The scientific organizing committee includes M. Sigwarth (Chair), S. Keil, H. Lin, D. Rabin, E. Landi (Florence), B. Lites (HAO), S. Solanki (Max-Planck-Institut für Aeronomie), O. Steiner (Kiepenheuer), and V. Martínez Pillet (IAC, Tenerife).

Prospective participants are invited to direct suggestions concerning this workshop, within the framework outlined above, to:

ws2k@sunspot.noao.edu or to M. Sigwarth
National Solar Observatory, Sunspot, NM
88349-0062 USA; Ph. (505) 434-7018;
FAX (505) 434-7029;
email: *msigwarth@noao.edu*.

Additional information about the workshop is also available at: www.sunspot.noao.edu/INFO/MISC/WORKSHOPS/2000/ws2k.html.

NSO Observing Proposals

Dick Altrock

The current deadline for submitting observing proposals to the National Solar Observatory is 15 January 2000 for the second quarter of 2000. Forms, information, and a Users' Manual are available from the NSO Telescope Allocation Committee at P.O. Box 62, Sunspot, NM 88349 for Sacramento Peak facilities (sp@sunspot.noao.edu) or P.O. Box 26732, Tucson, AZ 85726 for Kitt Peak facilities (nso@noao.edu). A TeX or PostScript template and instruction sheet can be e-mailed at your request, obtained by anonymous *ftp* from [ftp.sunspot.noao.edu](ftp://ftp.sunspot.noao.edu) (cd *pub/observing_templates*) or [ftp.noao.edu](ftp://ftp.noao.edu) (cd *nso/nsoforms*), or downloaded from www.nso.noao.edu/. A Windows-based observing-request form is also available at the web site.

NSO Telescope/Instrument Combinations

Dunn Solar Telescope (SP):

Echelle Spectrograph
 Universal Spectrograph
 Horizontal Spectrograph
 Universal Birefringent Filter
 Fabry-Perot Filter System
 Advanced Stokes Polarimeter
 Slit-Jaw Camera System
 Correlation Tracker
 Branch Feed Camera System
 Horizontal and Vertical Optical Benches
 for visitor equipment
 Optical Test Room

Evans Solar Facility (SP):

40-cm Coronagraphs (2)
 30-cm Coelostat
 40-cm Telescope
 Littrow Spectrograph
 Universal Spectrograph
 Spectroheliograph
 Coronal Photometer
 Dual Camera System

Hilltop Dome Facility (SP):

H α Flare Monitor
 White-Light Telescope
 20-cm Full-Limb Coronagraph
 White-Light Flare-Patrol Telescope (Mk II)
 Sunspot Telescope
 Fabry-Perot Etalon Vector Magnetograph
 Mirror-Objective Coronagraph (5 cm)
 Mirror-Objective Coronagraph (15 cm)

McMath-Pierce Solar Telescope Facility (KP):

160-cm Main Unobstructed Telescope
 76-cm East Auxiliary Telescope
 76-cm West Auxiliary Telescope
 Vertical Spectrograph: IR and visible gratings
 Infrared Imager
 Near Infrared Magnetograph
 CCD cameras
 1-m Fourier Transform Spectrometer
 3 semi-permanent observing stations for visitor equipment

Vacuum Telescope (KP):

Spectromagnetograph
 1083-nm Video Filtergraph

Razdow (KP):

H α patrol instrument