

>>>NOAO/NSO Newsletter

NATIONAL OPTICAL ASTRONOMY OBSERVATORY/NATIONAL SOLAR OBSERVATORY

ISSUE 91 – SEPTEMBER 2007

Science Highlights

The Role of NOAO in the Discovery of the Accelerating Universe	3
Latitude Distribution of Polar Magnetic Flux	4
Cosmology Revealed by WIYN Imaging	5

Director's Office

The Time Domain – A Bigger Change Than You Think.....	6
Update on ReSTAR	6
Announcement of Opportunity for Participation in Large Synoptic Survey Telescope Science Collaborations	7
Workshop on Ground-Based Optical Interferometry	9
GSMT Program Office News Jay Elias & Steve Strom	10

NOAO Gemini Science Center

Gemini Observing Opportunities for Semester 2008A.....	11
Altair and the Laser Guide Star System at Gemini North	12
Gemini Observing Overhead Revisions	14
Designing GMOS Masks Without Pre-Imaging	15
The Gemini Science 2007 Meeting at Iguazu	15
The Loss of GNIRS and the Special Call for Proposals for 2007B	16
NGSC Instrumentation Program Update	17
Frenetic Growth of Supermassive Black Holes in the Early Universe	17

Observational Programs

Updates on the Availability of NEWFIRM, WHIRC, and ET.....	18
Standard Observing Proposals Due 1 October 2007 - Survey Proposals Due 17 September 2007 ..	19
Community Access Time Available in 2008A with Keck, HET, Magellan, and MMT	20
NOAO-GLAST Collaborative Science Agreement.....	20
Observing Request Statistics for 2007B Standard Proposals.....	21
CTIO Instruments Available for 2008A	22
KPNO Instruments Available for 2008A	23

Gemini Instruments Expected to be Available for 2008A	24
HET Instruments Available for 2008A	25
MMT Instruments Available for 2008A	25
Magellan Instruments Available for 2008A.....	25
Keck Instruments Available for 2008A.....	25

Data Products Program

Workshop Report: Hot-Wiring the Transient Universe	26
Accessing the Virtual Observatory from Within Your Favorite Programming Environment	27
IRAF 2.14	28

Cerro Tololo Inter-American Observatory

Community Requirements for the Dark Energy Camera	29
SOAR Completes Second Semester of Science Operations	30

Kitt Peak National Observatory

Kitt Peak National Observatory Successfully Meets Challenge of Alambre Wildfire	31
KPNO Staff Changes	34
IRMOS Status	34

National Solar Observatory

From the Director's Office.....	35
ATST	36
SOLIS	38
Mapping Sodium Absorption in the Mercury Exosphere During the 2006 Transit	39
2007 Summer School in Solar Physics	40
GONG++	41

Public Affairs and Educational Outreach

Kitt Peak Remains A Valued Public "Wonder"	43
KPNO Hosts Tohono O'odham Boys & Girls Club Horse Camp	44
Six Students Needed for REU at CTIO	45
Posters for CADIAS	46
Big Summer Shutdown for WIYN	47

Five Current or Former NOAO Astronomers Share Gruber Cosmology Prize

Current NOAO staff members Chris Smith and Tom Matheson, and former staff members Mark Phillips, Nicholas Suntzeff, and the late Robert Schommer, are part of two teams that have been awarded the 2007 Gruber Cosmology Prize

The teams are being recognized for their simultaneous yet independent discovery of the unexpected phenomenon of the accelerating expansion of the Universe, known since then by the name dark energy.

Both teams used observations of distant Type-Ia supernovae as standard light sources to make their discoveries, announced in 1998 and later given the SCIENCE magazine "Discovery of the Year" award. The citation for the Gruber Prize cites work presented in two papers that relied heavily on NOAO facilities: see the following page of this *Newsletter* for more details.

The \$500,000 prize will be split four ways, with a share for each team leader (Brian Schmidt of the High-z Supernova Search Team and Saul Perlmutter of the Supernova Cosmology Project) and a share distributed across each of their two teams, which total 51 co-authors. The award is the second in the eight-year history of the Gruber Cosmology Prize to be based on results using data from NOAO telescopes, following Vera Rubin's 2002 prize for work on dark matter.

The 2007 award was announced in New York on July 17 and will be awarded at a ceremony at the University of Cambridge on September 7.



Correction: The final figure caption for the first Science Highlight in the June 2007 NOAO/NSO Newsletter (page 4) was incorrect due to editorial error. The correct caption is shown below.

Figure 4. A sample variable (RR Lyrae) light curve from the data set, illustrating the typical time sampling for a field over a week-long timescale. Many fields will also have re-observations after 1-3 years.

The NOAO-NSO Newsletter is published quarterly by the **National Optical Astronomy Observatory**
P.O. Box 26732, Tucson, AZ 85726
editor@noao.edu

Douglas Isbell, Editor

Section Editors

Abhijit Saha
Dave Bell
Mia Hartman
Christopher J. Miller
Nicole S. van der Blik
Buell T. Jannuzi
Ken Hinkle
Sally Adams
John Leibacher
Priscilla Piano
Douglas Isbell

Science Highlights
Observational Programs
Observational Programs
Data Products Program
CTIO
KPNO
NGSC
NGSC
NSO
NSO
Public Affairs &
Educational Outreach

Production Staff

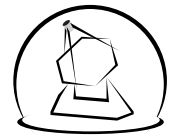
Sheryl Falgout
Peter Marenfeld
Kathie Coil

Managing Editor
Design & Layout
Production Support

On the Cover

NGC 3582 is a minor nebula in the Sagittarius arm of the Milky Way galaxy. It is part of star-forming region RCW 57 in Carina. This image of NGC 3582 was taken using the Mosaic-2 imager on the Blanco 4-meter telescope at Cerro Tololo Inter-American Observatory.

Image credit: T.A. Rector/University of Alaska Anchorage, T. Abbott and NOAO/AURA/NSF



The Role of NOAO in the Discovery of the Accelerating Universe

Tom Matheson & Chris Smith

The discovery of credible evidence for acceleration in the expansion rate of the Universe is certainly one of the more surprising cosmological results in modern astronomy.

The fact that two independent groups using Type-Ia supernovae as distance indicators—the High-z Supernova Search (High-z SN) team, founded by Brian Schmidt of Australian National University and Nicholas Suntzeff of Cerro Tololo Inter-American Observatory (CTIO), and the Supernova Cosmology Project (SCP) led by Saul Perlmutter of the University of California at Berkeley—both arrived at the same conclusion helped to speed the acceptance of such an unexpected result.

Subsequent data from ground-based and space-based programs, including studies using tools other than SNe, have confirmed the initial results, although the nature of the “dark energy” that is apparently driving this acceleration is still uncertain. The first reports, though, were the product of essentially ground-based programs that relied heavily on the resources of the National Optical Astronomy Observatory.

At the time when the two groups were developing their programs, new observations of Type-Ia SNe showed that they were not homogeneous standard candles. Early CCD observations of SN 1986G obtained at CTIO showed it to be unusual.

In 1991, two SNe (the overluminous SN 1991T and the underluminous SN 1991bg) provided unquestionable evidence that SNe Ia are heterogeneous, with a spread of 2.5 magnitudes at peak brightness.

Fortunately, the Calan/Tololo SN survey had begun in 1989. This search was led by Mario Hamuy, Mark Phillips, Nicholas Suntzeff (all CTIO astronomers at the time), and Jose Maza (Universidad de Chile). They used the CTIO Curtis Schmidt camera to search for SNe, timing the observations to catch SNe soon after explosion. Most of the photometry of the newly discovered SNe was obtained with the CTIO 0.9-meter telescope, while the CTIO 1.5-meter and Blanco 4-meter telescopes provided most of the spectroscopy.

Analysis of this well-observed and well-calibrated SNe sample showed that the peak brightness of a Type-Ia SN was correlated with the light-curve shape. Using the light curve, one could transform a relatively diverse set of Type-Ia SNe into “calibratable” standard candles. Without this calibration, neither team could have obtained luminosity distances to high-redshift Type-Ia SNe with the precision necessary to detect the subtle effect introduced by the acceleration of the expansion. These SNe also provided the low-redshift anchor for the cosmology derived from the high-redshift SNe. The Calan/Tololo survey was essential to the success of each cosmological program.

The techniques for finding high-redshift SNe began with a Danish group using the 1.5-meter telescope at ESO. They adopted a timing scheme similar to that used by the Calan/Tololo survey. Expanding on this, the SCP started using the Kitt Peak Mayall 4-meter and 2.1-meter telescopes for searches and photometry. With these facilities, they refined the strategy of observing blank fields to catch high-redshift SNe early in their development. These early runs often shared fields with other programs to extend the utility of the data, a practice continued with many later SNe searches.

In order to find large numbers of SNe at high redshift, both teams employed the wide-field imaging capability of the Blanco 4-meter telescope at CTIO. Initially, they used the prime-focus CCD camera, switching to the Big Throughput Camera when it became available. Previously obtained template images were subtracted from frames during SNe searches. Promising new objects could then be observed spectroscopically to securely identify the new object as a Type-Ia SN. Multiple epochs of photometry (often with the Blanco 4-meter) produced light curves that could be anchored using the calibration

provided by the Calan/Tololo sample.

The WIYN 3.5-meter telescope at Kitt Peak was used by the High-z SN team and the SCP to observe many of the high-redshift SNe found by the Blanco 4-meter telescope. One of the reasons that WIYN was particularly useful was

that it was operating with a queue schedule at that time. For transient objects such as SNe, the ability to obtain observations on demand is a tremendous resource. Both teams explicitly acknowledged the importance of the WIYN queue observers to their projects.

NOAO facilities continue to play an important role in studies of dark energy. The Blanco 4-meter is the host of the NOAO Survey project Equation of State: SupErNovae trace Cosmic Expansion (ESSENCE), which is searching for more high-redshift Type-Ia SNe in order to constrain the equation-of-state parameter of dark energy (see www.ctio.noao.edu/essence). NOAO supports both ESSENCE and the Canada-France-Hawaii Telescope SN Legacy Survey in their use of the Gemini Observatory to obtain spectra of high-redshift SNe.

The Blanco Cosmology Survey (www.cosmology.uiuc.edu/BCS) will also attempt to constrain dark energy through observations of clusters of galaxies. In the near future, the Dark Energy Survey (www.darkenergysurvey.org) will build the 500-megapixel Dark Energy Camera for the Blanco, dramatically expanding survey capabilities for NOAO and its user community, and enhancing the observatory’s historic place in the quest to understand the mystery of the accelerating universe.



Latitude Distribution of Polar Magnetic Flux

N.-E. Raouafi, J. W. Harvey, & C. J. Henney

The magnetically unipolar-dominated polar caps are among the most prominent solar features throughout the activity cycle of the Sun, particularly at solar minimum. The magnetic fields, concentrated in small elements due to solar convection, expand with height and spread out to fill most of the heliosphere, in addition to creating numerous fine coronal structures. These regions also harbor the streaming fast solar wind, and the processes responsible for the plasma heating and acceleration near the Sun.

These regions are among the most challenging to interpret. Despite the great importance of the solar polar areas for numerous solar and astrophysical phenomena (e.g., coronal heating, solar wind acceleration, cosmic ray propagation, etc.), the polar caps are not sufficiently studied because of observational and modeling difficulties. This is due mainly to the weakness of the polar magnetic fields and the unfavorable solar geometry close to the limb, which makes measurement of the polar regions difficult from the ecliptic plane. Instrumental limitations in matters of sensitivity and accuracy are another major handicap. In order to get significant measurements of the polar magnetic field, instruments with high polarimetric sensitivity and spatial resolution are needed.

Chromospheric line-of-sight (LOS) magnetograms from the SOLIS Vector Spectromagnetograph (VSM) are utilized to study the latitudinal distribution of the magnetic flux in the polar regions. These Ca II 854.2 nm magnetograms have an advantage with respect to photospheric magnetograms close to the solar limb because of the spreading canopy structure of the magnetic field in the chromosphere, which provides a better signal in the LOS field close to the limb (see figure 1).

Magnetic flux elements are identified and located using simple closed-structure recognition methods. An average location in terms of latitude is determined for every selected feature and a histogram is computed for their distribution as a function of latitude. The obtained histograms are normalized by the surface area distribution corresponding to each latitude bin to remove any bias due to the observed area of the polar cap. The solar geometry in terms of the polar axis tilt (B_0 angle) is taken into account. This procedure was repeated for every magnetogram

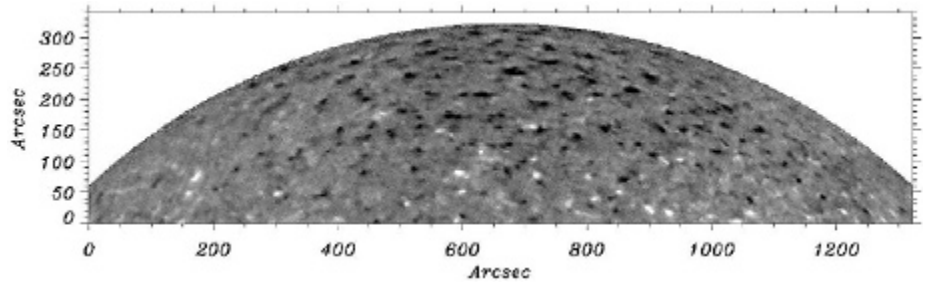


Figure 1. Typical chromospheric (Ca II 854.2 nm) line-of-sight magnetogram from the SOLIS/VSM recorded on 22 October 2006. Flux elements are easily identified due to the good visibility everywhere on the solar disk.

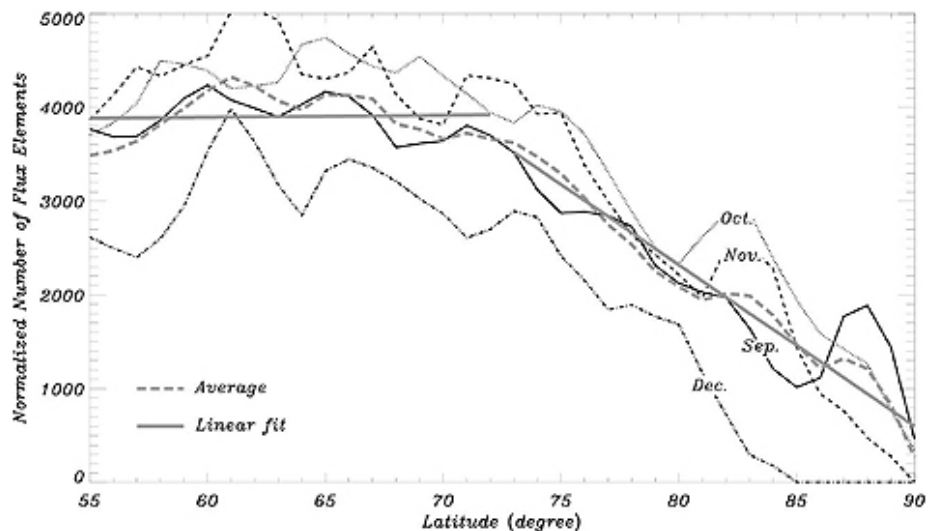


Figure 2. Monthly averaged histograms of the magnetic flux distribution as a function of latitude for the north polar cap. The grey dashed curve is the average of the monthly averages. The straight lines are linear fits for portions of the grey dashed curve for latitudes ranging from 55°–73° and 74°–90°.

recorded in the time interval September–December 2006. The north solar pole is well seen during this period. Daily distribution histograms are noisy, and therefore are averaged for every month and for the whole period considered here.

We find that the density distribution of the magnetic flux elements within the northern polar cap observed during September–December 2006 has a strong dependence on latitude (see figure 2). The flux distribution normalized to the surface of the polar cap is relatively flat up to latitudes of about 75°–80°, where it drops significantly up to the solar pole. This result is confirmed for the whole period of observations considered. There is also a relative difference in the distributions of flux elements

of different sizes. Large flux elements show a preferential high density at low latitudes.

We believe that the mechanisms responsible for the flux transport from low latitudes toward the solar poles are less efficient close to the poles. This means that the meridional circulation responsible for the flux transport slows before reaching the poles. Such a result would have a significant impact on the theories and models dealing with flux transport. These results also put important constraints on solar phenomena that are inaccurately (if at all) determined by other means, such as helioseismic studies that become inefficient at high latitudes. More details will be published in a paper in press with the *Astrophysical Journal* (vol. 668, October 2007).

Cosmology Revealed by WIYN Imaging

Steve Howell

WIYN telescope observations aimed at surveying galaxy clusters for lensing events have struck gold thanks to high-resolution imaging. Using Mini-Mosaic and the Orthogonal Parallel Transfer Imaging Camera (OPTIC), the two workhorse imagers at the WIYN 3.5-meter telescope on Kitt Peak, Joe Hennawi (University of California at Berkeley) and collaborators have found new, exciting examples of lensed systems (see *astro-ph/0610061*).

Hennawi et al. ask the question, “Does the currently favored Λ CDM cosmological model explain the detailed distribution of dark matter in galaxy clusters?” This group is using strong gravitational lensing by clusters of galaxies as a powerful test of this model. They are probing the largest collapsed structures of dark matter in the Universe. The multiply imaged background galaxies and highly distorted giant arcs in well-known clusters like Abell 1689 and CL0024+1654 can be used to construct detailed models of the dark matter gravitational potential. Beside providing cosmological constraints, lensing clusters are natural gravitational telescopes, and their high magnification enables the study of the faintest, most distant known galaxies ($z \sim 6-9$), which would otherwise be unobservable.

Astrophysicists have been studying the same handful of strong-lensing clusters for nearly a decade, and their interpretation and

understanding have been limited by poor statistics. The Hennawi survey aims to dramatically increase the number of known cluster lenses by combining the $\geq 2 \text{ Gpc}^3$ cosmological volume of the Sloan Digital Sky Survey (SDSS) with the exceptional imaging capability provided by the WIYN telescope.

Clusters of galaxies in range $z \leq 0.6$ can be efficiently identified in the SDSS multicolor imaging, which covers $8,000 \text{ deg}^2$; however, the SDSS imaging is too shallow and the image quality too poor to detect the much fainter gravitationally lensed background sources. The strategy of the Hennawi survey is to obtain deep high-resolution WIYN images of the most massive clusters in the SDSS volume. Thus far, the group has imaged ~ 160 clusters in sub-arc conditions and discovered ~ 30 new lensing clusters, nearly doubling the total number of such systems known!

The two new systems shown in figure 1 and 2 (and several others discovered in this survey) will likely become ‘poster-child’ lenses similar to Abell 1689 and CL0024+1654. By conducting the largest survey for cluster lensing to date, this WIYN high-resolution imaging survey will help transform strong lensing by galaxy clusters from the study of a handful of rare systems into a powerful statistical probe of the formation of structure in the Universe.

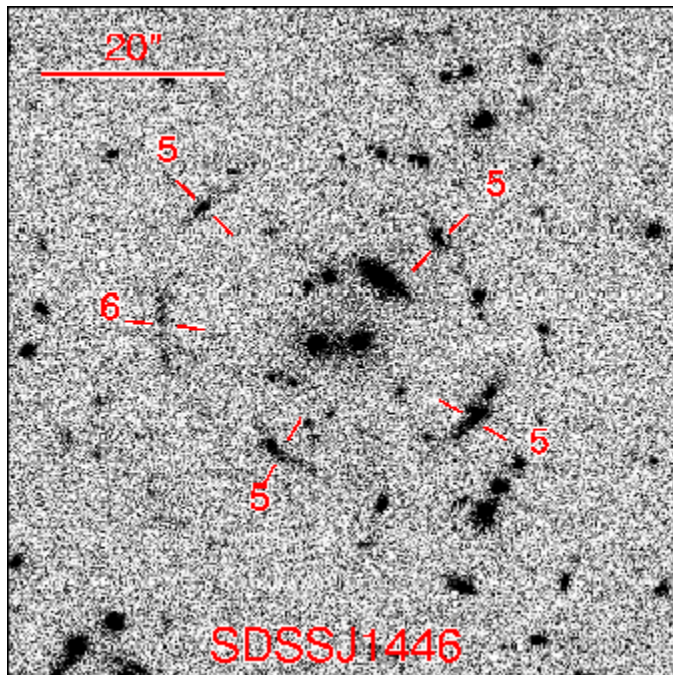


Figure 1. WIYN OPTIC g-band image of SDSSJ1446+3032. This cluster at $z=0.47$ is one of the most dramatic examples of strong gravitational lensing ever discovered. Because of the excellent image quality (FWHM=0.63 arcsec), it is easy to see five extended blue high-surface-brightness arcs oriented in an ellipse about the cluster center.

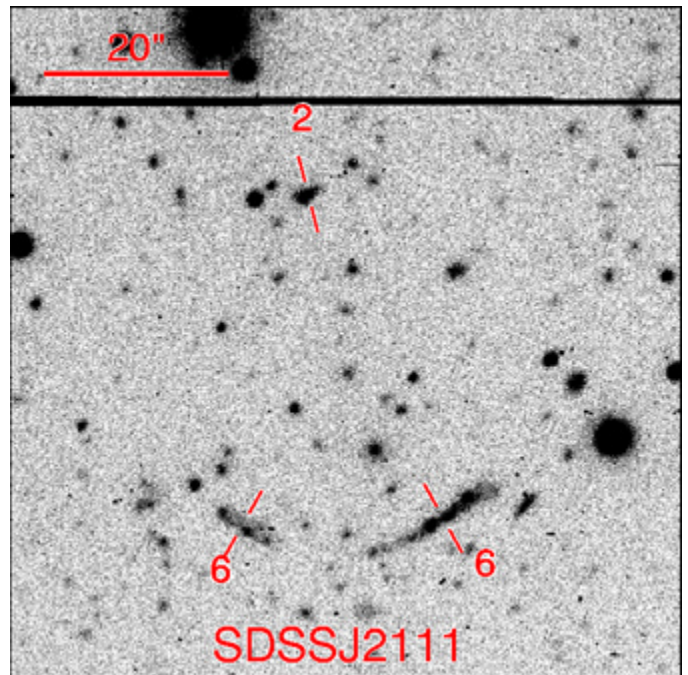
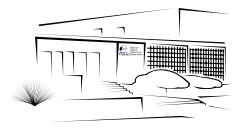


Figure 2. WIYN Mini-Mo image (FWHM=0.74 arcsec) of another lensing cluster, SDSSJ2111-0115 at $z=0.68$. Two very-high-surface-brightness arcs are apparent south of the cluster center, and a possible counter arc is flagged about 40 arcsec to the north.



The Time Domain – A Bigger Change Than You Think

Todd Boroson

As I write this, the Renewing Small Telescopes for Astronomical Research (ReSTAR) committee has been meeting in Washington, DC for the last two days. Their discussions about the facility needs of the community—using input from the many contributions to the ReSTAR Web site—have impressed upon me the difficulty of coming up with a reliable estimate for what the community wants.

How do you know that the input is representative? How do you factor in a reasonable oversubscription rate? How do you adjust for the difference between what people say they will do and what they will actually have time to do? However, these are merely concerns of a quantitative nature. The more interesting questions are those that are qualitative and have to do with the evolution of fields and of capabilities, and how our interests will change as a result. Among these, the '800-pound gorilla' is the time domain.

The door has just been cracked on the time domain, with little bits from projects like the Sloan Digital Sky Survey, MACHO and SuperMACHO, and the Palomar-Quest Survey. Researchers study dozens or even hundreds of variable or transient objects, and explore statistical properties of larger samples. But now we are gearing up for projects that will produce many orders of

magnitude more discoveries, and will require significant new facilities—operated in significantly different ways—to make effective use of those projects.

The Panoramic Survey Telescope and Rapid Response System (Pan-STARRS-1) will soon begin to show us how bad a mess we are in, and by the middle of the next decade, the Large Synoptic Survey Telescope (LSST) will have fundamentally changed the way we view the sky. The need to follow up on short-lived transients, the challenge of putting together programs that provide the appropriate sampling of extrasolar planet transits, cataclysmic variable orbits, reverberation effects in active nuclei, or supernova light curves, will not be satisfied by telling the Time Allocation Committee, "I know I'll have objects whenever my observations are scheduled."

The time domain follow-up network of facilities must be created. It will include 1-meter, 2-meter, and 4-meter telescopes (and maybe larger ones) with optical and infrared imagers and spectrographs. But time will be allocated and observations will be made in a different way.

Your 12,000 spectra of 600 targets will be preprogrammed to give you just the phase coverage you need. You will be allocated 150 target-of-opportunity (TOO) interrupts over

the semester given a certain set of transient characteristics from an LSST "filter" that you have defined. Perhaps 30 percent of the time will be reserved for unanticipated events, requiring some sort of quick-response peer review. And, in between the time domain observations, the telescope will slew to the nearest object from a non-time-critical program and obtain that observation.

We already do this to some extent. We schedule TOO interrupts on our classically operated telescopes. We schedule a series of fractional nights to monitor some object with a known period. The huge quantitative change, however, will drive a huge qualitative change.

Of course, the current projects we do, and our normal observing modes, will not disappear. And bits of the time domain system—VOEvent, the Panchromatic Robotic Optical Monitoring and Polarimetry Telescopes (PROMPT), the Las Cumbres Observatory Global Telescope network, the robotic P60 telescope—are already starting to appear. But the time domain represents such a huge discovery space, and an opportunity to explore a new dimension of the Universe, that it will be an unforgivable waste of the resources that are going into those discoveries if we do not prepare ourselves to systematically follow-up on them.

Update on ReSTAR

The Renewing Small Telescopes for Astronomical Research (ReSTAR) committee concluded a very successful solicitation of community input on the specific and quantitative needs for capabilities on small telescopes. Over 160 individuals ranked capabilities and contributed their ideas through the committee Web site (www.noao.edu/system/restar) in time for their meeting at the end of July. The input was summarized statistically and all the comments were read and discussed by the committee. Their next meeting will be October 15-16 in Chicago.

Announcement of Opportunity for Participation in Large Synoptic Survey Telescope Science Collaborations

Michael Strauss (Princeton University) & the LSST Science Advisory Committee

The science goals of the Large Synoptic Survey Telescope (LSST), a dedicated 8.4-meter wide-field telescope to be placed on Cerro Pachón in the Chilean Andes, have been discussed in numerous forums and meetings. Now it is time for more detailed investigations of the science questions that LSST will address. A call for proposals is being prepared (targeted for release in December) to offer formal participation in the planning and execution of science activities with the LSST, for researchers in the US astronomical and elementary particle physics communities.

The LSST will obtain repeated images of ~20,000 square degrees in six pass bands (u,g,r,i,z,Y) during a ten-year survey of the southern-hemisphere sky. Individual visits by LSST to each 10 square-degree field will reach $r = 24.7$ (5σ for point sources) in a pair of 15-second exposures, and each field will be imaged ~1,600 times, spread over the six bands, with co-added aggregate images reaching $r \sim 27.6$ AB mag.

The current project plan calls for telescope commissioning to begin in 2014. Survey operations are expected to begin in 2015. This survey will enable a vast range of investigations that can exploit the depth, sky coverage, and time-domain sampling provided by the LSST data. The design of the telescope and operations is driven by four core science goals:

- Investigating the Nature of Dark Energy and Dark Matter
- Taking an Inventory of the Solar System
- Exploring the Transient Optical Sky
- Mapping the Milky Way

Detailed descriptions of the core project goals and design criteria can be found in the LSST Science Requirements Document at www.lsst.org/Science/docs/SRD.pdf. Previous discussions of the science drivers for the project can be found at various sites, including www.lsst.org/Science/community_input.shtml, www.lsst.org/Science/science_goals.shtml, and most recently, www.lsst.org/Meetings/AAS/2007/AAS209.shtml.

The LSST vision is built on the notion that a survey that primarily addresses the four core goals above will also be useful for a wide range of other scientific investigations. LSST will go deeper and will cover a wider range of wavelength than any other steradian-class sky survey, and its extensive time domain coverage over such a large solid angle will be unprecedented. It is in this context that the LSST Board of Directors and LSST Project Director, Tony Tyson, have established a series of Science Collaborations in broadly defined scientific areas in which LSST will provide opportunities for scientific investigation. The collaborations have been initially seeded by members from the LSST partner institutions. The chairs of the seed collaborations have been appointed for a period of two years; future leadership of the col-



This image from the Deep Lens Survey (DLS) provides a sense of LSST imaging data. The DLS image shows roughly ten times as many galaxies per unit area as images from the Sloan Digital Sky Survey, and LSST data will actually go deeper than the DLS. LSST images will also have better resolution, and each will cover 50,000 times the area of a DLS image, in five different optical bands.

Image credit: Deep Lens Survey/University of California-Davis/NOAO

laborations will be chosen by the full complement of their respective members, in consultation with the chair of the LSST Science Advisory Committee and the LSST director.

In addition, new collaborations, or even competing collaborations, may be formed (see more below). The collaborations are organized by science area, with the explicit understanding in the project that there will be many areas in which different groups have overlapping interests. The tasks of the Science Collaborations are to:

- develop and document in more detail the science opportunities provided by the LSST
- provide input to aspects of the LSST design that remain under discussion such as the planned cadence, software and database design, filter design, etc.
- develop a roadmap and participate in precursor studies, calibrations, algorithm development, etc., that may be required in

continued

Participation in LSST Science Collaborations continued

advance of first light, so that it is possible to take full advantage of LSST early in its operational phase

- participate actively in the commissioning of the telescope, instrument, and data system by using the early data to do science, and thus determine the data quality, identify any systematic effects, etc., and recommend ways to address any problems that are identified.

Prospective applicants can get a sense of the science goals of the existing collaborations from posters presented at the January 2007 American Astronomical Society meeting, which can be found at www.lsst.org/Meetings/AAS/2007/AAS209.shtml.

With this pending announcement, we are alerting members of the broader US astronomical and particle physics communities that we will soon invite them to apply to join one of the existing collaborations, or to propose and constitute a new collaboration, either in one of the existing areas or in a new area.

Receipt and review of applications will be organized by NOAO and the Stanford Linear Accelerator Center/Kavli Institute for Particle Astrophysics and Cosmology (SLAC/KIPAC) on behalf of the LSST Corporation. The review will involve individuals representing both the astronomical and particle physics communities. Recommendations from the review process will be forwarded to the LSST director for approval. Membership in the Science Collaborations is open to individuals from both the astronomy and physics communities, so applications submitted through either NOAO or SLAC will be given full and equal consideration.

The Science Collaborations will work closely with the LSST project as it builds the telescope, camera, and software, and the collaborations will be expected to play a substantial role in the scientific commissioning of the project. The chairs of each Science Collaboration comprise the LSST Science Advisory Committee (SAC), which is chaired by Michael Strauss (Princeton). The SAC reports to LSST System Scientist Zeljko Ivezic (University of Washington) and to LSST Project Director Tony Tyson (University of California-Davis).

It should be emphasized that because the LSST data taken during the operations phase will be made public immediately, there is no requirement that an individual be a member of a Science Collaboration in order to use these data. However, in practice, the Science Collaborations will be closer to the instrument, software, and data-taking process, and therefore will better understand its characteristics than people from the general community just starting to work with the data after commissioning is completed. Moreover, the collaborations will be able to influence the LSST in decisions on cadence and software, as described above, and members of the Science Collaborations will be welcome to attend relevant LSST technical meetings.

The LSST project does not plan to explicitly fund the science operations, since the NSF major facilities and research equipment program, to which LSST has applied for construction funds for the telescope facility, cannot be used to fund research.

Therefore, project support for the Science Collaborations will be limited to funds for phone conferences and support for science com-


missioning activities required to complete the construction phase. The Science Collaborations will be encouraged to submit proposals to the NSF, DOE, or other funding sources to support precursor work and science projects to be carried out with data from the LSST operations phase.

The proposal and selection process is presently being structured and initiated. Expect to see a detailed announcement on the NOAO, SLAC, and LSST main web pages (www.noao.edu, www.slac.stanford.edu, and www.lsst.org) with application forms and discussion of the specifics by which proposals will be judged. You will be asked to include a description of the science program that you would like to pursue, a description of your expected contribution to the Science Collaboration of your choice, and a list of recent publications and/or experience relevant to the work of the Collaboration.

Membership in a Science Collaboration represents a serious commitment of time and energy. Thus, if you apply for membership in more than one Science Collaboration, you should submit separate applications and justify your time commitment to each. Finally, the initial Science Collaborations listed do not attempt to cover all possible science to be done with LSST; if you are interested in defining another Science Collaboration, you will be asked to describe why you think such a group is necessary, and to suggest other members in it.

The current Science Collaborations and their initial chairs are:

- Supernovae: Michael Wood-Vasey (Harvard-Smithsonian Center for Astrophysics)
- Weak lensing: David Wittman (UC-Davis) and Bhuvnesh Jain (University of Pennsylvania), co-chairs
- Stellar Populations/Variable Stars: Abi Saha (NOAO)
- Active Galactic Nuclei: Niel Brandt (Pennsylvania State University)
- Solar System: Steve Chesley (Jet Propulsion Laboratory)
- Galaxies: Harry Ferguson (Space Telescope Science Institute)
- Transients: Shri Kulkarni (Caltech)
- Large-scale structure/baryon oscillations: Andrew Hamilton (University of Colorado)
- Milky Way structure: Connie Rockosi (University of California-Santa Cruz)
- Strong lensing: Phil Marshall (University of California-Santa Barbara)

Please send any questions to lsstcollabqueries@noao.edu. We will begin posting answers soon to frequently asked questions at www.lsst/collab_faqs.noao.edu. 

Workshop on Ground-Based Optical Interferometry

Stephen Ridgway



The CHARA Array on Mount Wilson, showing telescopes E1 and E2 (separation 75 meters) and the vacuum light pipe. Other telescope separations range from 34 to over 300 meters. NOAO participated in the CHARA Array project in several ways. Under contract with Georgia State University, NOAO carried out design of the telescopes, design of custom optical mounts and subsystems, and design and fabrication of major parts of the vacuum beam transport system. It also provided components for the first-light beam combiner and data system.

(Photo credit: S. Ridgway and NOAO/AURA/NSF)

Since the Bahcall Committee gave a high priority to technology development for optical interferometry in the decadal survey of 1990, prototype experiments have led the way to the first generation of user facilities. As optical interferometry now comes of age (with approximately 100 science papers published in the last two years), it is becoming clear that high spatial resolution is sparking a revolution in stellar physics. At the same time, filled-aperture technology is approaching its limits with an Extremely Large Telescope (ELT), yet still falling short of fully relieving confusion in crowded regions. We are still very far from resolving main structure in compact and/or distant sources.

The 2005 report of the community-based Optical/Infrared Long Range Planning Committee, “Strategies for Evolution of US Optical/Infrared Facilities” (www.noao.edu/dir/lrplan/strategies-final.pdf), included a recommendation for further study of a next-generation infrared interferometer featuring sub-milliarcsecond resolution and faint-target capability.

Given this recommendation and the looming start of the next decadal survey, it is timely to look beyond the unique capabilities of today’s optical and near-infrared arrays, and consider what science opportunities may be enabled by the performance of future arrays. In order to shape and inform discussions of the future of interferometry for long-range planning at NOAO, a community workshop was convened in Tucson in mid-November 2006.

This international workshop was sponsored and supported by AURA, NOAO, the NOAO New Initiatives Office, and the Georgia State University Center for High Angular Resolution Astronomy (CHARA).

Fifty scientists participated, including both experienced users of interferometry and experts in scientific areas to which interferometry might contribute in the future.

The workshop was oriented around four themes:

- science opportunities with a next-generation optical array
- array concepts
- candidate sites
- current arrays and future technologies—toward a roadmap to the future.

During the workshop and in the following weeks, the participants developed a consensus of findings and recommendations. The participants’ major conclusions are:

1. Optical interferometry offers a unique and powerful resource for astrophysics.
2. Two significant opportunities exist:
 - a. Very-high angular resolution studies of compact sources. The highest-priority science objective is the detailed study of circumstellar material related to star and planet formation. A second high-priority objective is the study of energetic and interacting systems, including active galactic nuclei (AGNs), relativistic stellar systems, and binary systems with mass transfer.
 - b. High angular resolution observations over extended fields with high sensitivity. The highest priority science objectives in this area include deep imagery and photometry of stellar fields in distant galaxies that are confusion limited with ELTs.
3. The scope of a next-generation facility requires national coordination at a minimum; international collaboration may be essential.

continued

CTIO Partnerships continued


4. Vigorous programs with current generation interferometer arrays will clarify and assure the scientific motivation and technical foundation for significant future projects.

Two promising concepts have been identified. High angular resolution within a wide field can be achieved with a compact array of large apertures (as in the Large Binocular Telescope). Very-high angular resolution within a narrow field is possible with a classical array consisting of a sparse distribution of moderate apertures.

The workshop also prepared a lengthy series of recommendations to NOAO, NSF, and the interferometry science community. The first recommendation to NOAO, which seems particularly timely in light of report of the NSF Senior Review, is to “support or otherwise facilitate broad community access to existing US optical interferometer facilities under competitive, peer-reviewed guest observer programs.” Additional recommendations to NOAO concerned primarily technology, concept and program development.

The recommendations to NSF emphasized funding for facilities, and bringing existing interferometry facilities further into mainstream astronomy, including the optical/infrared system and access to competitive funding opportunities for instrumentation and technology.

Workshop recommendations to the interferometry community focused on improvement of imaging capabilities and sensitivity, and on scientific program development and implementation, particularly including better communication of the opportunities offered by current capabilities to scientists who may wish to exploit them.

A synopsis of the workshop sessions and the detailed recommendations on science opportunities, technical rationale, and the roadmaps, can be found at www.noao.edu/meetings/interferometry/Workshop-report.pdf, and further input is welcomed. 

GSMT Program Office News

Jay Elias & Steve Strom

The revised role of the Giant Segmented Mirror Telescope Science Working Group (GSMT SWG) was outlined in the June 2007 NOAO-NSO Newsletter. Since then, the SWG has resumed its activities with a modified membership (listed at www.gsmt.noao.edu). The SWG will continue to be chaired by Rolf-Peter Kudritzki (University of Hawaii), with Steve Strom (NOAO) as vice-chair.

Initial activities for the coming year include completion of the studies underway from last year, and a “hand-off” meeting between past and present members of the working group. Links to published reports from the SWG can be found on the GSMT Program Office Web site listed above.

AURA wishes to express its gratitude to the departing SWG members for their past efforts, and to thank new and continuing members for their willingness to continue to work in support of community access to extremely large-aperture telescopes.



Gemini Observing Opportunities for Semester 2008A

Verne V. Smith

The NOAO Gemini Science Center (NGSC) encourages the US community to take advantage of Gemini observing opportunities for semester 2008A (1 February 2008 – 31 July 2008). US Gemini observing proposals are submitted to and evaluated by the NOAO Time Allocation Committee (TAC).

The formal Gemini “Call for Proposals” for semester 2008A will be released on or about 1 September 2007, with a US proposal deadline of Monday, 1 October 2007 (since the nominal 30 September deadline is on a Sunday). As this article is prepared well before the release of the Call for Proposals, the following list of instruments and capabilities is only our expectation of what will be offered in semester 2008A. Please watch the NGSC Web page (www.noao.edu/usgp) for the Gemini Call for Proposals, which will list clearly and in detail the instruments and capabilities that will be offered.

NGSC anticipates the following instruments and modes on Gemini telescopes in 2008A:

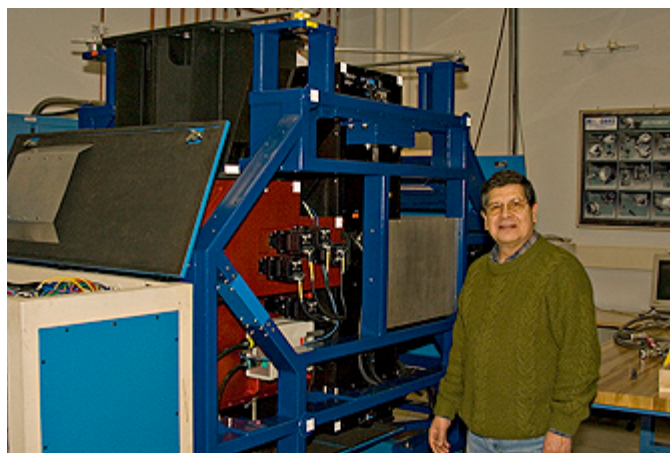
Gemini North:

- Near-infrared Integral Field Spectrometer (NIFS).
- Near Infra-Red Imager (NIRI) and spectrograph with both imaging and grism spectroscopy modes.
- Altair adaptive optics (AO) system in Natural Guide Star (NGS) and Laser Guide Star (LGS) modes. Altair can be used with NIRI imaging and spectroscopy and with NIFS IFU imaging and spectroscopy, as well as NIFS IFU spectral coronagraphy.
- Michelle, mid-infrared (7-26 micron) imager and spectrometer, which includes an imaging polarimetry mode.
- Gemini Multi-Object Spectrograph (GMOS-North) and imager. Science modes are imaging, multi-object spectroscopy (MOS), long-slit spectroscopy, and integral-field unit (IFU) spectroscopy. Nod-and-Shuffle mode is also available.
- All of the above instruments and modes are offered for both queue and classical observing.
- There is a change in policy for classical observing runs at Gemini in 2008A; the previous three-night minimum limit for a classical run is removed and **classical runs can be one night** or more (integer nights only, though).
- More details on use of the LGS system can be found at www.gemini.edu/sciops/instruments/altair/altairLaserGuideStar.html, but there are a few points that should be emphasized. Target elevations must be >40 degrees and proposers must request good weather conditions (Cloud Cover=50 percent or better, and Image Quality=70 percent or better, in the parlance of Gemini observing conditions). Proposals should specify “Laser Guide Star” in the Resources section of the Observing Proposal. Because of the need for good weather, LGS programs must be ranked in Bands 1 or 2 to be scheduled on the telescope.

- Time trades will allow community access to the high-resolution optical spectrograph (HIRES) on Keck, as well as to the Suprime-Cam wide-field imager and the infrared imager and spectrograph (MOIRCS) on Subaru.

Gemini South:

- Thermal-Region Camera Spectrograph (T-ReCS) mid-infrared (2-26 micron) imager and spectrograph.
- Gemini Multi-Object Spectrograph (GMOS-South) and imager. Science modes are imaging, multi-object spectroscopy (MOS), long-slit spectroscopy, and integral-field unit (IFU) spectroscopy. Nod-and-Shuffle mode is also available.
- Phoenix, high-resolution infrared spectrograph. It can be requested in either queue or classical mode.
- Near-Infrared Coronagraphic Imager (NICI) is a 1- to 5-micron dual-channel coronagraphic imager that is optimized to use the Simultaneous Spectral Differential Imaging (SSDI) technique to detect faint sub-stellar companions to stars. NICI is undergoing commissioning during 2007B, and it is anticipated that it will be offered for general user proposals in 2008A. At the time of this writing, the decision on whether NICI will be offered had not been made. Interested users should watch for the 2008A Call for Proposals. For general information on NICI, consult the Web at www.gemini.edu/sciops/instruments/nici/niciIndex.html.
- All modes for GMOS-South and T-ReCS are offered for both queue and classical observing.
- There is a change in policy for classical observing runs at Gemini in 2008A; the previous three-night minimum limit for a classical run is removed and **classical runs can be one night** or more (integer nights only, though).



Gemini senior instrumentation technician Luis Hernán Solís with NICI in the Cerro Pachón lab. Photo credit: Ken Don/NOAO/AURA/NSF

continued

Gemini Observing Opportunities for Semester 2008A continued

We note that due to the April 2007 accident that damaged GNIRS, the instrument is currently being repaired and refurbished. Its availability for semester 2008A is uncertain at the time of this writing. Interested users should monitor the Gemini Web site that provides the latest updates on the status of GNIRS (www.gemini.edu/sciops/instruments/nirs/nirsIndex.html).

Detailed information on all of the above instruments and their respective capabilities is available at www.gemini.edu/sciops/instruments/instrumentIndex.html.

The percentage of telescope time devoted to science program observations in semester 2008A is expected to be greater than 85 percent at Gemini North and greater than 75 percent at Gemini South.

We remind the US community that Gemini proposals can be submitted jointly with collaborators from other Gemini partners. An observing team requests time from each relevant partner. Multi-partner proposals are encouraged because they access a large fraction of the available Gemini time, thus enabling larger programs that are likely to have substantial scientific impact. Please note that all multi-partner proposals must be submitted using the Gemini Phase I Tool (PIT).

Note that beginning in semester 2007B, proposers have the option to fill in a so-called "Band 3" box, in which they can optimize their program execution if it is scheduled on the telescope in Band 3. Historically, it has been found that Band 3 queue programs have a higher probability of completion if they are smaller than average and if they use weather conditions whose occurrences are more probable. Users may want to consider this option when preparing proposals.

Efficient operation of the Gemini queue requires that it be populated with programs that can effectively use the full range of observing conditions. Gemini proposers and users have become increasingly experienced at specifying the conditions required to carry out their observations using the on-line Gemini Integration Time Calculators (ITCs) for each instrument. NGSC reminds you that a program has a higher probability of being awarded time and of being executed if ideal observing conditions are not requested. The two conditions that are in greatest demand are excellent image quality and no cloud cover. We understand the natural high demand for these excellent conditions, but wish to remind proposers that programs that make use of less than ideal conditions are also needed for the queue.

There is a continuing need for proposals that can be run under the poorest conditions. To help fully populate the queue, a category of "Poor Weather" proposals has been established. Poor-weather programs may be submitted for any facility instrument; for these proposals, neither the Principle Investigator nor the partner country will be charged for any time used. For additional information, please see www.gemini.edu/sciops/ObsProcess/ObsProcCFP_background.html.

NOAO accepts Gemini proposals via either the standard NOAO Web proposal form or the Gemini PIT software. We note to proposers who plan to use the PIT that NOAO offers a tool that allows proposers to view how their PIT proposal will print out for the NOAO TAC (please see www.noao.edu/noaoprop/help/pit.html).

Feel free to contact me (vsmith@noao.edu) if you have any questions about proposing for US Gemini observing time. ☺

Altair and the Laser Guide Star System at Gemini North

Bob Blum

The Gemini North facility adaptive optics (AO) system, Altair, continues to see routine use on the telescope. In semester 2007A, commissioning of the laser guide star system (LGS) was completed and the combined LGS-Altair facility system entered regular scientific use.

This is a major milestone in the development of high angular resolution capability at Gemini. An image of the laser in operation is shown below. The laser system, including the launch telescope (which sits above the secondary mirror), is similar to the system being integrated at Gemini South for its multi-con-

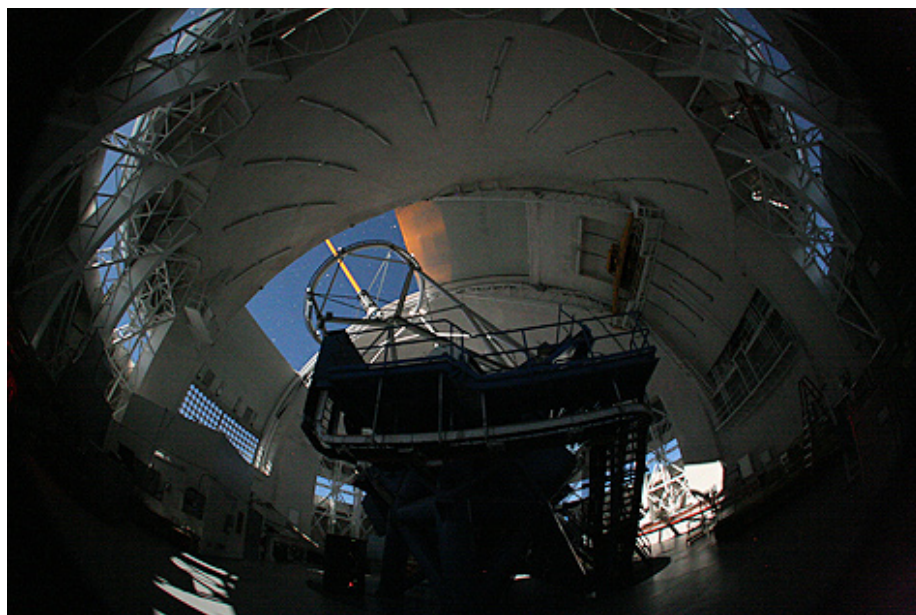
jugate adaptive optics system (MCAO). The MCAO system will deploy five laser beacons simultaneously, "multiplexed" into a five-star constellation, using a more powerful laser than the ~14W unit at Gemini North.

For those behind the AO curve (isn't it time you applied for time with Altair/NIRI/NIFS?), Altair is a 177-element Shack-Hartmann sensor system with a deformable mirror conjugated at the ground (with use of a deployable field lens) and running in closed loop at a maximum of 1,000 Hertz for top performance. The addition of the laser greatly increases the areal coverage of Altair.

Without the laser, a bright ($R < 12$ for full correction) natural guide star (NGS) is required. At galactic latitudes greater than 30 degrees, the availability of such stars is a few percent or less. With the laser, a much fainter NGS is needed (about $R = 15$ for full correction). At 30 degrees, the sky coverage is then ~20 percent. In both NGS and LGS modes, fainter stars can be used but with lesser degrees of atmospheric correction (15 and 18, for NGS and LGS, respectively, in full moon). In both cases, the AO system results in near diffraction-limited images, with the NGS mode consistently producing the very best on-axis images.

continued

Altair and Laser Guide Star System continued



The Laser Guide Star (LGS) system in operation at Gemini North. The 14W laser is propagated from a small launch telescope mounted behind the secondary mirror. The laser beam is generated on the azimuth platform, and relayed up the telescope tube and across the secondary support by all-reflective transfer optics [see www.noao.edu/noao/noaonews/sep07/pdf/ for a color image]. This wide-angle view was obtained in late June 2007, during normal science operations. Photo credit: Paul Hirst/Gemini Observatory

Altair actually uses four different wave front sensors (WFS), depending on the mode in which it is being used. Users need to be aware of these modes because each has separate limits. For NGS, it is relatively simple: the NGS Shack-Hartmann WFS is used and it handles tip-tilt, defocus, and higher-order correction. There is a separate LGS WFS that does only higher-order corrections, based on the laser star or spot (about 1.5 arcsecs projected on the sky). The effect of atmospheric tip-tilt is, to first order, canceled for the LGS, since the wavefront sees nearly equal and opposite tips and tilts on its way up to the 90-kilometer sodium layer and back. This is why a separate tip-tilt NGS is needed.

An independent WFS called “STRAP” is used for NGS tip-tilt in LGS mode. Since the laser spot is tuned to the sodium transition wavelength, the remainder of the light below one micron can be fed to the STRAP. STRAP is a quad-cell avalanche photo diode (APD) sensor and, since it is a photon counting device, it is very sensitive. Because it is so sensitive, STRAP can be damaged by bright light sources and it has a strict brightness cutoff at R=10 mag. For brighter tip-tilt stars, STRAP uses a neutral-density filter to decrease the

incident flux by eight magnitudes. Thus, it is most efficient to choose STRAP guide stars that are fainter than R=10.

The last WFS is called the “slow focus” WFS. It uses a small amount of the optical light passed toward STRAP from the same guide star. The slow-focus sensor’s job is to reliably track the “true” focus of the system as measured by a star. The LGS WFS is sensitive to changes in focus (which it will correct for) due to the changing altitude of the sodium layer. These changes are a combination of systematic range changes due to the telescope elevation motion and variations in the true altitude of the sodium layer. Therefore, the NGS brightness limit for use with the LGS system (R=18 at full moon, R=18.5 at new moon) is set by the need for both tip-tilt and slow-focus correction.

For reasons explained in the NOAO Gemini Science Center (NGSC) section of the December 2005 *NOAO-NSO Newsletter* and fully described on the Gemini Web pages, Altair normally uses a field lens that restricts the guide star separation from the science target to a distance of 25 arcsecs or less. The highest Strehl ratio images will then occur for targets

observed close to bright guide stars. (Recall that Strehl ratio is just the ratio of peak intensity to the diffraction-limited theoretical peak intensity.) Strehls of 25 percent (LGS, R=12 guide star) and 45 percent (NGS, R=9 guide star) have been recorded in the K-band. The latter corresponds to approximately 65 milli-arcsec (mas) FWHM while the former is 83 mas FWHM. Optimization of the LGS mode is ongoing.

Each of the WFS described above need to be configured rapidly when slewing to a new science target. Starting with accurate coordinates provided by the Gemini Observing Tool, the individual WFS are deployed and their loops closed at the rate appropriate to their brightness. This includes setting neutral-density filters if needed, choosing the appropriate wavelength range, and such details as whether or not the Cassegrain instrument rotator will be “fixed” to the telescope or “following” to remove the alt-az telescope field rotation on the sky.

Once observations have begun, the WFS and associated loops must account for dithers on the science field, and motion to and from sky positions. Initiating a sequence requires the skilled work of the Gemini telescope operators, but the ensuing observations—including the myriad off-loads from all WFS and associated mechanisms to the primary, secondary, launch telescope, and more—now are handled automatically by the telescope control system. In NGS, Altair has been reduced to “just another guider.” While somewhat demeaning, this is a wonderful state of affairs for routine observation near the diffraction limit of an 8-meter telescope. The NGS system is regularly run with just two people: an operator, or system support associate (SSA) in Gemini parlance, and the observer.

For LGS, the situation is still a bit more complicated, but the system is in normal, routine use as of this semester (2007A). The need to keep the laser tuned, powered, and centered in the launch telescope requires, for now, a laser specialist in addition to the SSA and observer. Typically, this poor soul is as forlorn as the classic Maytag washing machine repairman. But occasionally, to the great delight of the laser specialist, something requires attention.

continued

Altair and Laser Guide Star System continued

In addition to the specialist, the laser requires a small band of “spotters” to watch for aircraft and clouds entering the laser zone. This hardy band of laser enthusiasts is in constant radio contact with the SSA. A crew of four and a driver rotate through shifts sitting out in the cold Mauna Kea night air, with two spotters deployed at any given time each night while the laser is propagating. This extra level of support (required by civil air transport authorities) means the laser is not scheduled on every night like the other non-laser instruments used in the general observing queue at Gemini. Currently, the laser runs are blocked into the schedule for at least one week per month, with longer runs possible depending on demand.

Two other issues affect normal LGS operation and schedule. First, the US Air Force Space Command requires three day’s advance warning for LGS targets. Second, LGS targets are subject to “beam collision avoidance” rules so that they do not pass through the field of view of another telescope on Mauna Kea. An automated Web system is run on Mauna Kea to track the current laser pointing on the sky

and alert users of all the observatories regarding potential collisions.

The table below shows the breakdown of approved Altair programs at Gemini North (both NGS and LGS). The laser itself is sensitive to attenuation by clouds, meaning it requires essentially clear conditions. Proposers should chose “photometric” conditions (CC=50), but can state in their proposals if a small amount of cirrus is acceptable. The LGS can usually run with attenuations up to about 10 percent. An issue here is that the attenuated light is heavily backscattered off low clouds, causing a high background that swamps the laser spot. Both NGS and LGS work best with typical site-delivered image quality, so most programs should chose IQ=70 conditions, but the NGS mode can work in somewhat worse conditions with bright guide stars. Because the required LGS conditions (which affect guide star brightness too) are generally good, laser programs are only done in Bands 1 and 2.

This table provides a snapshot of Altair programs for 2007A (as scheduled, not necessar-

ily completed), for both NGS and LGS. Altair use varies a good deal among the smaller partner shares as expected, since a few programs can dominate the distribution. The relatively large UK program shows healthy AO interest, while the US time allocation to Altair science is a bit disappointing, at least for this one semester. Now that the LGS has become fully operational, providing much improved sky coverage, it can be expected that use will expand in our community.

Potential users of Altair and the LGS system are encouraged to contact members of the NGSC to learn more about the capabilities of Altair and the LGS system, and associated instrumentation on Gemini North.

I would like to thank C. Trujillo (Gemini Observatory) and K. Olsen (NOAO) for useful discussions while writing this article, and the staff of Gemini Observatory for hosting my visit in July 2007. It was a pleasure to see Altair/LGS in operation, observe on Mauna Kea, and interact with the Gemini staff in Hilo for an extended stay.

2007A Altair Programs (NGS+LGS) in Bands 1 and 2

	Argentina	Australia	Brazil	Canada	Gemini	U Hawaii	UK	US
Band 1	0.0	0.0	4.5	5.9	19.9	0.0	1.2	5.0
Band 2	0.0	8.0	2.4	25.8	6.0	10.0	40.8	36.0
Total	0.0	0.0	6.9	31.7	35.9	10.0	42.0	41.0
Fraction of partner time allocation*	0%	17%	68%	25%	45%	10%	17%	12%

*Assumes 60 percent of total partner time for 2007A is Band 1 and 2. See the Gemini 2007A Call for Proposals for the partner science time allocation.

Gemini Observing Overhead Revisions

Ken Hinkle

In Phase I planning for Gemini observations, the time requested must include the “overhead.” The overhead includes typical times to point the telescope to a new target and to align the target for observation as well as instrument-related closed shutter times. Overhead estimates change as Gemini both evaluates statistics from previous observing runs and tunes the efficiency of the telescope and instruments. Proposal writers should confirm they are using the current overhead numbers since revised values appear in the Observing Tool and on the instrument Web pages with little fanfare.

Designing GMOS Masks Without Pre-Imaging

Ilona Soechting (UK Gemini Science Office at Oxford University)

Starting with selected programs in semester 2007B, Gemini will be offering the option to design Gemini Multi-Object Spectrograph (GMOS) masks without pre-imaging. New Gemini IRAF scripts allow one to construct object tables compatible with GMMPS (the GMOS mask design software) using target lists, without having to know the corresponding X and Y positions on the GMOS CCDs. The same scripts can also produce a pseudo-GMOS image from, for example, a DDS or SDSS frame, which can be used to visualize the target and slitlet positions in GMMPS.

The high accuracy of the transformation has been shown in on-sky tests to produce a light loss of less than 10 percent for 1-arcsec slits for each object on a mask. For total exposure times of less than six hours, this corresponds to less time loss than would be incurred by taking the shortest possible pre-image.

The new software will have several new applications beyond the capacity of the current mask-making software. It can design masks for approved programs using wider slits (1 arcsec or wider) than had

been previously possible. There is a gain in efficiency for programs with short to medium integration times (less than ten hours), since pre-imaging is not necessary. Masks can be created rapidly for targets of opportunity.

The implicit ability to design masks from other images also provides a mechanism for optimization of the base position and position angle during the Phase II process for all MOS programs. The mask will no longer be constrained to have the same position and orientation as the pre-image. This will also assist during the proposal process, as the number of masks needed (and the number of targets per mask) can be assessed in detail using pre-existing images.

The new scripts will be included in the next release of Gemini IRAF. Until then, the scripts and corresponding instructional Web pages will be made available by the author to Gemini users on request (see gemini.physics.ox.ac.uk/contact/contact.html for contact information).

The Gemini Science 2007 Meeting at Iguazu

Katia Cunha & Verne V. Smith

More than 130 participants from the seven-country Gemini partnership met June 11–15 at Iguazu, Brazil, near the Foz de Iguazu park, to discuss current Gemini science results and capabilities, as well as future research goals, programs, and collaborations.

The Laboratório Nacional de Astrofísica (LNA), in its role as the Brazilian National Gemini Office, hosted the meeting, and Albert Bruch of the LNA chaired the Local Organizing Committee. The Scientific Organizing Committee was chaired by Verne Smith, director of the NOAO Gemini Science Center. A number of major themes within current astrophysical research were covered by 60 oral presentations and about 45 poster papers. The available Gemini capabilities were highlighted by results presented at the meeting, demonstrating the observational power that the Gemini suite of instruments provides to the partner community.

Following the three-day science meeting, a one-day Gemini Users meeting was held. Topics discussed included scientific productivity, current operations, the time



Participants at the Gemini Science 2007 meeting, Iguazu, Brazil.
Photo credit: Peter Michaud/Gemini Observatory

allocation process, and current and future instrumentation. On the fifth day, members from both the Gemini Observatory staff and the National Gemini Offices reviewed issues related to user support and how the current organizational structure can best serve its broad user community.

More information on this meeting, including the list of talks and posters, can be found at www.lna.br/~gsm2007/, www.gemini.edu/sciops/ObsProcess/ObsProcUsersMtg.html, and www.gemini.edu/index.php?option=content&task=view&id=236. The next meeting in this series is tentatively scheduled for 2010.

The Loss of GNIRS and the Special Call for Proposals for 2007B

Verne V. Smith & Ken Hinkle

In late April, the Gemini Near-Infrared Spectrograph (GNIRS) was damaged during routine maintenance. Details can be found on Gemini Observatory's GNIRS Web page (www.gemini.edu/sciops/instruments/nirs/nirsIndex.html). Repairs, which include the acquisition of a replacement infrared array detector, are expected to take at least six months. As a result, GNIRS time was not scheduled for semester 2007B.

Driven in part by the temporary removal of GNIRS from the Gemini South suite of instruments, an ongoing science-driven discussion is taking place at Gemini about whether GNIRS, after the repairs are completed, is more appropriately based at Gemini North rather than Gemini South. Prospective GNIRS users should check the Call for Proposals and the Gemini Web site for further news.

Due to the loss of GNIRS through at least all of semester 2007B, the Gemini Observatory issued a "Special Call for Proposals" for Gemini South. This Special Call was restricted to bright time (or a sky-brightness index of SB=80 or 100, as defined in the Gemini Phase I

Observing Tool) on the instruments GMOS-S, T-ReCS, or Phoenix. The visitor instrument Phoenix was scheduled to move to the SOAR telescope, but this move was postponed in order to provide Gemini users with the opportunity to use Phoenix, in lieu of GNIRS, on Gemini South throughout 2007B.

At the time of the GNIRS accident, each of the Gemini partner Time Allocation Committees (TACs) had either already met or were in the process of meeting. In order to determine how much time would need to be filled with the loss of GNIRS, all of the partner TACs graded and ranked the submitted GNIRS proposals, with the highest ranked GNIRS proposals being merged together at the Gemini International TAC (ITAC), as would be done normally if GNIRS were operational. The semester 2007B schedule was then first put together with the GNIRS programs included in order to determine which would have gone into the various Bands 1, 2, or 3. Without its loss, some 390 hours of time would have been devoted to GNIRS programs in 2007B. This 390 hours was then awarded under the Special Call as replacement for the GNIRS programs.

Proposals submitted under the Special Call were due at Gemini by May 30. Each Gemini partner was responsible for grading and ranking their own proposals. There were 80 US proposals submitted in response to the Special Call, and these proposals were reviewed by subsets of the NOAO TAC panels (one for Solar System and Extragalactic, respectfully, and two for Galactic).

We owe a great deal of thanks to the NOAO TAC members, who agreed to review these proposals on very short notice. The graded and ranked list of US programs was then merged with similar lists from each of the Gemini partners at a special Gemini ITAC meeting held in June.

The response to the Special Call for Proposals from the Gemini partners was very heavy, with 1,842 hours of requested time from all partners spread across 120 proposals. The NOAO community responded enthusiastically, with 1,200 hours requested (in 80 proposals) for 190 hours of vacant US GNIRS time. This represents an oversubscription rate of over 6-to-1 for the Special Call, with particularly heavy demand for Phoenix and T-ReCS from the US community.



Gemini science fellow Steve Margheim helps prepare Phoenix for semester 2007B observing. Photo credit: Ken Don/NOAO/AURA/NSF

NGSC Instrumentation Program Update

Verne Smith & Mark Trueblood

The NGSC Instrumentation Program continues its mission to provide innovative and capable instrumentation for the Gemini telescopes in support of frontline science programs. This article gives a status update on Gemini instrumentation being developed under the oversight of the NGSC, with progress since the June 2007 NOAO/NSO Newsletter.

NICI

The Near Infrared Coronagraphic Imager (NICI) will provide a 1- to 5-micron dual-beam coronagraphic imaging capability on the Gemini South telescope. Mauna Kea Infrared (MKIR) in Hilo is building NICI, under the leadership of Doug Toomey.

NICI continues commissioning on the Gemini South telescope. MKIR recently delivered final versions of manuals for Gemini review prior to contract closeout. This will be the last update on NICI in this column. Future issues of the newsletter will contain articles on NICI performance during commissioning and announcements of observing opportunities using NICI.

FLAMINGOS-2

FLAMINGOS-2 is a near-infrared multi-object spectrograph and imager for the Gemini South telescope. FLAMINGOS-2 will cover a 6.1-arcmin-diameter field at the standard Gemini f/16 focus in imaging mode, and will provide multi-object spectra over a 6.1 x 2-arcmin field. It will also provide a multi-object spectroscopic capability for Gemini South's multi-conjugate adaptive optics system. The University of Florida is building FLAMINGOS-2, under the leadership of Principal Investigator Steve Eikenberry.

The NGSC held a Quarterly Review of the FLAMINGOS-2 instrument at Gainesville with the University of Florida Team in July. The instrument continues in the integration and testing phase of the project. The prism for the R ~ 3000 grating is now expected to be delivered in August, and then both optical elements will be placed with an intervening air space in a single optical mount.

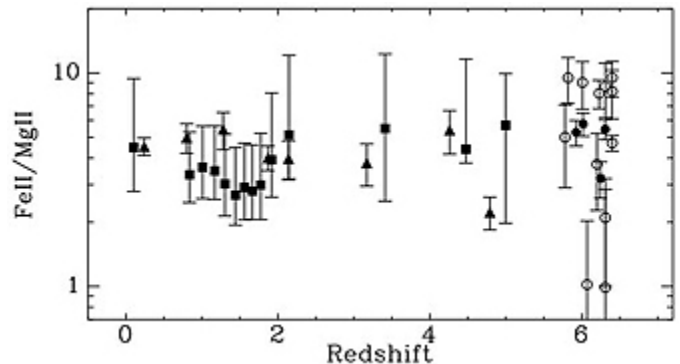
Problems with cooling the MOS dewar were traced to improper O-rings supplied by an electrical connector vendor and improperly cured epoxy on the G-10 thermal isolator. These problems have been corrected, and the MOS dewar has been cooled to its proper temperature. Problems with mechanism motors have forced replacement of stepper motors prepared for cryovac use in-house at Florida with commercial cryovac motors.

As of July, the University of Florida team reports that 95 percent of the work to FLAMINGOS-2 final acceptance by Gemini has been completed.

Frenetic Growth of Supermassive Black Holes in the Early Universe

Linhua Jiang (University of Arizona) has led a United States/Germany team of astronomers in the study of some of the most distant and youngest known quasars. The six distant quasars they observed are at redshifts ranging between $z = 5.8$ to 6.3 and correspond to a period when the Universe was only about one billion years old. Using the Gemini Near-Infrared Spectrograph (GNIRS) at Gemini South and the Near-Infrared Imager (NIRI) at Gemini North, the team found these very young quasars to be already super-enriched in heavy elements. The quasars are also powered by extremely massive black holes.

The Jiang et al. results cast a new light on the assembly of black holes and the chemical enrichment of the Universe less than one billion years after the Big Bang. For more details, see the paper "Gemini Near-Infrared Spectroscopy of Luminous $z \sim 6$ Quasars: Chemical Abundances, Black Hole Masses, and Mg II Absorption," in *The Astronomical Journal* (September 2007).



Fe II/Mg II abundance as a function of redshift indicating no sign of cosmic evolution as a function of age, even as far back as $z \sim 6$.



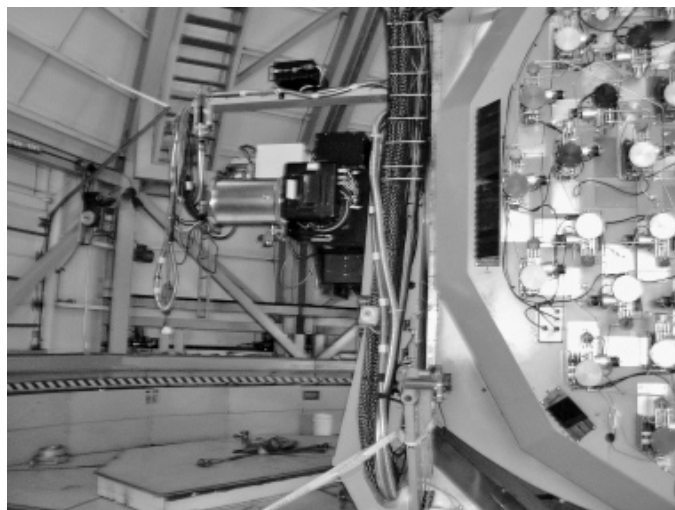
Updates on the Availability of NEWFIRM, WHIRC, and ET

Buell T. Jannuzi

NEWFIRM: Commissioning of the NOAO Extremely Wide-Field Infrared Imager (NEWFIRM) has been progressing well and we are accepting regular and survey proposals for the use of NEWFIRM at the Mayall 4-meter telescope starting in semester 2008A. NEWFIRM will be a facility instrument shared between the Mayall 4-meter and Blanco 4-meter telescopes.

Those wishing to propose to use NEWFIRM should consult the NEWFIRM instrument Web page and the NOAO proposal Web pages for current information about the availability of NEWFIRM at KPNO and CTIO from 2008 through 2011. Similarly, the process for determining which filters will be loaded into the instrument each semester is outlined on the NEWFIRM Web page. Please consult this information before you prepare your proposal.

WHIRC: The WIYN High-Resolution Infrared Camera (WHIRC) will be available for shared risk observing at the WIYN 3.5-meter telescope during semester 2008A. The total number of nights scheduled will be limited to no more than 26 nights during this semester. Observing runs will be distributed between no more than two scheduling blocks. While WHIRC (*see photo*) will eventually be used with the WIYN Tip-Tilt Module (WTTM), this mode is NOT available in 2008A.



WHIRC saw first light at WIYN in July 2007. Commissioning will be completed during 2008A. WHIRC will become a facility near-IR (0.9-2.5 micron) camera for the WIYN 3.5-meter telescope, residing on the WIYN Tip-Tilt Module (WTTM) port.

During 2008A, WHIRC will be provided only in direct imaging mode (WTTM is not available). WHIRC will have limited seeing performance of approximately 0.5-0.6 arcsec Full Width Half Maximum (FWHM) in the near-infrared. Once WHIRC becomes available with the full tip-tilt first-order adaptive optics corrections that will be possible with WTTM (expected in 2008B), the instrument should typically deliver images with approximately 0.3 arcsec FWHM and near-diffraction-limited images (0.15 arcsec) in the K_s on exceptional nights. The optical design uses a Raytheon 2048x2048 HgCdTe VIRGO array with a fixed pixel scale of ~ 0.1 arcsec (20 μm pixels). The field of view (3.3 arcminx3.3 arcmin) covers most of the WTTM corrected field.

WHIRC has two filter wheels providing three broadband filters (J, H, K_s), and an assortment of 10 narrowband filters. Please see the available instruments Web pages for a complete list of available filters. Margaret Meixner (Space Telescope Science Institute) is the instrument principal investigator (PI); Ed Churchwell (University of Wisconsin) is the project scientist; Pat Knezek is the WIYN Observatory liaison; and Dick Joyce is the KPNO WHIRC instrument scientist. Those interested in proposing to use WHIRC during 2008A should direct questions to Dick Joyce (joyce@noao.edu).

Exoplanet Tracker: The University of Florida's Exoplanet Tracker (ET), built by Jian Ge and collaborators, will be available for programs at the 2.1-meter telescope during the 2008A observing semester. Potential users may wish to contact Steve Howell (howell@noao.edu) before submitting proposals in order to discuss how their observational program will match the ET instrument.

NOAO proposals accepted to observe with ET will be performed in a joint queue program during one or two long observing blocks in 2008A. The proposer will be responsible for providing observers to help carry out the block-scheduled queue observations at the 2.1-meter. The total number of available nights will depend on the community demand and determined by the NOAO Time Allocation Committee.

Time allocations for ET will not be scheduled as "classical" observing runs because each single observation generally requires a small integration time. Therefore, proposers should ask for time in nights (or fractions thereof) based on the following example. If a proposer is monitoring a single $V=8$ star in hopes of planet detection and wants a measurement each night for 10 nights, your total integration time would approximately be $10 * (15 \text{ min} + 15 \text{ min (overhead)}) = 300 \text{ min} = 1/2 \text{ night}$ (assuming a 10-hour night). Targets that conform to the general optimized ET observing mode will be batch reduced (by the University of Florida) and the radial velocity results distributed to the PI within a few months of the observations.

Standard Observing Proposals Due 1 October 2007 - Survey Proposals Due 17 September 2007

Dave Bell

Standard proposals for NOAO-coordinated observing time for semester 2008A (February–July 2008) are **due by Monday evening, 1 October 2007, midnight MST**. The facilities available this semester include the Gemini North and South telescopes, Cerro Tololo Inter-American Observatory (including SOAR), Kitt Peak National Observatory, and community-access time with Keck, HET, Magellan, and MMT.

Survey proposals will be due two weeks earlier, on Monday 17 September 2007, and require a letter of intent to propose to have been sent in July.

Proposal materials and information are available on our Web page (www.noao.edu/noaoprop/). There are three options for submission:

- **Web submissions**—The Web form may be used to complete and submit all proposals. The information provided on the Web form is formatted and submitted as a LaTeX file, including figures that are “attached” to the Web proposal as encapsulated PostScript files.
- **Email submissions**—As in previous semesters, a customized LaTeX file may be downloaded from the Web proposal form, after certain

required fields have been completed. “Essay” sections can then be edited locally and the proposal submitted by email. Please carefully follow the instructions in the LaTeX template for submitting proposals and figures.

- **Gemini’s Phase-I Tool (PIT)**—Investigators proposing for Gemini time **only** may optionally use Gemini’s tool, which runs on Solaris, RedHat Linux, and Windows platforms, and can be downloaded from www.gemini.edu/sciops/P1help/p1Index.html.

Note that proposals for Gemini time may also be submitted using the standard NOAO form, and that proposals which request time on Gemini plus other telescopes **MUST** use the standard NOAO form. PIT-submitted proposals will be converted for printing at NOAO, and are subject to the same page limits as other NOAO proposals. To ensure a smooth translation, please see the guidelines at www.noao.edu/noaoprop/help/pit.html.

The addresses below are available to help with proposal preparation and submission.

Web Proposal materials and information
Request help for proposal preparation
Address for thesis and visitor instrument letters, as well as consent letters for use of PI instruments on the MMT
Address for submitting LaTeX proposals by email
Gemini-related questions about operations or instruments

www.noao.edu/noaoprop/
noaoprop-help@noao.edu

noaoprop-letter@noao.edu
noaoprop-submit@noao.edu
usgemini@noao.edu
www.noao.edu/gateway/gemini/support.html

CTIO-specific questions related to an observing run
KPNO-specific questions related to an observing run
HET-specific questions related to an observing run
Keck-specific questions related to an observing run
MMT-specific questions related to an observing run
Magellan-specific questions related to an observing run

ctio@noao.edu
kpno@noao.edu
het@noao.edu
keck@noao.edu
mmt@noao.edu
magellan@noao.edu

Community Access Time Available in 2008A with Keck, HET, Magellan, and MMT

Dave Bell

As a result of awards made through the National Science Foundation's Telescope System Instrumentation Program (TSIP) and a similar earlier program, telescope time is available to the general astronomical community at the following facilities in Semester 2008A:

- **Keck Telescopes**

A total of eight nights of classically scheduled observing time will be available with the 10-m telescopes at the W. M. Keck Observatory on Mauna Kea. All facility instruments and modes are available, including the Interferometer. For the latest details, see www.noao.edu/gateway/keck/.

- **Hobby-Eberly Telescope**

About 76 hours of queue observations are expected to be available at the 9.1-m effective aperture Hobby-Eberly Telescope at McDonald Observatory. Available instruments include the High-, Medium-, and Low-Resolution Spectrographs. For the latest information on HET instrumentation and instructions for writing observing proposals, see www.noao.edu/gateway/het/.

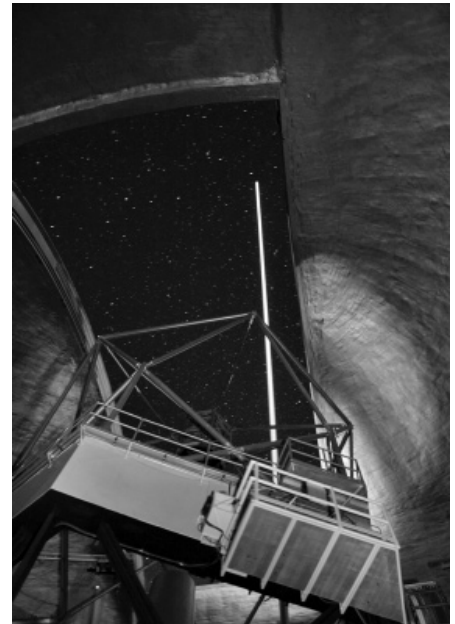
- **Magellan Telescopes**

A total of five nights will be available for classically scheduled observing programs with the 6.5-meter Baade and Clay telescopes at Las Campanas Observatory. For updated information on available instrumentation and proposal instructions, see www.noao.edu/gateway/magellan/.

- **MMT Observatory**

Twelve nights of classically-scheduled observing time will be available with the 6.5-meter telescope of the MMT Observatory. For further information, see www.noao.edu/gateway/mmt/.

A list of instruments we expect to be available in 2008A can be found at the end of this section. As always, investigators are encouraged to check the NOAO website for any last-minute changes before starting a proposal.

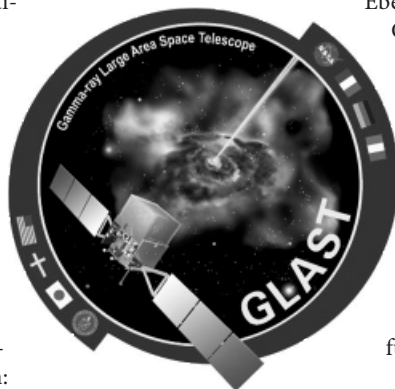


The Keck II Laser Guide Star on 21 April 2007. Photo credit: Andrew Cooper

NOAO-GLAST Collaborative Science Agreement

NOAO and NASA's Gamma-ray Large Area Space Telescope (GLAST) mission have concluded an agreement for collaborative science. This agreement will maximize the science output from both GLAST and NOAO telescopes by providing both telescope observing time and funding for multi-wavelength investigations.

GLAST currently is scheduled for launch in early 2008. Its primary mission will be to perform an all-sky survey for gamma-ray sources, with an expectation that 5,000-10,000 discrete gamma-ray sources will be detected, compared to approximately 300 confirmed sources known from the Compton Gamma-Ray Observatory. The NOAO-GLAST agreement will enable researchers to propose peer-reviewed multiwavelength investigations for funding from the GLAST mission: if their proposals pass the GLAST peer review and require optical observations with NOAO telescopes, NOAO will grant observing time based on the peer review from GLAST without requiring any separate proposal submission.



NOAO will make available up to approximately 5 percent of NOAO's share of the scientific observing time on the CTIO Blanco 4-meter, SOAR 4.1-meter, KPNO Mayall 4-meter, WIYN 3.5-meter, KPNO 2.1-meter, WIYN 0.9-meter, Gemini North, Gemini South, Hobby-Eberly, and SMARTS telescopes for Cycle 1 of the GLAST Guest Investigator (GI) Program. NOAO will work to add additional access to some smaller telescopes in time for the Cycle 2 GLAST GI call for proposals. Details may be found at www.noao.edu/gateway/nasa/ and glast.gsfc.nasa.gov/ssc/.

Target of Opportunity (ToO) proposals and NOAO Survey Program proposals must be submitted to both NOAO and the GLAST GI program in order to be considered for NOAO observing time and funding by NASA/GLAST. NOAO is funded by the National Science Foundation.

GLAST GI proposals are due on 7 September 2007. The proposal deadline for NOAO Survey Project proposals is 17 September 2007 and the NOAO deadline for ToO proposals is 1 October 2007.

Observing Request Statistics for 2007B Standard Proposals

	No. of Requests	Nights Requested	Average Request	Nights Allocated	DD Nights (*)	Nights Previously Allocated	Nights Scheduled for New Programs	Over-subscription for New Programs
GEMINI								
GEM-N	159	175.72	1.11	60.49	0	0	60.49	2.9
GEM-S	80	88.71	1.11	23.78	4.92	0	23.78	3.73
CTIO								
CT-4m	65	236.2	3.63	104	4	2.5	101.5	2.33
SOAR	14	33.6	2.4	30	2	0	30	1.12
CT-1.5m	6	39	6.5	34	0	8	26	1.5
CT-1.3m	8	16.59	2.07	17.7	0	0.72	16.98	0.98
CT-1.0m	5	30	6	44	0	0	44	0.68
CT-0.9m	18	74.8	4.16	50.3	0	1.6	48.7	1.54
KPNO								
KP-4m	77	274.8	3.57	94.5	0	0	94.5	2.91
WIYN	25	66.9	2.68	45.5	0	2	43.5	1.54
KP-2.1m	16	81.2	5.08	93.5	0	0	93.5	0.87
KP-0.9m	3	18	6	12	0	0	12	1.5
Keck/HET/MMT/LCO								
HET	9	15.34	1.7	6.64	0	0	6.64	2.31
Keck-I	16	24	1.5	4	0	0	4	6
Keck-II	19	26.5	1.39	4	0	0	4	6.62
Magellan-I	4	9	2.25	2	0	0	2	4.5
Magellan-II	5	10	2	3	0	0	3	3.33
MMT	13	25	1.92	12	0	0	12	2.08

*Nights allocated by NOAO Director

CTIO Instruments Available for 2008A

Spectroscopy	Detector	Resolution	Slit
4-m Blanco			
Hydra + Fiber Spectrograph	SiTe 2Kx4K CCD, 3300-11,000Å	700 - 18000, 45000	138 fibers, 2" aperture
R-C CCD Spectrograph	Loral 3Kx1K CCD, 3100-11,000Å	300-5000	5.5'
4-m SOAR¹			
OSIRIS IR Imaging spectrograph	HgCdTe 1Kx1K, JHK windows	1200, 3000	1.3', 3.3'
1.5-m²			
Cass Spectrograph	Loral 1200x800 CCD, 3100-11,000Å	<1300	7.7'
Imaging	Detector	Scale ("/pixel)	Field
4-m BLANCO			
Mosaic II Imager	8Kx8K CCD Mosaic	0.27	36'
ISPI IR Imager	HgCdTe (2Kx2K 1.0-2.4mm)	0.3	10.25'
4-m SOAR¹			
Optical Imager	E2V 4Kx4K Mosaic	0.08	5.5'
OSIRIS IR Imaging spectrograph	HgCdTe 1Kx1K	0.14, 0.35	1.2', 3.2'
1.3-m^{2,3}			
ANDICAM Optical/IR Camera	Fairchild 2Kx2K CCD	0.17	5.8'
	HgCdTe 1Kx1K IR	0.11	2.0'
1.0m⁴			
Direct Imaging	Fairchild 4Kx4K CCD	0.29	20'
0.9-m⁵			
Direct Imaging	SiTe 2Kx2K CCD	0.4	13.6'

¹ The amount of science time available on SOAR in 2008A will be at least 50%. Classical (i.e. visitor) observing is the only observing mode offered for NOAO proposals. The availability of the Goodman spectrograph, the Spartan IR imager, and the Phoenix high-resolution IR spectrograph at time of writing is uncertain. Please consult the NOAO Proposals Web pages for the latest information.

² Service observing only.

³ Proposers who need the optical only will be considered for the 1.0m unless they request otherwise. Note that data from both ANDICAM imagers is binned 2x2.

⁴ Classical observing only - Observers may be asked to execute up to 1 hr per night of monitoring projects which have been transferred to this telescope from the 1.3m. In this case, there will be a corresponding increase in the scheduled time. No specialty filters, no region of interest.

⁵ Classical or service, alternating 7-night runs. If proposing for classical observing, requests for 7 nights are strongly preferred.

KPNO Instruments Available for 2008A

Spectroscopy	Detector	Resolution	Slit	Multi-object
Mayall 4m				
R-C CCD Spectrograph	T2KB/LB1A/F3KB CCD	300-5000	5.4'	single/multi
MARS Spectrograph	LB CCD (1980x800)	300-1500	5.4'	single/multi
Echelle Spectrograph	T2KB/F3KB CCD	18000-65000	2.0'	
FLAMINGOS ¹	HgCdTe (2048x2048, 0.9-2.5mm)	1000-1900	10.3'	single/multi
IRMOS ²	HgCdTe (1024x1024, 0.9-2.5mm)	300, 1000, 3000	3.4'	single/multi
WIYN 3.5m³				
Hydra + Bench Spectrograph	T2KA CCD	700-22000	NA	~100 fibers
SparsePak ⁴	T2KA CCD	700-22000	IFU	~82 fibers
2.1m				
GoldCam CCD Spectrograph	F3KA CCD	300-4500	5.2'	
FLAMINGOS ¹	HgCdTe (2048x2048, 0.9-2.5mm)	1000-1900	20.0'	
Exoplanet Tracker (ET) ⁵	CCD (4Kx4K, 5000-5640 Å)	See Note	Fiber (2.5")	
Imaging	Detector	Spectral Range	Scale ("/pixel)	Field
Mayall 4m				
CCD MOSAIC-1	8Kx8K	3500-9700 Å	0.26	35.4'
NEWFIRM ⁶	InSb (mosaic, 4, 2048x2048)	1–2.3 μm	0.4	28.0'
SQIID	InSb (4-512x512)	JHK	0.39	3.3'
FLAMINGOS ¹	HgCdTe (2048x2048)	JHK	0.32	10.3'
WIYN 3.5m				
Mini-Mosaic ⁷	4Kx4K CCD	3300-9700 Å	0.14	9.3'
OPTIC ⁷	4Kx4K CCD	3500-11000 Å	0.11	9.3'
WHIRC ⁸	VIRGO HgCdTe (2048x2048)	0.9-2.5 μm	0.11	3.3'
2.1m				
CCD Imager	T2KB/F3KB CCD	3300-9700 Å	0.305	10.4'
SQIID	InSb (4-512x512)	JHK	0.68	5.8'
FLAMINGOS ¹	HgCdTe (2048x2048)	JHK	0.61	20.0'
WIYN 0.9m				
CCD MOSAIC-1	8Kx8K	3500-9700 Å	0.43	59'

¹ FLAMINGOS Spectral Resolution given assuming 2-pixel slit. Not all slits cover full field; check instrument manual. FLAMINGOS was built by the late Richard Elston and his collaborators at the University of Florida. Steve Eikenberry is currently the PI of the instrument.

² IRMOS, built by John MacKenty and collaborators. Availability will depend on proposal demand and block scheduling constraints.

³ A new Volume Phase Holographic (VPH) grating, 740 l/mm, is now available for use. Please contact Di Harmer for information.

⁴ Integral Field Unit, 80"x80" field, 5" fibers, graduated spacing

⁵ Exoplanet Tracker (ET) is an instrument provided by Jian Ge of the University of Florida and his colleagues. It enables very high precision measurements of radial velocities for suitably bright enough targets. Details regarding this instrument are available via our instrument web pages. It is capable of providing Doppler precision of 4.4 m/s in 2 minutes for a $V = 3.5$ mag. G8V star.

⁶ NEWFIRM is being offered on a "shared-risk" basis for this semester. Please see <http://www.noao.edu/ets/newfirm/> for more information. Permanently installed filters include J, H, and K_s. Please see NEWFIRM Web pages for update on availability/scheduability of other filters.

⁷ OPTIC Camera from U of Hawaii is anticipated to be available through an agreement with John Tonry of the University of Hawaii. This instrument may be assigned to those that request to use Mini-Mosaic if this substitution still meets proposed imaging needs and making such an assignment would further observatory support constraints. Fast-guiding mode of operation of OPTIC is now a supported mode for NOAO users of the instrument.

⁸ WHIRC, built by Margaret Meixner (STScI) and collaborators, will be available for shared-risk use during 2008A. During this first semester of shared-risk observing the total number of nights scheduled will be limited to no more than 26 nights. These will be distributed between no more than two scheduling blocks during the semester. While WHIRC will eventually be used with the WTTM (WIYN Tip-Tilt Module), this mode is NOT available in 2008A.

Gemini Instruments Expected to be Available for 2008A

GEMINI NORTH	Detector	Spectral Range	Scale ("/pixel)	Field
NIRI	1024x1024 Aladdin Array	1-5 μ m R~500-1600	0.022, 0.050, 0.116	22.5", 51", 119"
NIRI + Altair (AO- Natural or Laser)	1024x1024 Aladdin Array	1-2.5 μ m R~500-1600	0.022	22.5"
GMOS-N	3x2048x4608 CCDs	0.36-1.0 μ m R~670-4400	0.072	5.5' 5" IFU
Michelle	320x240 Si:As IBC	8-26 μ m R~100-30,000	0.10 img, 0.20 spec	32"x24" 43" slit length
NIFS	2048x2048 HAWAII-2RG	1-2.5 μ m R~5000	0.04 x 0.10	3" x 3"
NIFS + Altair (AO- Natural or Laser)	2048x2048 HAWAII-2RG	1-2.5micron R~5000	0.04 x 0.10	3" x 3"

GEMINI SOUTH	Detector	Spectral Range	Scale ("/pixel)	Field
Phoenix	512x1024 Aladdin Array	1-5 μ m R<70,000	0.085	14" slit length
GMOS-S	3x2048x4608 CCDs	0.36-1.0 μ m R~670-4400	0.072	5.5' 5" IFU
T-ReCS	320x240 Si:As IBC	8-26 μ m R~100,1000	0.09	28" x 21"
NICI	2 InSb Aladdin III 1024x1024	1-5 μ m	0.018	18"

*Please refer to the NOAO Proposal Web pages in September 2007 for confirmation of available instruments.

HET Instruments Available for 2008A

	Detector	Resolution	Slit	Multi-object
LRS (Marcario low-res spec)	Ford 3072x1024			
	4100-10,000Å	600	1.0"-10"x4'	13 slitlets, 15" x 1.3" in 4' x 3' field
	4300-7400Å	1,300	1.0"-10"x4'	13 slitlets, 15" x 1.3" in 4' x 3' field
	6250-9100 Å	1,900	1.0"-10"x4'	13 slitlets, 15" x 1.3" in 4' x 3' field
MRS (med-res spectrograph)	(2) 2Kx4K, 4200-9000 Å	70,009,000	1.5" or 2" fiber	single
HRS (high-res spectrograph)	(2) 2Kx4K 4200-11,000Å	15,000-120,000	2" or 3" fiber	single

MMT Instruments Available for 2008A

	Detector	Spectral Range	Scale ("/pixel)	Field
BCHAN (spec, blue-channel)	Loral 3072 x 1024 CCD	0.32-0.8µm	0.3	150"
RCHAN (spec, red-channel)	Loral 1200 x 800 CCD	0.5-1.0µm	0.3	150"
MIRAC3 (mid-IR img, PI inst)	128 x 128 Si:As BIB array	2-25µm	0.14, 0.28	18.2, 36"
MegaCam (optical imager, PI)	36 2048x4608 CCDs	0.32-1.0µm	0.08	24'
Hectospec (300-fiber MOS, PI)	2 2048x4608 CCDs	0.38-1.1µm	R ~1K	60'
Hectochelle (240-fiber MOS, PI)	2 2048x4608 CCDs	0.38-1.1µm	R ~32K	60'
SPOL (img/spec polarimeter, PI)	Loral 1200 x 800 CCD	0.38-0.9µm	0.2	20"
ARIES (near-IR imager, PI)	1024x1024 HgCdTe	1.1-2.5µm	0.04,0.02	20", 40"
SWIRC (wide n-IR imager, PI)	2048x2048 HAWAII-2	1.0-1.6µm	0.15	5'

Magellan Instruments Available for 2008A

	Detector	Resolution	Spectral Range	Scale ("/pixel)	Field
Magellan I (Baade)					
PANIC (IR imager)	1024x1024 Hawaii		1-2.5µm	0.125	2'
IMACS (img/lslit/mslit)	8192x8192 CCD	R~2100-28000	0.34-1.1µm	0.11, 0.2	15.5', 27.2'
Magellan II (Clay)					
MagIC (optical imager)	2048x2048 CCD		BVRI, u'g'r'i'z'	0.07	2.36'
LDSS3 (mslit spec/img)	4096x4096 CCD	R~200-1700	0.4-0.8 µm	0.19	8.25' circ.
MIKE (echelle)	2Kx4K CCD	R~19000-65000	0.32-1.0µm	0.14	

Keck Instruments Available for 2008A

	Detector	Resolution	Spectral Range	Scale ("/pixel)	Field
Keck 1					
HIRESb/r (optical echelle)	Tek 2048 x 2048	30k-80k	0.35-1.0µm	0.19	70" slit
NIRC (near-IR img/spec)	256 x 256 InSb	60-120	1-5µm	0.15	38"
LRIS (img/lslit/mslit)	Tek 2048 x 2048	300-5000	0.31-1.0µm	0.22	6x7.8'
Keck 2					
ESI (optical echelle)	MIT-LL 2048 x 4096	1000-6000	0.39-1.1µm	0.15	2x8'
NIRSPEC (near-IR echelle)	1024 x 1024 InSb	2000, 25000	1-5µm	0.18 (slitcam)	46"
NIRSPA0 (NIRSPEC w/AO)	1024 x 1024 InSb	2000, 25000	1-5µm	0.18 (slitcam)	46"
NIRC2 (near-IR AO img)	1024 x 1024 InSb	5000	1-5µm	.01-.04	10-40"
DEIMOS (img/lslit/mslit)	8192 x 8192 mosaic	1200-10000	0.41-1.1µm	0.12	16.7x5'
Interferometer					
IF (See http://msc.caltech.edu/software/KISupport/)					



Workshop Report: Hot-Wiring the Transient Universe

Rob Seaman

The NOAO Data Products Program hosted more than 60 astronomers and software engineers in Tucson at the conference “Hot-Wiring the Transient Universe” from 4-7 June 2007. This meeting served as a joint workshop between the International Virtual Observatory Alliance’s VOEvent working group (voevent.org) and the Heterogeneous Telescope Networks (HTN) consortium (www.telescope-networks.org).

In addition to NOAO, co-sponsoring institutions included the Large Synoptic Survey Telescope (LSST), the National Virtual Observatory (NVO), the Thinking Telescope project at Los Alamos National Laboratory, and the eSTAR project in the United Kingdom.

VOEvent is the standard format for representing reports of transient celestial events within the Virtual Observatory. It is broadly applicable to the description of time-varying astronomical phenomena of all types, from supernovae and gamma-ray bursts to the light curves of variable stars, from events on the solar disk to the orbits of solar system objects.

The fifteen sessions at the workshop ranged widely over topics such as *The Science from Rapid Response*, *A Long Range Vision for Transient Astronomy*, *Event Classification*, *Web Services for Real Time Data Reduction and Analysis*, *Distributed Scheduling*, and *Grid Markets*.

NOAO presentations highlighted our recent efforts toward VOEvent activities such as a case study of how Target-of-Opportunity observations can be managed using a VOEvent-mediated process, some new tools, and an infrastructure for deploying VOEvent services. For those interested in learning more about these technologies, NOAO’s VOEvent software can be downloaded from voevent.noao.edu.

No discussion of transient alert reporting and follow-up response would be complete without mentioning the digital tsunamis of alerts soon to arrive from Pan-STARRS, the Dark Energy Survey and LSST. Tens to hundreds of thousands of discoveries per night will be reported from these facilities, making it critical that a mature VOEvent infrastructure be in place before they are commissioned. VOEvent will provide the critical network link between publishers of transient alerts and their subscribers.

Presentations from the conference are available at www.cacr.caltech.edu/hotwired/program. The conference proceedings will be published in 2008 as a special issue of *Astronomische Nachrichten*. The organizers acknowledge a great debt to Barbara Fraps for unending logistical support, to Pete Marenfeld for the eye-popping workshop poster, and to Sarah Emery Bunn of the NVO for attentive Web support.



Accessing the Virtual Observatory from Within Your Favorite Programming Environment

Christopher J. Miller, David Gasson, & Exequiel Fuentes

The Virtual Observatory (VO) has made significant progress over the last few years in defining standards, providing methods for data discovery, and providing means to access and analyze data. As part of its evolution, there is a growing glossary of terms that VO users should be familiar with.

- VOTables– These are XML files that are in the standard format for dealing with data and metadata in the VO.
- Cone services– These are URLs that, when accessed, return a VOTable containing catalog data within a user-specified search radius on the sky.
- Simple Image Access Protocol (SIAP) services– These are URLs that, when accessed, return a VOTable containing image metadata within a user-specified region on the sky. Included in the metadata is a URL link to the actual image.
- The NVO Registry– This is a service that allows users to query for NVO resources (e.g., data archives, SIAP servers, cone servers, analysis services, etc.)
- The Open SkyQuery Portal– This service allows users to send an SQL-like query, and retrieve object catalog data in VOTable format.
- Name Resolvers– These services allow users to specify a position on the sky and retrieve the names of astronomical objects at that location.

There are Web-based tools available at us-vo.org to help users with these services. In addition, NOAO Data Products Program staff members have been creating libraries to utilize the VO resources. These libraries are available at www.nvo.noao.edu.

The Interactive Data Language (IDL) was created by David Stern for use with NASA's Mars Mariner 7 and 9 missions. In 1981, IDL was rewritten into FORTRAN 77, which is a familiar programming language to many astronomers. The spread of the use of IDL in astronomy can be attributed to both the FORTRAN legacy as well as the wealth of publicly available libraries (idlastro.gsfc.nasa.gov/).

IDL's VOLib is a set of IDL procedures (IDL 6.+) which allow users to discover and access data in the Virtual Observatory, typically with a single command-line call. This means that users can pull in data from the VO to use with their own IDL science and visualization codes.

As an example, a user can call the Far Ultraviolet Spectroscopic Explorer (FUSE) and fill the IDL data structure called "fuse_data" with objects observed by FUSE within 10 degrees of the position RA=180 and DEC=1:

```
IDL> fuse_url = 'http://archive.stsci.edu/fuse/search.php?'
IDL> conecall,str=fuse_data, url = fuse_url, 180,1,10
```

VOLib is available at www.ctio.noao.edu/~chrism/VOLib. If you have questions or need help, please contact Chris Miller (cmiller@noao.edu).

Ruby (www.ruby-lang.org/) is an object-oriented scripting language with a focus on simplicity and productivity. It was first released by the author (Yukihiro "Matz" Matsumoto) in 1995 and has enjoyed gradual growth ever since.

Lately, Ruby has experienced a surge of activity due to Ruby on Rails (www.rubyonrails.org), a popular Web application-building framework that has emerged as its "killer app." Many people now come to Ruby through Rails, and it is a very powerful general-purpose programming language with full and elegant support for objects, closures, iterators, and other denizens of the programming landscape.

VORuby began as a set of Ruby classes for parsing VOTables and has grown from there. Originally conceived as part of the infrastructure for the NOAO NVO Portal, it is now a standalone set of modules available to anyone in the community from RubyForge (rubyforge.net/projects/voruby/) under the terms of the GNU General Public License version 2 (GPLv2).

As an example, a user can obtain the coordinates of Messier 1 via this simple line:

```
coords = @sesame.query_position('m1')
```

A user might take these coordinates and make a *Cone* service call to FUSE, as shown above, to create an object with the positions of spectroscopic objects observed around M1.

If you would like help or more information on using VORuby for your scientific needs, please contact David Gasson (dgasson@noao.edu).

Python is a programming environment that many astronomers use in their daily research. S. Kwok (Keck Observatory) has provided Python libraries that offer similar access to the IDL and Ruby libraries described above.

For instance, the following line will quickly download an image from the GALEX mission using Python:

```
python SIAPEx.py siapImages 'http://galex.stsci.edu/gxWS/SIAP/gx-SIAP.aspx?' 180 0 1
```

Users can obtain these Python VO libraries at:

viewcvs.cacr.caltech.edu/us-vo/viewcvs.cgi/contrib/summerschool/python/.

IRAF 2.14

Chris Smith & Mike Fitzpatrick

We are pleased to announce the new release of the beta version of IRAF 2.14 in September/October 2007. This is an official release of IRAF from NOAO, to be followed by a final 2.14 release within a few months.

Due to resource limitations and higher-priority demands, NOAO dedicated little effort to the maintenance of IRAF in 2005 and 2006. However, the community effort led by Mike Fitzpatrick and Frank Valdes (above and beyond NOAO's commitment) made significant improvements to the core IRAF code base. These improvements included numerous bug fixes and, most significantly, ports to the Mac/Intel and Cygwin platforms (IRAF 2.13 beta). The official NOAO release of IRAF 2.14 is built upon those improvements and incorporates several bug fixes and changes not previously released.

NOAO anticipates a significant investment in IRAF development over the next year, leading to at least one additional release of the core and the release of several external packages. Announcement of all official releases will be made through the official IRAF Web site (iraf.noao.edu), the *NOAO/NSO Newsletter*, and via postings to iraf.net. NOAO will also work with the Space Telescope Science Institute to ensure

that PyRAF and the associated Python environment continues to provide the important services it is bringing to the astronomical community.



Specific help questions about the newly released packages should be sent to the email addresses specified in the documentation associated with the packages. This will allow NOAO to provide direct support of these new packages, which are relevant to new NOAO instruments and other development efforts such as the National Virtual Observatory. Nevertheless, NOAO staff will monitor iraf.net to provide appropriate support for the new releases.

The iraf.net Web site has grown into an active and important community forum for discussion of IRAF questions and general IRAF support. NOAO hopes that it will continue to grow, with even more community participation in answering posted queries. NOAO staff participation in this principal IRAF community forum will also provide a method for gathering community input into the next generation of data reduction and analysis environments, thereby helping us plan NOAO's role in developing and supporting one or more of those future environments.



Community Requirements for the Dark Energy Camera

Alistair Walker, Chris Smith & Tim Abbott

A progress report for the Dark Energy Camera (DECam) was given in the June 2007 issue of the *NOAO/NSO Newsletter*. In summary, DECam is a very large format CCD imager and optical corrector for the prime focus of the Blanco 4-meter telescope, and is expected to replace the present Mosaic-2 imager in late 2010. It is being built by a consortium of more than 110 scientists from 14 universities and institutions in five countries (Brazil, Chile, Spain, UK, and the US), in exchange for 30 percent of Blanco telescope observing time over five years to carry out the Dark Energy Survey (DES).

DECam will be a Cerro Tololo Inter-American Observatory facility instrument, available to all users. The dual purpose of DECam requires careful design and planning so that the instrument and its data systems satisfy the needs of both the DES consortium and the general user community. Many specifications derived from the DES science requirements will fully satisfy community users, but this will not always be the case. For example, the DES will use SDSS g,r,i,z filters (possibly splitting z into Z and Y), whereas the community will doubtless wish to use other filters with DECam. In the June 2007 article about DECam community filters, Chris Miller described historical filter use with the two NOAO Mosaic imagers, laid out some of the options for DECam, and called for input from the astronomical community on the subject.

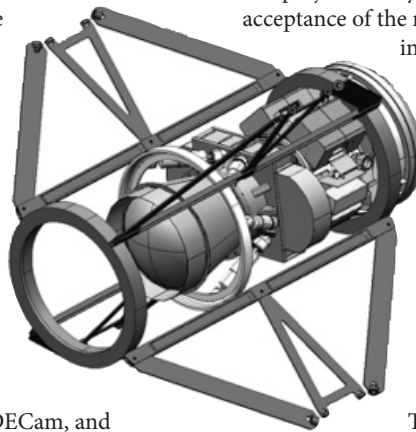
A second example is the data system. Both DES and community data will use the NOAO Data Transport System to move the data across high-bandwidth lines from Cerro Tololo to the National Center for Supercomputer Applications at the University of Illinois. There, the DES data will be processed by a DES pipeline and then subjected to the specialized analyses needed to produce the DES science. Community data will be processed by a similar pipeline—a project deliverable—that will be imbedded in the NOAO end-to-end (E2E) system, which will finally deposit the data into the NOAO Science Archive.

We have put together a document, called “Community Needs for the Dark Energy Camera & Data Management System” (see www.ctio.noao.edu, under headlines). This document first outlines DECam and its data management system, and then goes on to describe the specific uses and features that will be needed to provide full functionality to the NOAO user community. This document, together with the DES Scientific and Functional Requirements document that covers the DES-specific requirements, establishes the guiding principles for building DECam and its data systems.

The project is only a few months away from the stage where formal acceptance of the requirements documents will be necessary. Following that, any changes will be more difficult to make, and will be under the strict purview of a change-control board.

A community-needs working group will be set up to provide recommendations both during the present process of defining the specifications, and in the future when the question of possible changes might arise. It is very important that the community needs are fully considered now and incorporated into the instrument design where appropriate.

The NOAO Users Committee will meet in Tucson in early October: an important part of their meeting will be devoted to evaluating the Community Needs document and recommending additions and revisions. You are strongly encouraged to read the “Community Needs for the Dark Energy Camera & Data Management System” document, and to provide feedback either to the authors of this article (awalker@noao.edu, csmith@noao.edu, and tabbott@noao.edu), or directly to the Users Committee (see www.noao.edu/dir/usercom/).



SOAR Completes Second Semester of Science Operations

Sean Points & Steve Heathcote

The second semester of regular science operations at the Southern Astrophysical Research telescope (SOAR) has drawn to a successful close. Eleven NOAO programs totaling 27 nights of observing were carried out on the 4.1-meter telescope during semester 2007A.

Since the start of regular science operations in October 2006 through June 2007, SOAR has been used for science 39 percent of the time, with 41 percent spent on engineering and maintenance, 18 percent lost to weather, and only 2 percent lost to failures. Of the time allocated to NOAO, 71 percent was used for science, with 25 percent lost to weather and 4 percent lost to failures. To date, six refereed papers based on data obtained at SOAR have been published, although none were by NOAO users.



Figure 1. Three-color image of Thackeray's Globules in IC 2944 taken using the SOAR Optical Imager with B, V, and R filters corresponding to the blue, green, and red channels in the image. The mean FWHM of the PSF of the point sources is about 0.6 arcsec.

After the primary mirror lateral link support upgrade (see the March 2006 *Newsletter*), SOAR has routinely been achieving image quality consistent with the Cerro Pachón seeing monitors. More extensive work is underway to quantify the delivered image quality from SOAR. The best images taken so far have had a resolution of ~ 0.5 arcsec in V with the SOAR Optical Imager (SOI), ~ 0.43 arcsec in SDSS i' with SOI, and ~ 0.21 arcsec in K with the Ohio State InfraRed Imager/Spectrometer (OSIRIS). Furthermore, the primary mirror now stays tuned for extended periods of time, greatly increasing observing efficiency. Further improvements in delivered image quality and efficacy are expected as we implement low-order wavefront sensing allowing closed-loop control of the primary mirror figure.

Semester 2007B, in which there are 11 NOAO programs scheduled for a total of 30 nights, is about to start. SOI and OSIRIS remains the instrument suite at SOAR in regular science use (see www.soartlescope.org for further information on these instruments). However, semester 2007B will also see extensive work on instrument commissioning, with three new instruments scheduled for delivery in 2007B and early 2008A.

The new detector package for the Goodman Spectrograph has been received at the University of North Carolina at Chapel Hill and is working in the lab. Both the collimator and the camera optics have been rebuilt, and software integration work is progressing. Once this has been completed, the camera will be shipped to Chile for integration with the spectrograph, allowing us to complete the commissioning of this instrument.

Given this timeframe, we do not expect commissioning to have advanced far enough for us to offer the Goodman Spectrograph as a general-user instrument in time for the 2008A NOAO Call for Proposals. However, if integration and commissioning progresses according to our plans, we will issue a special call for proposals to use this instrument during semester 2008A.



Figure 2. Three-color image of the massive stellar cluster associated with the IRAS 16177-5018 source taken using OSIRIS with [FeII], H₂, and Br γ filters corresponding to the blue, green, and red channels. The mean FWHM of the point sources in the image is about 0.7 arcsec.

Testing of the Spartan infrared (IR) camera at Michigan State University continues, but has revealed mechanical problems that remain to be resolved. Consequently, the date for delivery to Chile and the start of commissioning remains uncertain, but it is unlikely to be before November 2007.

The Phoenix high-resolution IR spectrometer was scheduled to move to SOAR in April 2007 after a successful stint at Gemini South as a visiting instrument. However, after the accident with GNIRS on Gemini South, an agreement has been reached between NOAO and Gemini to leave Phoenix at Gemini South for the remainder of 2007. Thus, it is anticipated that Phoenix will move to SOAR during the early part of semester 2008A, but the timeframe remains uncertain.



Kitt Peak National Observatory Successfully Meets Challenge of Alambre Wildfire

The threat of wildfires to the observatories on Kitt Peak is one of our persistent concerns. Dry conditions over the past few years and the resulting growth of potential fuel (dead plants) on the mountain have increased the chance that a nearby fire might make its way to the top of the mountain. Fires on nearby Mount Graham, Mount Lemmon, and Mount Bigelow have threatened our sister observatories in southern Arizona in recent years, so we know that a major fire is not as rare as we might wish.

In early July, we were presented with a chance to make use of our planning and training as we worked with the Tohono O'odham Nation and other government agencies to protect the observatories from the Alambre wildfire. Advancing to within a mile and a half of the observatories, this was the first major fire to threaten our facilities in 30 years.



The wildfire, first reported on Saturday, July 7, at approximately 1:30 pm, involved burning grass, chaparral, oak, and mesquite, in the Alambre Valley south of Kitt Peak (known as Iolkam Duag to the people of the Tohono O'odham Nation). Soon, white smoke was easily visible toward Baboquivari mountain in images taken by the southward-facing Webcam mounted on the Mayall 4-meter telescope dome. This camera proved to be a useful and popular way to monitor the intensity of the fire.

After the initial reports of the fire, the Tohono O'odham fire department, led by Guy Acuna, responded strongly with three air attack Single Engine Air Tankers (SEATs) and three fire-fighting crews who worked by hand. The Tohono O'odham fire department also contacted Kitt Peak National Observatory and asked that we be prepared for evacuation should it become necessary. NOAO staff initiated the response and communication structure that was prepared in 2002

as part of a comprehensive NOAO/NSO Contingency Plan. Senior managers were notified, communications protocols were confirmed, and mountain personnel (including those from tenant observatories) were notified about the potential evacuation.



Unfortunately, the fire grew quickly and by mid-afternoon we were instructed to evacuate the mountain. Later that evening, command of the growing fire-fighting effort was transferred to the East/Southeast Incident Management Team (IMT) headed by Incident Commander Larry Raley. This is a "Type-2 Team," trained to deal with all but the largest wildfires. With approval of the IMT, a small number of observatory staff returned to the mountain to help coordinate and support the fire response personnel throughout the next four days.

Updates on the health and status of the observatory were posted regularly on the NOAO and KPNO Web sites, along with responses to a constant stream of media calls and interview requests (see related story in the public affairs section of this *Newsletter*).

During the next few days, helicopters, SEATs, and slurry tankers regularly dumped fire retardant and water near and on the fire to slow its progress towards the mountain. Flying at least 30 air missions per day, the pilots established a fire-retardant line in the valley south of the observatory. Meanwhile, ground crews toiled to create a four-mile fire break in the valley that will remain in place to help block future fires. These two fire lines effectively contained the fire, protecting Kitt Peak and nearby Tohono O'odham communities.

The skilled multi-agency fire fighting crews battled the fire in 100-degree weather and very rough terrain as they surrounded the fire. Increased helicopter activity required KPNO staff to relocate heavy equipment around the mountain to expand the availability of helicop-

continued

Kitt Peak and the Alambre Wildfire continued



ter landing access and supply areas for delivery to the ground crews. The small backup water supply pond on the mountain was heavily used by the helicopters—its proximity provided them with a quick six-minute turnaround time between water drops, greatly aiding the efforts to control the fire.

However, drought conditions in the months prior to the fire had led to low water levels on the mountain, so it was necessary for tanker trucks from the IMT to haul water up the mountain to meet the demand of the fire helicopters. During the fire, some of the fire crews on the mountain were fed and housed in the KPNO dormitories, and look-out stations were established on the south side of the mountain near the WIYN and McMath-Pierce telescopes. Portable cell and repeater towers were also brought in by the IMT to improve communications with the hand crews down in the valley and on the ridge.



As the risk to mountain began to diminish, the IMT allowed a few time-critical indoor tasks to resume, such as the re-aluminizing of the Sloan Digital Sky Survey telescope primary mirror, and the servicing of science instruments at the tenant observatories and KPNO.

The Type 2 East/Southeast Incident Management Team deployed more than 424 personnel, 12 hand crews, 14 engines, two bulldozers, five helicopters and at least four aircraft to fight the fire. As the fire got under control, there were as many as 10 fire response teams (with 50 total members) continuously working on Kitt Peak to remove underbrush and extend the defensible space around buildings beyond previous brush-clearing efforts conducted in 2003. These excellent crews were able to complete a great deal of defensive brush cutting around the structures on Kitt Peak and the west ridge, helping to provide better fire protection for the future.

The observatories on Kitt Peak were able to resume daytime operations on July 12, and most of the telescopes resumed work on the evening of July 13. The fire was declared 100 percent contained on July 14, and


continued

Kitt Peak and the Alambre Wildfire continued

the mountain reopened to the general public on Sunday, July 15. Over 7,267 acres were burned, but no lives were lost. Potentially much worse damage to the land of the Tohono O’odham was avoided, and all structures belonging to Tohono O’odham communities and the observatories were protected successfully.

We are extremely grateful that there were no injuries or property damage reported by Kitt Peak National Observatory staff or fire-fighting personnel. While there had been some lightning strikes prior to the time the fire was noticed, the cause of the fire is considered

undetermined. Further information and many photos related to the Alambre fire are posted at www.inciweb.org/incident/789/.

The staffs of KPNO, NSO, and NOAO would like to thank everyone involved in the response to the Alambre fire for their quick response, expertise, and dedication in quenching the flames as quickly as possible. The lasting impression that we have of the experience is the outstanding teamwork and shared effort that helped avert a disaster to both nature and our scientific enterprise, and prepared us all to better face similar incidents that are bound to occur in the future. 

How to Have a Restful Vacation

During my family’s summer vacation at the beach, I received a phone message from Todd Boroson (Interim Director of NOAO) that began, “There is a fire near Kitt Peak...they are evacuating the mountain.” Fortunately, the message continued with a list of the steps our talented and dedicated staff were taking to keep everyone safe, and the phrase, “Everything that can be done seems to be getting done”.

I want to thank the Tohono O’odham Department of Public Safety, the Eastern Arizona Interagency Incident Management Team, and the Bureau of Indian Affairs for their wonderful defense of the Tohono O’odham lands and astronomical facilities threatened by the fire. Particular notice should be paid to the leadership of Larry Raley, Incident Commander Eastern Arizona Interagency Incident Management Team; Guy Acuna, Fire Management Officer Division Chief, Tohono O’odham Nation Fire Department (TONFD); Craig Encinas, Fire Chief, TONFD; and, Chuck Kmet, Emergency Management Officer, TONFD.

With the risk of inadvertently leaving out someone that should be recognized, I also want to thank all of the KPNO/NSO/NOAO staff that helped all the observatories on Kitt Peak get through the Alambre Fire safely. Chuck Gessner and John Dunlop handled communications with the Tohono O’odham Fire Department, the Eastern Arizona Interagency Incident Management Team, and the Bureau of Indian Affairs. Working with the help of Mike Merrill and Todd Boroson, John and Chuck skillfully managed our actions on the mountain, communicated with the tenant observatories, and handled the many other decisions that had to be made.

Doug Isbell handled numerous updates with the print and electronic media—so well that by the end of the fire the stories moved beyond the fire to focusing on the importance of the observatories on the mountain. Hal Halbedel and Hillary Mathis handled the initial evacuation of the mountain. Hal spent many days and nights as part of the on-site support for the fire response team, and took care of instrumentation. Fred Wortman, Daniel Abraham, Dawn Clemons, Randy Feriend, Wally Thurn, Dave Murray, and Casey Muse helped with on-site support, and many other tasks.

Kiki Atkinson, Joanne Hudson, Mike Merrill, and Nanette Bird handled communications with our visiting astronomers and assisted with the necessary revisions to their travel and lodging plans. Public Outreach staff (including Rance Lewis, Kevin Bays, and Rudy Islas) had to similarly handle the disruption to our Visitor Center and Nightly Observing Program. At NSO, Claude Plymate secured the facilities so they would be as safe as possible. David Gasson, Mark Newhouse and others helped keep our Web pages current. Near the end of the fire, Will Goble, with others from Kitt Peak Engineering and the Mountain Facilities Staff, managed to realuminize the Sloan Digital Sky Survey telescope’s mirror, right on schedule.

During the course of the fire I admit that I kept checking in, via phone and the Web pages, to get an update on how the fire fighting was going. However, I was still able to enjoy a family vacation because of my great confidence that our staff was doing everything possible to ensure the safety of our employees, tenants, visitors, and facilities.

— Buell T. Jannuzi

KPNO Staff Changes

Buell T. Jannuzi



Nanette Bird has joined KPNO as an administrative assistant in the KPNO Director's Office. She comes to KPNO from the LSST, where she had been the assistant to the project managers since September 2006. Prior to working for LSST, Nanette was employed as an estimating assistant/IT manager at Meridian Engineering Company. Nanette is taking over from Sheryl Falgout, who has joined the WIYN Observatory. We thank Sheryl for all her efforts in support of KPNO.

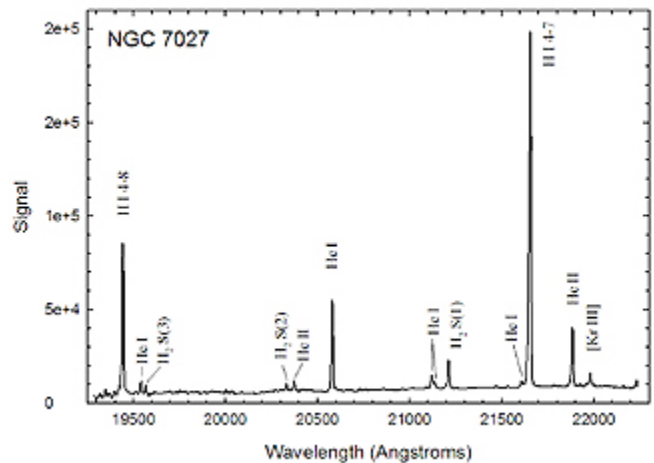
Steve Howell will be joining the NOAO science staff full-time on October 1. Steve will continue as the telescope scientist for the WIYN 3.5-meter telescope. He will also continue his work with the successful Research Based Science Education program run by the NOAO educational outreach group, including research projects that enable high-school teachers to work with data from the Spitzer Space Telescope. We are pleased to welcome Steve to the KPNO/NOAO staff.

IRMOS Status

Dick Joyce & Jay Elias

IRMOS, the configurable multi-object IR spectrograph built by John MacKenty (STScI) and collaborators, continues to be available to proposers for use on the KPNO Mayall 4-meter telescope. A cooled baffle stack has been added to the radiation shield in a largely successful effort to reduce scattered background light from falling on the detector. Although the relatively warm (230 K) digital multi-mirror at the input focal plane results in some inevitable dispersed background for spectroscopy in the K band, the background at shorter wavelengths has been reduced significantly.

We have obtained some performance data from observations of standard stars and an emission-line target in the H and K bands. An updated version of the IRMOS capabilities and performance will be installed on the instrument capabilities page on the KPNO Web site (www.noao.edu/kpno/instruments.html) well in advance of the 2008A proposal deadline.



Spectrum of the planetary nebula NGC 7027 taken with IRMOS on the Mayall 4-meter telescope in November 2006, using the R=3000 grating and the K blue blocking filter. Identified lines are noted. Lines at the 0.5 percent level compared to Br γ are easily detected.



From the Director's Office

Steve Keil

The National Solar Observatory and its community were very pleased to learn that the National Science Board (NSB) approved the following resolution at its August 6-8 meeting: "RESOLVED, that the National Science Board authorizes the [NSF] Director at his discretion to include the construction of the Advanced Technology Solar Telescope in a future budget."

This action moves the ATST out of the "readiness" stage and makes it a potential new start in the Major Research Equipment and Facility Construction (MREFC) account. While NSB approval is not a commitment of funds, it is a necessary step toward a possible future appropriation for a construction start.

Project manager Jeremy Wagner, project scientist Thomas Rimmele, and the rest of the project team deserve our congratulations for their superb efforts that enabled us to cross this major threshold. The NSO also extends special thanks to NOAO staff members Jeff Barr and Chuck Gessner for their contributions to the project.

* * *

AURA's management oversight committee for the NSO, the Solar Observatory Council (SOC), has undergone a few changes recently. Steven Kawaler (Iowa State University) and Pere Pallé (Instituto de Astrofísica de Canarias) have rotated off the council. We would like to thank Steve and Pere for their useful and helpful advice these last few years. Peter Gilman (High Altitude Observatory), who has been an SOC member since its inception, has also rotated off, but we hope to continue to work with him and benefit from his invaluable insight and help as he remains active on the AURA Board. We welcome two newly elected SOC members, Sarah Gibson (High

Altitude Observatory) and Rene Walterbos (New Mexico State University). Their term began July 1, and we look forward to working with them over the next several years.

* * *

The NSO Users Committee met in April in conjunction with the NSF "Town Hall" meeting in Tucson. A subset of the committee also met during the AAS Solar Physics Division meeting in Honolulu. The 2007 report of the committee is available at www.nso.edu/general/committees/.

* * *

The NSO had a sizable presence at the May 27-31 AAS Solar Physics Division (AAS/SPD) meeting in Honolulu. Twenty-six papers by NSO scientists were presented, including three posters by Research Experiences for Undergraduates (REU) students and one by a graduate student who just completed his PhD thesis with NSO.

A few weeks later, the second annual University of Arizona and NSO Summer School in Solar Physics was held at NSO/Sacramento Peak (see separate article with details in this *Newsletter*). Both the AAS/SPD meeting and the Solar Physics Summer School provided opportunities for announcing the new graduate program in solar physics at the University of Arizona Lunar and Planetary Laboratory (LPL). The new program provides opportunities for collaborations with NSO scientific staff. Former NSO/REU student Thomas Schad has been admitted to the graduate program at LPL and will be the first student in this program beginning with the semester that has just started. Tom presented very exciting results at the AAS/SPD meeting in Honolulu on a definitive measurement of

Alfven waves in the solar corona. In addition to the usual graduate course load at LPL, Tom will be working closely with Matt Penn at NSO this academic year.

* * *

In addition to Tom Schad, we are pleased to welcome Kim Streater to NSO as our new Kitt Peak Projects Manager. Kim's primary responsibility will be serving as project manager for the SOLIS facility, which is in an extended commissioning phase at the Kitt Peak SOLIS Tower (formerly known as the KPVT). Kim comes to us from the High Altitude Observatory (HAO) in Boulder, Colorado, where he served as Manager of the HAO Instrumentation Group since 1993. His accomplishments at HAO include management of projects and operations for both ground- and space-based instrumentation in solar physics. With a degree in physics from the University of Arizona, Kim is neither a stranger to Tucson nor to the NSO, where he started his career serving as an observer at Sacramento Peak from 1979-1983. His significant experience in the development and commissioning of new solar instrumentation will be a tremendous asset to the NSO.

* * *

K. S. (Bala) Balasubramaniam left NSO this summer to join the Air Force Research Laboratory scientific staff in residence at Sacramento Peak. While we miss Bala as part of the NSO staff, we extend our very best wishes to him for success in his new career with the Air Force. Since he is still at Sac Peak, we will continue to receive the benefits of his participation in our programs, such as the REU and graduate student programs.

ATST

The ATST Team

The Advanced Technology Solar Telescope (ATST) project took a significant step forward in August with the approval of a resolution by the National Science Board (NSB) authorizing “the [NSF] Director at his discretion to include the construction of the Advanced Technology Solar Telescope in a future budget,” thus advancing the ATST from “readiness” under the NSF’s Major Research Equipment and Facilities Construction process to candidacy for a new start in a future budget cycle. This is not a commitment to fund, and does not imply that the construction funds request will be in the next budget cycle. Nevertheless, the project is pleased with this major action by the NSB.

Meanwhile, ATST design refinements continue, and steady progress is being made toward completion of the Final Environmental Impact Statement (EIS) for the Haleakalā site, following an internal review of the process by the NSF, the Lead Agency for the proposed project. Interactions with other interested state and federal agencies are the current focus. Communications are ongoing with Haleakalā National Park, the Federal Aviation Administration, the Advisory Counsel for Historic Preservation, the Office of Hawaiian Affairs and other agencies regarding issues raised by review of the Draft EIS, released in September 2006. The Final EIS is expected to be completed by the end of 2007, with a Lead Agency Record of Decision to follow by mid 2008.

* * *

Optical systems for the ATST underwent a series of three systems design reviews (SDRs) July 24-26. The purpose of these reviews was to determine readiness for freezing designs and preparing subsystem Request for Proposal (RFP) packages, and to identify risk areas requiring further analysis or design effort. The SDRs covered the overall optical prescription, the Top-End Optical Assembly (TEOA), and the Wavefront Correction System (WCS).

The first SDR covered ATST’s overall optical prescription, which now is frozen and under change control. Optical Systems Manager Eric Hansen led the review. Since the optical design is a basic element determining the configuration of many subsystems, freezing it is a critical step in meeting the overall project schedule. The ATST Optical Prescription (SPEC-0029, rev. B) comprises 13 mirrors, from the 4-meter M1 to a 400-millimeter steering mirror that delivers the image beam to user instruments on the coude platform.

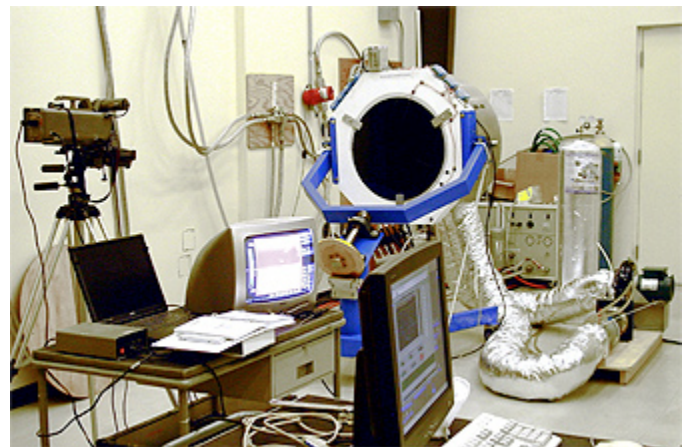
The Optical Systems SDR included the requirements overview and development, error budget development, design development and performance, instrument development, stray light modeling, quasi-static alignment modeling results, and the alignment plan. The committee assessed the status of the optical design and analyses efforts, and commented on readiness to freeze the design. This will allow preparation of subsystem RFP packages to complete the design and fabrication of optical and non-optical subsystems starting in FY 2009. The SDR also identified risk areas that require further analysis or design effort.

The review of the TEOA, a relatively new designation encompassing the M2 module, Heat Stop, Lyot Stop, M2 Support Frame, and their associated control system, was also led by Hansen. The review committee was asked whether the ATST team has done enough of the correct engineering work to proceed with preparations for procurement. The procurement strategy plan is one of competitive bidding, leading to a fixed-price contract for a final design and fabrication package consisting of both secondary and heat stop assemblies. In addition to the standard RFP package, the project intends to provide a “reference design” that may be used to guide a vendor’s proposal. Within the project, reference designs have been used to demonstrate feasibility, assess performance, and allocate error budgets, as well as define interfaces between various subsystems.

The last review, led by Adaptive Optics Project Manager Steve Hegwer, covered the Wavefront Correction System (WCS). The committee was asked to review the status of the WCS design and analyses efforts and comment on the readiness of the design, readiness of subsystems/components, readiness to let contracts to complete the design and fabrication of subsystems, and to assess risk areas that require further analysis or design effort. Four distinct areas comprise the WCS: quasi-static telescope alignment of the overall optical system, the active optics, a fast tip/tilt mirror system (M5), and the high-order adaptive optics (HOAO), including the M9 deformable mirror that will compensate for atmospheric distortion of the image. The HOAO system has been the focus of development efforts at NSO for the past several years.

* * *

Design concepts for cooling the ATST M1 mirror blank (made from Ultra Low Expansion glass, 4.4-meters in diameter and 75 millimeters thick) have proposed to utilize closed-cycle, chilled-air jets on the



The ATST mirror-cooling test-rig within the NOAO Flex-Rig facility at the beginning of Phase I testing.

continued

ATST continued

back surface. After thermal modeling of the mirror and the initial control system were reviewed, it was recommended that the risk associated with this process could be reduced if a prototype of the mirror and cooling system were tested. The ATST project proceeded with this recommendation, designing a scaled test-rig of the M1 mirror cooling system.

Following design, review, and construction, the ATST Mirror Cooling Test-Rig has begun Phase I testing in the NOAO Flex-Rig facility. Phase I testing is providing step response of the test-rig mirror for tuning the air-flow rate and temperature control. Thermal imaging of the mirror's front surface as well as monitoring of critical air and surface temperatures during the cooling process have provided interesting and exciting results. These results will be analyzed with respect to the initial modeling and the models refined. Once the models have been pinned and optimal parameters determined, the project anticipates moving the ATST Mirror Cooling Test-Rig to the NSO Global Oscillating Network Group farm facility for Phase II testing. This testing will introduce the closed-loop control of the jet air temperature while tracking the Sun throughout the day.

* * *

The ATST Integrated Project Schedule (IPS) has proven to be a useful tool to perform various "what-if" scenarios associated with the construction-related effort of the project. With the foundation for the IPS in place, attention is now focused on updating the design and development schedule and all of the activities required to prepare for construction funding. The majority of the activities are associated with enhancing requirements and specification documents, preparing bid packages, conducting design reviews and completing interface control drawings. Inputs for most of the major components have been updated and each of the Integrated Project Team (IPT) leaders

is in the process of updating their schedule. The schedule status will continue to be monitored on a monthly basis, and will also provide some of the initial data to implement the Project Management Control System (PMCS).

One common pitfall that many large science projects have experienced in the past is waiting until after the construction project is underway before beginning to implement a PMCS. This is a non-trivial task. By the time a PMCS is up and running, problems may have already occurred that are harder to address after the fact. ATST is mitigating this risk by putting the PMCS planning in place during the design and development phase of the project, and has engaged Triad Project Management Services to design and implement the PMCS. The initial infrastructure to support the PMCS is now in place and will be extended as construction nears.

The goal of the ATST PMCS is to integrate a suite of cost, scheduling, and reporting tools/databases that provide the Integrated Project Team and Project Manager with accurate and timely information used to continually manage and report on performance of the project. Fundamentally there are five key components to the PMCS system: 1) a bottom-up cost estimate that is frozen; 2) an Integrated Project Schedule (IPS), which is ultimately baselined; 3) an Earned Value Management System (EVMS), which is integrated with the IPS and contains time-phased budgets, actual costs and earned-value calculations; and 4) a PMCS Change Control to record, communicate and process approved changes to the baseline.

The ATST is using proven off-the-shelf applications such as Primavera for scheduling and Cobra for earned value, combined with leveraging some Triad-proprietary applications that have been developed for other large science projects. 

SOLIS

Carl Henney & the SOLIS Team

The past three months were highlighted by the return of Kim Streander to NSO in July as the new SOLIS Project Manager. Kim is well known to the NSO, where he was an observer at Sacramento Peak, NM from 1979–1983. Since 1993, Kim has been affiliated with High Altitude Observatory (HAO), where he was the manager of the HAO instrumentation group, and had operational responsibility for the Fourier Tachometer (working for several years in Tucson, where the Fourier Tach was operated) and Advanced Stokes Polarimeter projects. In total, Kim brings to SOLIS more than 25 years of experience involving solar instrumentation and project management oversight.

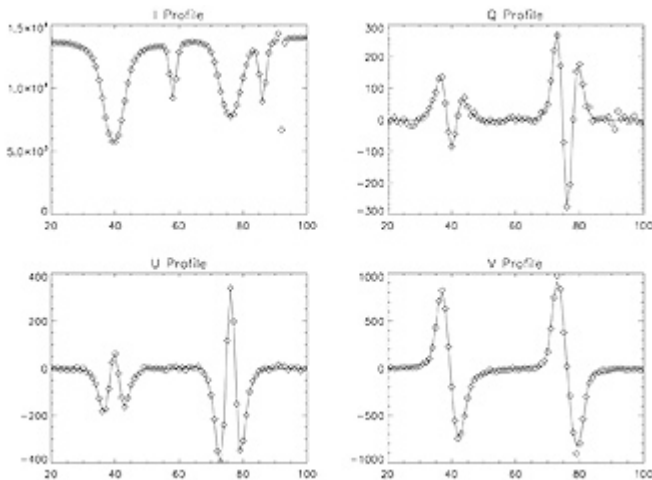


Figure 1. Example fits using the EHF method (solid line) to VSM Stokes data (diamonds) observed 3 November 2006. The fitting algorithm excludes outliers, as illustrated in the sample I-profile spectra shown in the upper left panel.

The VSM Vector Working Group (VSWG) continued to make good progress with the final calibration and pipeline code for processing VSM 630.2 nm vector data. Currently, the primary task is to better parameterize and remove polarization fringes from the VSM Stokes profile data. During this interim period, quick-look vector magnetic FITS-formatted data and JPEG image files are available for recent observations. In addition, the VSWG is investigating the feasibility of preserving all of the VSM Stokes profile data. The original scope of the SOLIS program did not include archiving the observed Stokes profiles; however, preliminary work has begun to store the profiles in a compressed format using the Expansion in Hermite Functions (EHF) method by del Toro Iniesta and Lopez Ariste (*A&A*, 412, p. 875). Example fits to VSM Stokes profiles data (observed 3 November

2006) are shown in figure 1. By utilizing the EHF method for data compression, a storage-space saving of a factor of eight is estimated for VSM vector data.

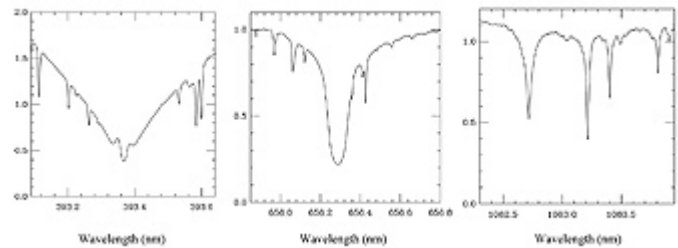


Figure 2. Sample integrated solar spectra measured by the SOLIS Integrated Sunlight Spectrometer (ISS). Shown are spectra of the Ca II K (left), H α (center), and He I 1083.0 nm (right) spectral bands. Ca II H & K and He I 1083.0 nm spectra are now available daily as both FITS-formatted data and JPEG image files. Additional bands, including H α , will be available soon.

Ca II H and K and He I 1083.0 nm spectra recorded by the SOLIS Integrated Sunlight Spectrometer (ISS) are now available daily (see figure 2). The spectra are available as both FITS-formatted data and JPEG image files. In addition, various Ca II K-line parameter time-series data are available as text-formatted data and JPEG image files. Additional spectral lines are expected to be available within the next quarter.

Work on the new SOLIS Data Acquisition System (DAS) and preparation for the replacement VSM cameras is progressing well. The new DAS will replace the no-longer-supported current system. The new DAS hardware configuration supports the new Sarnoff camera link format and reduces the current VxWorks bottleneck when sending data to the Storage Area Network. The DAS operational software has been written and tested using camera simulators, which allows the system to match the Sarnoff 300 HZ frame rate and array size of 1024 \times 256. Camera delivery is expected by the end of August, with qualification tests and finalization of the complete DAS expected by the end of this fiscal year.

In addition, the Full-disk Patrol (FDP) and VSM guider development is progressing well. Once completed, one guider will be installed and used to finalize the optical alignment in the FDP, whereas the second guider will be installed in the VSM to automate the spatial focus and pointing during observations. The original SOLIS guider design has been altered in order to reduce noise and meet scientific requirements. Testing of the new circuit, in quad cell mode, has demonstrated that the design functions well when using one linear array.

Mapping Sodium Absorption in the Mercury Exosphere During the 2006 Transit

A. E. Potter (NSO), R. M. Killen (University of Maryland), & T. Bida (Lowell Observatory)

We observed Mercury during the transit of 8 November 2006 at two NSO sites: the McMath-Pierce Solar Telescope on Kitt Peak and the Dunn Solar Telescope at Sacramento Peak. The observations were successful, with good seeing and clear skies at both sites.

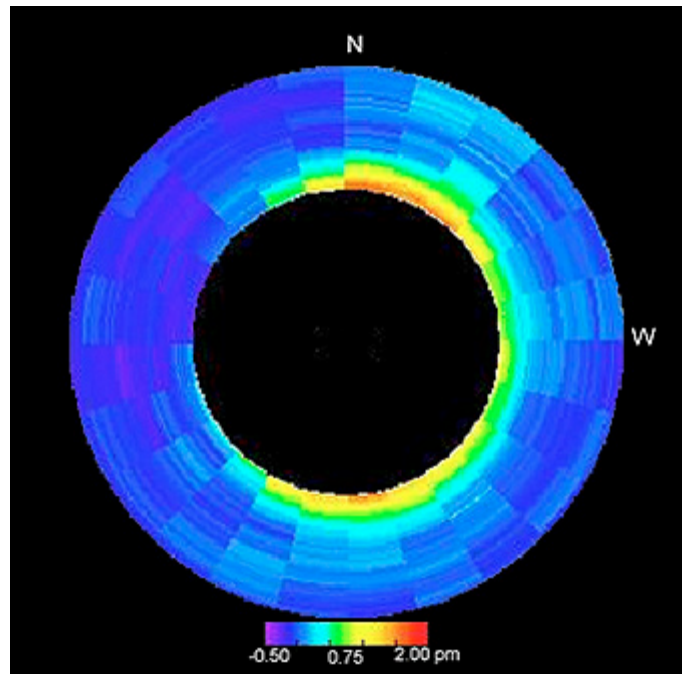
We present here the results from observations at Kitt Peak, where the main spectrograph was used to obtain spectra of the sodium absorption surrounding the disk of the planet silhouetted against the Sun. The observations at Sunspot used the Interferometric Bidirectional Spectrometer (IBIS). Processing of the data from this complex instrument is still in progress.

For the McMath-Pierce observations, the spectrograph slit was oriented first North-South, and later East-West, and a series of slit spectra were measured in each orientation. The planet's position relative to the spectrograph slit was controlled by an adaptive optics system that yielded an effective seeing of about 0.5 arcsec. The planet was stepped across the slit in 0.5-arcsec increments to obtain a series of slit spectra. The slit extended about 10 arcsecs beyond the silhouette on either side to provide absorption spectra close to the planet, as well as reference solar spectra well away from the planet.

The sodium absorptions near Mercury were determined by subtracting a reference solar spectrum from each of the spectra close to the planet. The figure shows the map of sodium absorption above the planet that was determined from these measurements. The absorption is expressed in terms of equivalent-width units of picometers. There was no measurable sodium absorption at the dusk equator (observer's east side), while the dawn equator (observer's west side) showed some sodium absorption.

Sodium absorption above the poles was five or more times larger than over the eastern equator, suggesting high-latitude sources for sodium. Absorption over the north pole was larger than over the

south pole. In both north and south high-latitude observations, the slope of the absorption with altitude above Mercury was less than above the eastern equator, suggesting the presence of high-temperature sodium at high latitudes. The authors were guest observers at the NSO, and the research was supported by the NASA Planetary Astronomy program.



Map of sodium absorption around Mercury during the November 2006 transit of Mercury across the Sun. The absorption is expressed in equivalent-width units of picometers.

2007 Summer School in Solar Physics

Dave Dooling

The second annual Summer School in Solar Physics, hosted by the University of Arizona and the National Solar Observatory (NSO), was held June 11-15 at NSO/Sacramento Peak. The intensive one-week “short” course on solar physics was aimed at graduate and advanced undergraduate students.

“The purpose of the short-course was to provide a basic introduction to solar physics for students who do not have an opportunity to take such a course at their home institution, or who have an interest in the physics of the Sun and may possibly want to pursue a career in solar physics, space physics, or a related field,” said Joe Giacalone of the University of Arizona. Some 31 students and faculty attended the school.

The featured speaker was Eugene Parker, the S. Chandrasekhar Distinguished Service Professor in Physics, Astronomy & Astrophysics at the University of Chicago. Parker is highly respected in the physics community for his seminal work on the solar wind and on the nature of astrophysical magnetic fields.

Speakers representing NSO included Han Uitenbroek, Frank Hill, Aimee Norton, and Matt Penn. Other speakers included Steve Cranmer (Harvard-Smithsonian Center for Astrophysics), Terry Forbes (University of New Hampshire), Giacalone and Randy Jokipii (University of Arizona), and Tami Rogers (High Altitude Observatory and University of Arizona). In addition, several students gave short talks on their own work.

Topics included solar radiative transfer, helioseismology, solar interior, solar magneto-hydrodynamics, chromospheric and photospheric magnetic fields, corona and solar wind, solar activity and magnetic reconnection, and high-energy charged particles.

The Summer School in Solar Physics is funded by a grant from the National Science Foundation and will be repeated in summer 2008.



A team of problem solvers: (left to right) Angela Curtis (Embry-Riddle Aeronautical University), Erica Morgan and Felipe Colazo (Vanderbilt University), and Michael Crain (University of Texas, San Antonio).



Professor Joe Giacalone (wearing hat) chats with students as they view the Sun with an H-alpha telescope.

GONG⁺⁺

Frank Hill & the GONG⁺⁺ Team

The past few months have been occupied mainly by activities leading to the evolution of GONG⁺⁺ to include an important Space Weather capability. We have initiated a research project to forecast active region evolution, begun design of an H-alpha observing capability, and made further progress on the calibration between the far-side signal and magnetic fields. While these steps will hopefully lead to operations support from the US Air Force, they are intrinsically valuable scientifically and should lead to improved understanding of the Sun and the evolution of its magnetic field.

GONG⁺⁺ Science Highlights

We co-sponsored the recent SOHO 19/GONG 2007 meeting on "Seismology of Magnetic Activity," held in Melbourne, Australia, from July 9-13. Led by Paul Cally and the group at Monash University, the meeting was a great success. Topics included coronal seismology, flare excitation of acoustic waves, theoretical models of wave propagation in magnetic fields, and local helioseismology with Hinode. Many thanks to Paul Cally, Alina Donea, Diana Besilu-Ionescu, and John Lattanzio for the local arrangements.

Thanks to a grant from the Air Force Office of Scientific Research, we have initiated a project to develop forecasts of active-region evolution. Using data assimilation techniques, we will incorporate the subsurface flow fields we derive from ring diagrams into two numerical simulations of the surface magnetic field. One model will be provided by George Fisher, Bill Abbett, Brian Welsch and David Bercik at the Space Sciences Laboratory, University of California, Berkeley. The other simulation will be produced by S. T. Wu, A. H. Wang, Allen

Gary, and Chakri Deverapalli at the Center for Space Plasma and Aeronomic Research, University of Alabama in Huntsville.

Work has begun on the development of a custom patch interface for the ring-diagram pipeline. With custom ring patches, and a catalog of active regions, the objective is to develop tools for the analysis and prediction of emerging active regions. Helena Freedlund, a teacher from LaRue County Middle School in Hodgenville, Kentucky, and a participant in this year's NSO Research Experiences for Teachers program, has done a terrific job of designing and populating the emerging region data base.

Motivated by the needs of the Air Force, we have begun to develop an enhancement of the GONG⁺⁺ instrument incorporating an H-alpha observing capability. An initial exercise indicated that it is quite feasible to add the capability with a non-polarizing beam splitter between the calibration wheel and the main optical components. The new light beam would be routed through a filter and the data recorded by a 2048 x 2048-pixel CCD with its own data acquisition system. All of the components are commercially available, substantially reducing the cost of development and deployment. This increased scientific capability should not compromise the global and local helioseismology capabilities in any way.

The GONG far-side monitor detected active region NOAA10953 in the far hemisphere of the Sun and was able to follow it before it appeared on the front side April 26. There was no active region at

continued

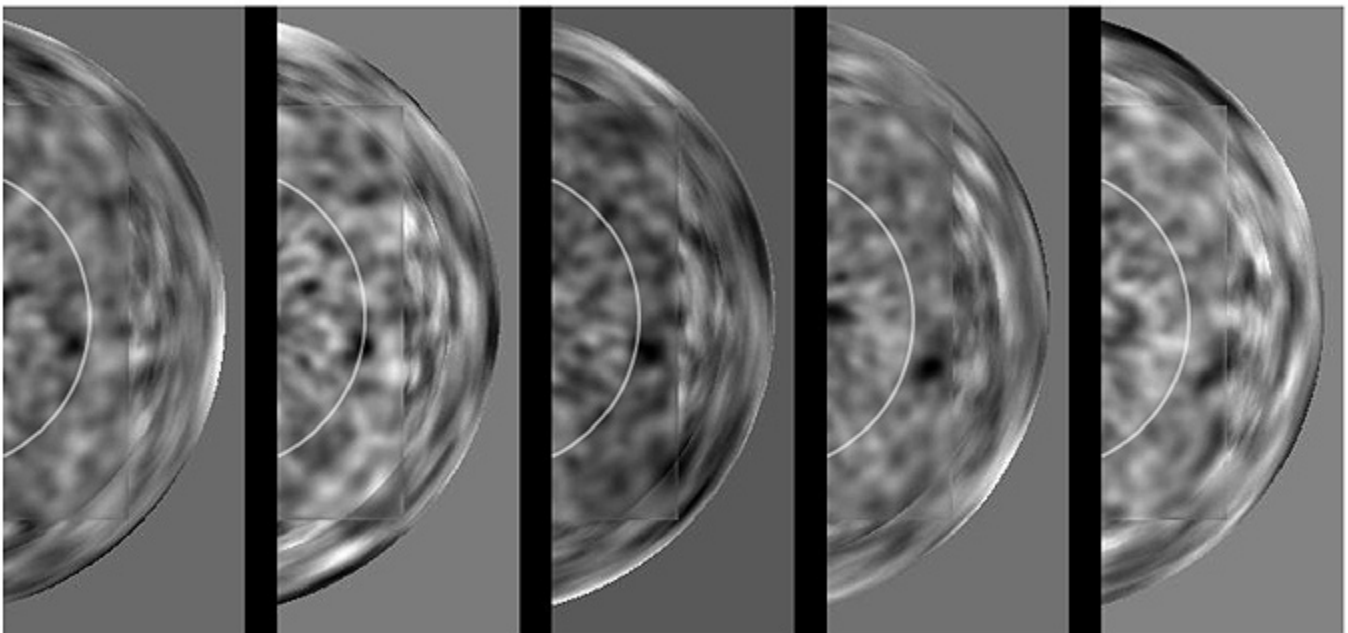


Figure 1. This sequence of images shows a projection of the phase shift of acoustic oscillations on the Sun's surface centered at the far-side antipode of disk center and extended all the way around the limb and onto the front side. The projection covers approximately ± 78 degrees of the front side, leaving only a small portion of the front side not sampled. The data are for days 7, 7.5, 8, 8.5 and 9 September 2005. The white circle represents the solar east limb. The strong signature corresponds to active region NOAA10808. These data allow a direct comparison of the phase shift and the magnetic field strength without the need for unrealistic assumptions about the variability of the magnetic field.

GONG⁺⁺ *continued*

the same position in the previous Carrington rotation, meaning that it was born on the far side. In a period of low solar activity, advance knowledge of the presence of active regions is very important. Hi-node scientists have expressed their interest in using the far-side maps as a tool to plan their observations and have asked us to include them in our activity alert distribution list.

Last issue, we reported the recent achievement of a calibration between the far-side phase shift signal and the magnetic field of the active regions. This is necessary for the use of the far-side signal as a space weather tool. However, the current calibration process requires the unrealistic assumption that the magnetic field of the active region does not change its magnitude between its appearance on the front side, and its passage across the far side. Now, Irene Gonzalez-Hernandez has developed the capability to extend the far-side analysis beyond the solar limb back onto the front side. This allows a direct simultaneous comparison of the far-side signal and the magnetic field strength without any assumptions. Figure 1 shows an example of the analysis.

Network Operations & Engineering

A preventive maintenance (PM) trip was made to Learmonth in April to replace the Lyöt filter, which was producing excessive scattered light and degrading image quality. Considerable improvement in image quality was achieved with the new filter. The next PM trip was to El Teide in May, where the CCD was replaced. Preparations for a post-monsoon September trip to Udaipur are underway. This instrument has been stowed since June 25 due to the onset of the rains.

Work has continued on troubleshooting camera problems and improving the performance of the thermoelectric coolers. A mechanical modification to the turret pitch head has been made and initial indications are that friction between the pitch head and the stationary surface is considerably decreased. Work on the hot spare by our instrument shop is drawing to a close.

The migration to the latest version of VxWorks has been put on hold, due in part to issues encountered when trying to compile TCL/TK under the new operating system. Troubleshooting the new CPU and Data Acquisition System (DAS) boards will be done using a slightly older version of the operating system instead. The search for a replacement camera has begun, and a promising candidate has been identified and placed on order for evaluation and testing. One of the benefits of a new camera will be the use of an industry standard camera-data interface. This means that we will be able to retire the current DAS and replace it with off-the-shelf hardware.

Data Processing, Software Development & Analysis

Porting of Data Storage and Distribution System (DSDS) applications and Data Management and Analysis System pipelines to Linux continues. New Graphical User Interface applications are being built around the constantly growing suite of magnetogram products. For example, the magnetogram group is continuing research into a new method of generating a series of synoptic maps that focus on a previously observed solar event. This new style of synoptic map sequences could enable the detection of transient solar phenomenon in near-real time. A new custom movie generator is now available on the magnetogram pipeline website. It allows users to export their movies to several standard formats, so that they can be saved and viewed offline.

Processing to date includes month-long (36-day) velocity time series and power spectra for GONG Month 118 (centered at 4 December



Figure 2. Participants in the GONG/IIA 2007 International Research Experience for Students (IRES) program at the Indian Institute of Astrophysics (IIA) in Bangalore, India. Left to right: Annapurni Subramaniam (Secretary, Board of Graduate Studies, IIA), Kiran Jain (IRES/GONG Program Coordinator), Siraj Hasan (Director of IIA), Sarah Sonnett (University of Hawaii, Manoa), Natalie Hinkel (Arizona State University), Russell Stoneback (University of Texas, Dallas), and Nicholas Moskovitz (University of Hawaii, Manoa).

2006), with a fill factor of 0.88. The 108-day Mode Frequency Tables, Merged Velocity images and Ring Diagrams are available through Month 117. Last quarter, the DSDS distributed 406 GB in response to 19 data requests.

Program

The NSF-sponsored International Research Experience for Students (IRES) School in Bangalore, India, is going well, and will have concluded by the time you read this *Newsletter*. Four US graduate students— Russell Stoneback (University of Texas Dallas), Natalie Hinkle (Arizona State University), Sarah Sonnett (University of Hawaii, Manoa), and Nicholas Moskovitz (University of Hawaii, Manoa)—arrived in early June and have settled in at the Indian Institute of Astrophysics.

Some significant personnel changes have occurred at our Australian site in Learmonth. John Kennewell has retired after 27 years as the chief physicist at Learmonth for the Ionospheric Prediction Service (IPS). In addition, David Cole has retired as the director of the IPS, based in Sydney, Australia. Both John and David have made major contributions to the success of GONG through their excellent management and scientific enthusiasm for the program. We wish both of them well in their future activities.

Mohamed Aksouh, a graduate student from the Centre de Recherche en Astronomie, Astrophysique et Géophysique (CRAAG) in Algiers, is visiting us in Tucson as part of the NSO 2007 Summer Research Assistantship program. He is working with Rudi Komm and Frank Hill on a project to estimate the profile of turbulence within the solar convection zone. Mohamed is using techniques borrowed from astronomical site testing, developing a theory that links acoustic scintillation to the internal solar turbulence in a manner similar to the relation between scintillation of sunlight and turbulence in Earth's atmosphere. ☼



Kitt Peak Remains A Valued Public “Wonder”

Douglas Isbell

A series of media events in late June and early July 2007—one planned, one unplanned, and one far beyond our control!—demonstrated vividly that Kitt Peak and the telescopes situated there remain objects of great public interest and affection.

On the afternoon and evening of June 28, NOAO public affairs hosted meteorologist Chuck George of KOLD-TV (the highest-rated TV weathercaster in Tucson) at the Kitt Peak Visitor Center for live broadcasts throughout the 5, 6, and 10 pm newscasts. Chuck enthusiastically interviewed Robert Wilson and Doug Isbell about the pending 50th anniversary of Kitt Peak National Observatory in 2008, the Kitt Peak Nightly Observing Program for the public, and the Kitt Peak membership program. Beautiful live views of the McMath-Pierce Solar Telescope and the Mayall 4-meter telescope were topped off at 10 pm by live pictures of Earth’s craggy Moon, and planet Jupiter and its moon Io, fed to the TV broadcast truck from the Visitor Center Observatory’s 20-inch telescope and its talented operator, Flynn Haase.



A video crew from the station toured Kitt Peak a few weeks in advance to tape three extensive stories about the observatory’s public outreach programs, the McMath-Pierce, and the Mayall, plus interviews with NOAO staff members and University of Clemson observers at the 4-meter. Kitt Peak was chosen to kick off a summer-long series of visits by the TV station and Chuck George to all of the major observatories and public telescopes in southern Arizona. Based on the most recent Tucson television ratings, the three broadcasts at Kitt Peak were seen by more than 50,000 local viewers ages 25-54.

Nine days later, a fire was spotted in the Alambre Valley a couple of miles to the south of Kitt Peak. By mid-afternoon that Saturday, two TV media crews (including KOLD-TV) were at the mountain to get video footage of the fire, and to talk with mountain employees. The situation escalated quickly, and the mountain was evacuated by night-fall. For more details on the fire, see the related story in the KPNO section of this *Newsletter*.

From Saturday evening through the re-opening of the Kitt Peak Visitor Center on following weekend, media calls and emails came with regularity, and the NOAO Tucson building lobby became a temporary TV studio. The Alambre wildfire “near Kitt Peak observatory” was at the top of nearly every TV news broadcast, and it received banner headlines and color photos on page 1 of the *Arizona Daily Star* for three days. (From Sunday onward, media access to the Kitt Peak roadway and summit was handled with consummate professionalism by the fire incident management team.)



The tone of all the reports was that a valuable local scientific and economic treasure, and sacred mountain to the Tohono O’odham people, was threatened but that an active response was beating back the danger. By the third day of the fire, the focus of the secondary TV stories turned to the lost science and cancellation of public programs caused by the fire, including two independent stories by the ABC and CBS stations reporting the frustration felt by NOAO staff at missing some important commissioning nights with the new infrared instrument NEWFIRM on the Mayall telescope.

Topping off this run of publicity for Kitt Peak, word of the fire and the threat to the observatory hit the national media on the very Sunday (July 8) that Kitt Peak National Observatory was named one of the “Seven Wonders of Southern Arizona” in an online public poll sponsored by the *Arizona Daily Star*, the major local daily newspaper in Tucson. (Kitt Peak was number three in the voting, behind Mission San Xavier del Bac and the Arizona-Sonora Desert Museum.)

The NOAO office of public affairs would like to thank all of the staff members who kept us well informed during the fire, volunteered their time for media interviews, and helped get the word out on the Web and elsewhere on the status of the observatory. We know that Kitt Peak National Observatory is a special place, and it was made very clear again that many, many people in our region (and far beyond) feel the same way.

KPNO Hosts Tohono O'odham Boys & Girls Club Horse Camp

The picnic grounds at Kitt Peak National Observatory (KPNO) welcomed some special overnight visitors from June 22-24—three dozen kids, ten adults, and a dozen horses came to the mountain to attend one of the periodic horse camps conducted by the Tohono O'odham Boys & Girls Club, based in Sells.



The summer horse camp (one of four camps held each year) has generally been held under the hot conditions typical of the Sonoran Desert, so the cooler weather on Iolkam Duag (also known as Kitt Peak), was appreciated by the kids and the adults. The mountain location also provided the opportunity for the participants to experience a site with great cultural significance to the people of the Tohono O'odham Nation in a program that has cultural education as a major goal.



The group was led by Silas Johnson Sr., president of the Sells Boys & Girls Club Board of Directors. Si developed and has led the horse camps for many years. In the spring of 2007, Si and Cody Chavez, executive director of the Boys & Girls Club, approached KPNO Director Buell Jannuzzi and NOAO outreach astronomer Katy Garmany about having KPNO host the 2007 summer edition of the camp on the mountain. They were very pleased to say yes. KPNO worked with the Tohono O'odham Natural Resources office and the government of the Schuk Toak District to make arrangements (beyond the normal open access of the mountain to the Tohono O'odham people) to host the camp in a manner safe for both the participants and the natural inhabitants of the mountain. Meals were provided on site with financial support from KPNO and the NOAO public outreach office.

Si also requested some teaching of astronomy as part of this edition of the camp (see photo below). With the help of three members of the Tucson Amateur Astronomy Association and NOAO public outreach staff, four small telescopes were deployed on the opening night of the camp to offer views of the Moon, Venus, Jupiter, Saturn, and a few deep-sky objects, along with a timely flyover by the International Space Station.

The Horse Camp program provided the participants with an interesting mix of camping, cultural education, and horse-riding instruction. The program aims to teach the value of personal responsibility and Native American cultural traditions. Jack Kennedy, a member of the KPNO and public outreach mountain staff, learned a lot during his weekend with the group as the Kitt Peak Emergency Medical Technician on hand.



The camp began with an opening ceremony around noon on Friday, including some welcoming remarks from KPNO facilities manager John Dunlop, and ended with a closing ceremony two days later. Tribal elders spoke to the kids around a talking circle (lower left photo) that housed a small fire, which the kids were tasked with keeping burning around the clock for the duration of the camp. The elders shared their life experiences and gave advice to the kids on how to make the most of their futures. Two Tohono O'odham rodeo queens talked about how to succeed through hard work. On Saturday afternoon, traditional O'odham dancers entertained the kids.

When they arrived on Friday morning, most of the kids appeared very timid around the horses, who function, as Si Johnson, Sr., says, as the "professors" that instruct the kids as they master horsemanship skills and the challenge of interacting with the horses. After some demonstrations on feeding, watering, brushing, and learning how to saddle the horses, each camper earned the right to climb aboard. By midday Sunday, the kids were full of self assurance, and comfortable enough to pick a horse, saddle it, and ride in the corral.

Throughout the weekend, the spirit of the gathering was very upbeat and inspiring. The group leaders expressed interest in returning, and KPNO looks forward to hosting further horse camps on Iolkam Duag in the future.

Six Students Needed for REU at CTIO

Styliani Kafka



The Cerro Tololo Inter-American Observatory (CTIO) offers six Undergraduate Research Assistantships during the northern winter semester 2007/2008 through the NSF- funded Research Experiences for Undergraduates (REU) program. The CTIO REU program provides an exceptional opportunity for undergraduates who are considering a career in science to engage in substantive research activities with scientists working at the forefront of contemporary astrophysics. Student participants will work in close collaboration with members of the CTIO scientific and technical staff on specific research projects. These projects include research in areas such as galaxy clusters, gravitational lensing, supernovae, planetary nebulae, stellar populations, star formation, variable stars and interstellar medium.

Furthermore, the CTIO REU program emphasizes observational techniques and provides opportunities for direct observational experience using CTIO's state-of-the-art telescopes and instrumentation.

Participants must be enrolled as full-time undergraduate students during the REU program, and must be citizens or permanent residents of the United States.

The program will run for 10 weeks, from approximately January 16 to March 25, 2008. Complete applications, including applicant information, official transcripts and two or three letters of recommendation should be submitted no later than October 5. For more information (and an application) please check www.ctio.noao.edu/REU/reu.html. Women and minorities are strongly encouraged to apply.

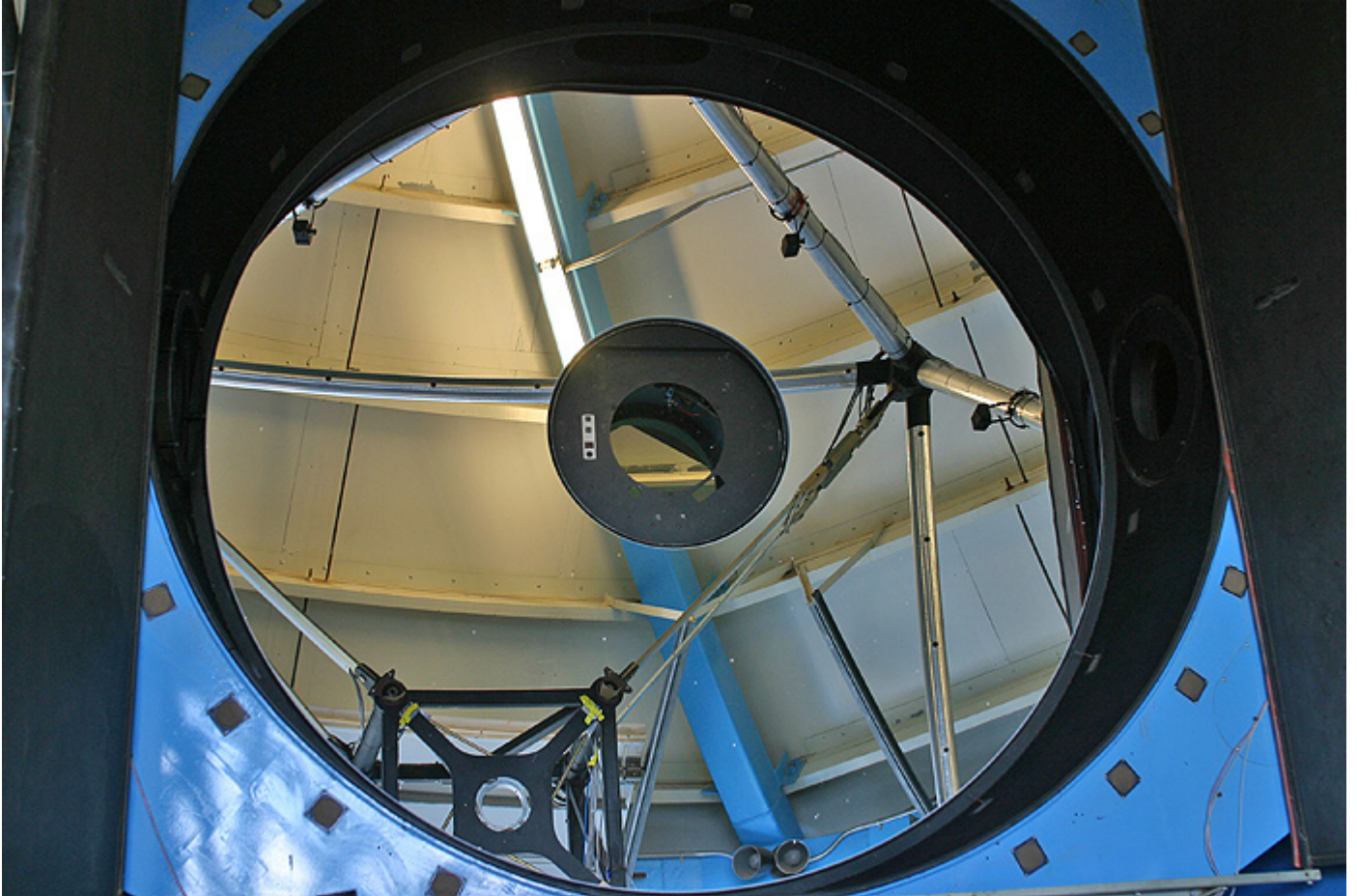


These three new posters describing NOAO and the Gemini Observatory will be displayed at the Centro de Apoyo a la Didáctica de la Astronomía (CADIAS), a community science center and Internet-connected library in Altovalsol, Chile, 14 kilometers east of La Serena.

CADIAS is funded primarily by NOAO and Gemini, and receives additional support from the University of La Serena, the local city government, and the European Southern Observatory. The center has hosted more than 2,000 visitors for programs and star parties in the past six months, along with thousands more who have attended its mobile planetarium program.

Credit: P. Marenfeld and NOAO/AURA/NSF

Big Summer Shutdown for WIYN



The WIYN 3.5-meter telescope on Kitt Peak underwent extensive work during the summer shutdown of 2007, including re-aluminizing of its primary, secondary and tertiary mirrors, and refurbishing of the elevation drive surface. The secondary mirror was removed at the time of this photo.

Image credit: Heidi Schweiker and WIYN/NOAO/AURA/NSF