National Optical Astronomy Observatory

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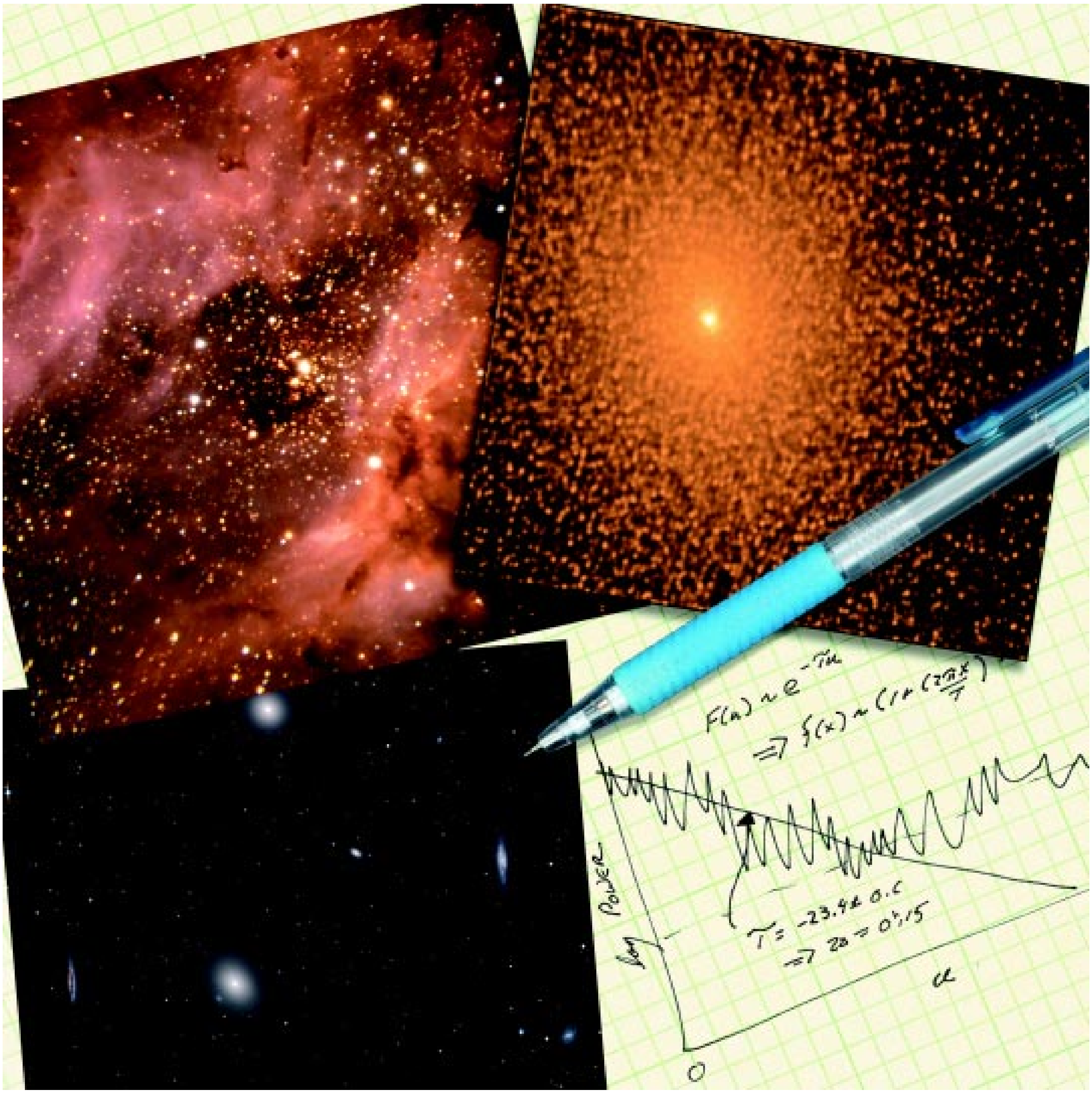
Newsletter 63 September 2000



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National Optical Astronomy Observatory

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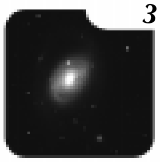

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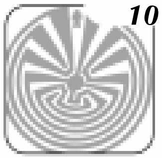

The September issue details instrument capabilities at facilities available through NOAO. Procedures for application and instrument capability tables are in *Observational Programs [Page 19].* Description of instrument upgrades and status can be found in *CTIO Operations [Page 23]*, *KPNO Operations [Page 30]*, and *US Gemini Program. [Page 38]*

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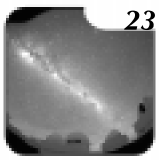

0.13″ Resolution in M32

Astronomers used the Hokupa'a/QUIRC adaptive optics camera on Gemini North to obtain superbly sharp near-IR images of the elliptical galaxy M32. The central 19″, resolved at 0.13″ FWHM, now has the appearance of a star cluster. *[Page 3]*

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Implementing the Decadal Survey

NOAO is sponsoring community workshops to determine how best to implement the "observing system" paradigm recommended by the AASC Decadal Survey and to define requirements for GSMT and LSST, two major facilities recommended by the AASC. *[Page 11]*

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Progress on the Advanced Technology Solar Telescope accelerates. SOLIS moves towards operational status in 2001. *[Page 46]*

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Peak fitting up through month 46 suggests that the temporally evolving component of the sound speed is purely a surface phenomenon. GONG$^+$ cameras are on schedule for deployment by year's end. *[Page 54]*

On the Cover

Expanding the Range of Resolution and Field of View

With Gemini North coming on-line, US astronomers have an expanded range of imaging capability available through NOAO.

Articles in this issue describe new capabilities with three instruments in different areas of the resolution–field of view–wavelength domain. Counter-clockwise from upper right:

- 0.13″ resolution with the Hokupa'a/QUIRC adaptive optics camera at Gemini North. *[Page 3]*
- 7.3′-square field with the four-color IR camera SQIID at Kitt Peak. *[Page 36]*
- 0.8 × 1 degree field with the optical CCD camera Mosaic at Kitt Peak. *[Page 33]*

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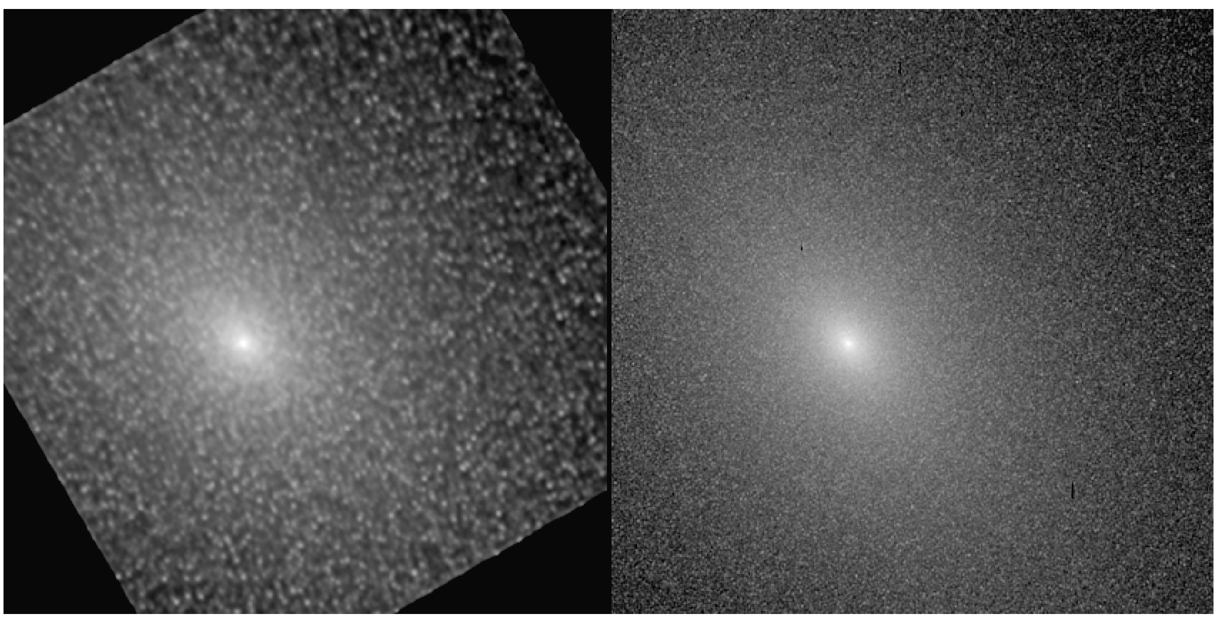
M32—A Galaxy Becomes a Star Cluster

Tod R. Lauer

Tim Davidge (National Research Council of Canada), François Rigaut (Gemini), Wolfgang Brandner, and Dan Potter (Hawaii) used the Hokupa'a/QUIRC adaptive optics camera on the Gemini North 8-m reflector to obtain superbly sharp near-IR images of the center of the Local Group galaxy M32. The images, obtained in the H and K bands, have 0.13″ FWHM resolution, which exceeds the resolving power of the Hubble Space Telescope at these wavelengths.

The most luminous stars appear to start to be resolved outside the central 2″ of the nucleus. Already in the HST I-band image, the granular texture shows that surface brightness fluctuations (point-to-point random variation in the number of stars contributing to any pixel) are the dominant noise source. Comparison of the Hokupa'a H and K images is likely to reveal new information about the evolved stellar population of M32. The nucleus of M32 itself is extremely dense, exceeding densities of 10^7 $M_{\odot}/pc^3$ in stars alone.

HST in the I-band has ~30% better resolution than the K-band Hokupa'a image. The Hokupa'a image, however, has over two times finer sampling; it has thus been rotated and binned to match the HST image in the figure below. The Hokupa'a data comprises sixteen 30s exposures, while the HST data is the sum of four 26s WFPC2 exposures. The region shown for both images is a 19.2 × 19.2″ square field offset slightly from the M32 nucleus. Both have been deconvolved and are displayed with a logarithmic stretch spanning a factor of one thousand in surface brightness. The M32 data were obtained in engineering time in support of early observations being conducted with Gemini, and will be released publicly this month.



The star cluster-like appearance of the core of M32 in the Hokupa'a K-band image (left above) illustrates the potential that this instrument offers for crowded-field photometry. Comparison with an HST I-band (F814W) image (right) shows the increasing contribution in the K-band of light from giant stars, causing the dramatic change in appearance of the galaxy as one moves further out into the near-IR.

Going for the Flow

Based on a Solicited Contribution from Mike Hudson

We are terribly saddened by the tragic accident that claimed the life of Jeff Willick on June 18. Jeff had recently used NOAO facilities as part of the "Shellflow" collaboration, and was the leader of the survey described below. His passion for illuminating the dark corners of the Universe will be sorely missed.

Jeff Willick (Stanford) began a large survey program using NOAO facilities to understand the mass distribution of the Universe on scales of hundreds of megaparsecs. The approach is to use the peculiar velocities of a full-sky sample of galaxy clusters—that is, their detectable deviations from an ideal uniform Hubble expansion—as a gravitational signature of the true underlying mass distribution of the Universe. Work of this sort was the central theme of Jeff's research. The "shellflow" survey that Jeff started continues through the team he established, which includes Mike Hudson (Waterloo, present PI); Roger Davies, John Lucey, Stephen Quinney, Steve Moore (Durham); David Schade (CADC/HIA); Russell Smith (Católica de Chile); Nick Suntzeff (NOAO); and Gary Wegner (Dartmouth).

A basic problem of large-scale structure has been understanding the origin of our own drift of 600 km s^{-1} with respect to the cosmic microwave background, particularly the spatial scale over which this motion is generated. A number of recent studies seem to indicate that large-scale bulk flows of galaxies are largely generated within 6000 km s^{-1} of us (using recession velocity as a proxy for distance), and are not seen on larger scales. At the same time, a few other programs suggest that coherent bulk flows continue to exist at far larger scales. This conflict is difficult to resolve with current data; because the surveys have different sky coverage and depths, there is insufficient overlap of common clusters, and there may be uncorrected systematic effects arising from the wide range of instrumentation used by different groups.

The shellflow survey, which uses observations from both KPNO and CTIO, seeks to measure bulk flows through a deep, homogeneous, all-sky spectroscopic

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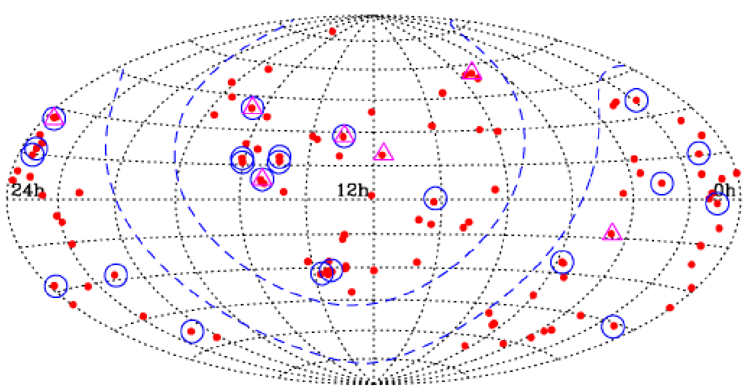

The distribution of shellflow survey clusters on the sky in equatorial coordinates. The Galactic Plane (|b| < 15) is indicated by the dashed line. Clusters in the survey are indicated by dots. Clusters with existing data (for ≥ 10 galaxies) are indicated by open circles (fundamental plane data) or triangles (Tully-Fisher data).

and photometric study of 100 X-ray selected clusters within 200 h^{-1} Mpc (FP200). The fundamental plane distance indicator will be used to make an independent determination of the large-scale flow of clusters of galaxies with respect to the cosmic microwave background frame. With 4,000 early-type galaxies (a factor of four increase over current fundamental plane surveys), the expected combined random and systematic errors should be < 120 km s^{-1} for each component of the bulk flow vector. The long-term time allocation of the NOAO survey program allows use of the same instrumental configuration for all northern and southern runs, thus minimizing a potentially important source of systematic errors.

All calibrated photometric and spectroscopic data will be available via the WWW. In addition to peculiar velocity applications, the resulting photometric and spectroscopic database will be a unique and valuable resource to the community for studies of galaxy morphology, stellar populations, and galaxy evolution in the cluster environment. More information is available at *http://astro.uwaterloo.ca/~mjhudson/fp200.*

NSO Adaptive Optics Operating Successfully at the Dunn Solar Telescope and the German VTT

Michael Sigwarth, Thomas Rimmele, Kit Richards, Richard Radick, Klaus Hartkorn, Kai Langhans, and Wolfgang Schmidt

Significant progress continues to be made with the NSO low-order adaptive optics (AO) system; there have been several successful scientific observing runs at the Dunn Solar Telescope (DST) since the first "closed-loop" run in September 1998 (see *NOAO Newsletter*, No. 56). Examples of observing runs in 1999 and early 2000 can be found at *http://www.noao.edu/noao/staff/keller/aopds/index.html* and *http://www.sunspot.noao.edu/PPAGES/sigwarth/results/2daospec.html.*

Klaus Hartkorn and Kai Langhans of the Kiepenheuer-Institut für Sonnenphysik (KIS) used the NSO AO system at the DST in March to study the very small magnetic field concentrations in the solar photosphere. By using the NSO Universal Birefringent Filter and a fast Speckle camera system from KIS, Hartkorn and Langhans were able to observe structures at the diffraction limit of the DST in the blue spectral range (G-Band 430 nm) of 0.13", corresponding to a physical scale of 100 km.

Each data set of the spectrometer observations consists of 18 filtergrams and continuum images, each with 1.5 sec integration time (30 sec to complete a line scan). The AO system allowed the observers to obtain

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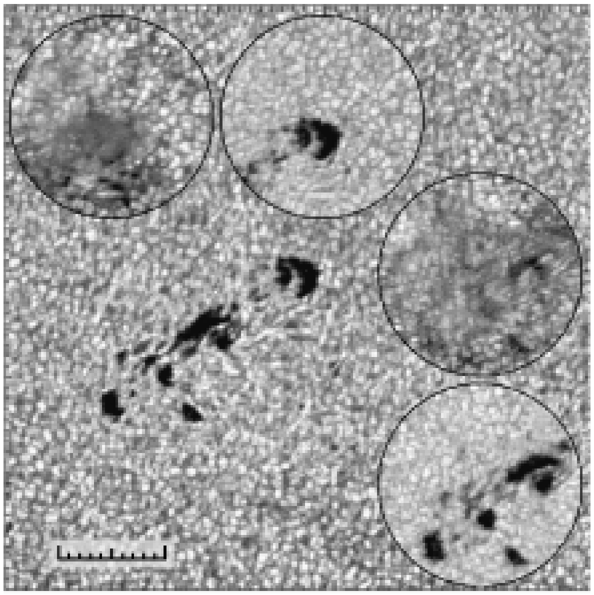

This image, taken with the NSO low-order AO system at the German VTT in Tenerife, shows the few-hours-old active region NOAA 8965 close to disc-center, observed on 22 April 2000, between 15:00 and 16:00 UT (north is up; east is right). The underlying image was selected from a burst of images taken in the G-Band (430 nm) with a fast Speckle camera system at 5 ms integration time. At this wavelength, magnetic flux concentrations show up as "bright points." The circular field-of-view data were obtained with the narrow band (20 mÅ) filter-spectrometer TESOS. They show continuum images taken at 550 nm and the corresponding Dopplergrams obtained from the line core shifts of Fe I 557 nm for each data point (bright are up flows; dark are down flows). Elongated features probably correspond to areas where new magnetic flux appears. Strong down flows in these areas can occur when convective instability exists within the magnetic field. These comments are based on preliminary data calibration and analysis.

a consistent spatial resolution of about 0.25", or 180 km, throughout several line scans.

As part of a joint effort involving NSO, Big Bear Solar Observatory (BBSO), and KIS to design and build high-order AO systems, the NSO low-order AO system was shipped this spring to the Observatorio del Teide in Tenerife, Spain. In early April 2000, Thomas Rimmele (NSO) and Kit Richards (NSO), with colleagues from KIS, integrated the system at the 70-cm German Vacuum Tower Telescope (VTT). The NSO AO system worked flawlessly from the first day of the observing campaign through the end of the run in June, demonstrating that it can be successfully adapted at other solar telescopes. KIS Director Oskar von der Lüehe summarized his experience with this AO system with the following statement: "If you have observed once with AO, you don't want to observe any longer without [it]."

At the end of April 2000, during the first AO observing campaign at the German VTT, Michael Sigwarth (NSO), Wolfgang Schmidt (KIS), and Kai Langhans (KIS) carried out high-resolution 2D spectroscopic observations with the KIS Triple-Etalon Solar Spectrometer (TESOS), the KIS

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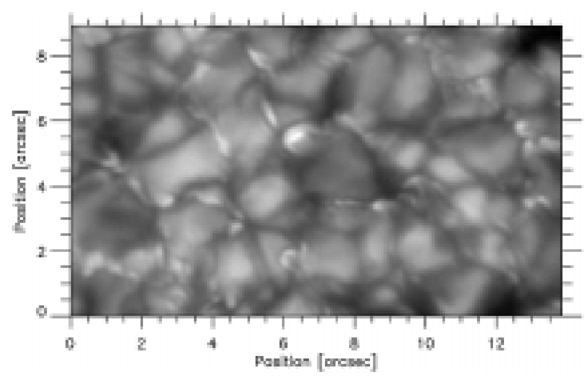


This 14 × 9" (10,150 × 6500 km) area of the solar photosphere shows the morphology of G-Band (430 nm) bright points, which are small magnetic flux concentrations that show up as brightening at very high spatial resolution. Some bright points appear to be at the edges of granules, while others are situated in the dark intergranular lanes. A "Crinkel" (bent arc) feature is visible at position (6,2). It seems to originate in the granule on the right and overlap the granule on the left. These data were obtained on 15 March 2000 by K. Hartkorn (KIS), K. Langhans (KIS), and T. Rimmele (NSO) et al. at the DST with the KIS Dalsa Speckle camera system and the NSO low-order AO system.

Speckle camera system, and the NSO AO system to investigate the development and flow pattern of young active regions. Additional observing campaigns were conducted to study, for example, the dynamics and origin of G-Band bright points, the development of sunspot penumbrae, and the nature of Evershed flows, granular dynamics, and sunspot oscillations.

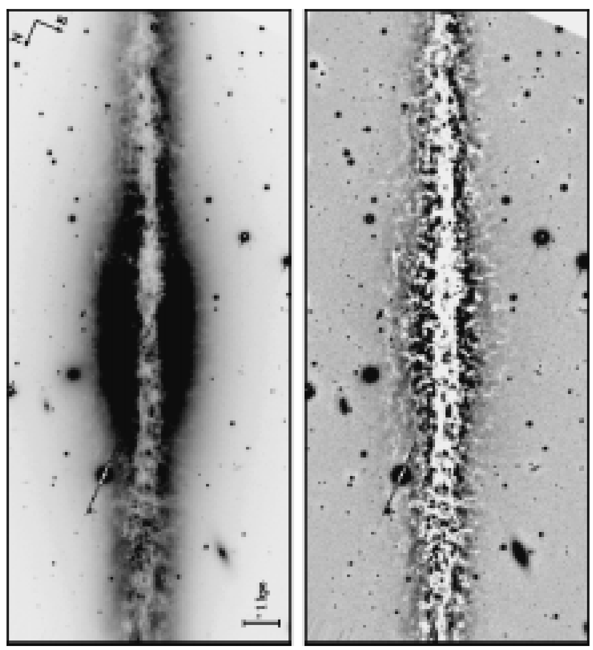
The AO system is now back at the DST in Sunspot, where several observing runs using the system have been scheduled and requested for the third and fourth quarters of 2000.

The original data and additional examples of these observations can be found *at http://www.kis.uni-freiburg.de/~kai/sac_peak/recent.html.*

High Altitude Clouds

Based on a Contribution Solicited from Chris Howk

Chris Howk (Johns Hopkins) and Blair Savage (Wisconsin) are taking advantage of the excellent image quality provided by the WIYN 3.5-m telescope to study the interstellar medium (ISM) in the "disk-halo interface" of massive spiral galaxies in the local universe. Their optical broadband images of large edge-on spirals have revealed complex webs of dusty material stretching kiloparsecs away from the midplanes of these systems. Such clouds are seen in approximately 70% of the edge-on spirals in the local universe.



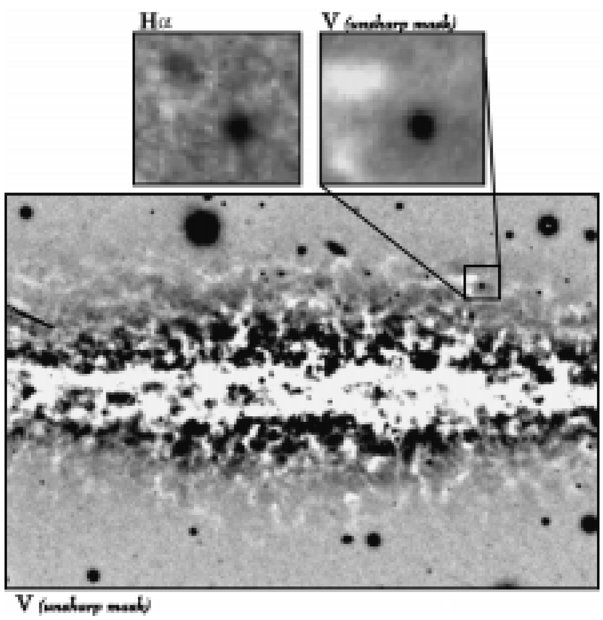
Two views of a WIYN V-band image of the edge-on spiral galaxy NGC 891, which exhibits prominent dust-bearing clouds in a thickened disk of interstellar material. The left panel shows the direct V-band image; the right panel shows the same image after the application of an unsharp masking technique. Individual clouds, observable through their extinction of background stellar light, have sizes on the order of a few hundred parsecs.

The presence of interstellar matter at large distances from the planes of spiral galaxies can be understood if the combined effects of supernovae and stellar winds provide enough kinetic energy to their surroundings to lift some of the material from the thin disks of these systems. In particular, the correlated explosions of multiple supernovae in OB associations are expected to shape the local interstellar material on large scales, perhaps opening an interstellar "chimney" through which hot, high-pressure gas can escape into the halo of a galaxy.

continued

Such scenarios can provide for the presence of material far above the planes of spirals, but the dusty material viewed in the WIYN images is extraordinary. The clouds seen in these images are only visible because they are more dense than their immediate surroundings. Estimates of the masses of individual clouds seen in the WIYN images invariably suggest total gas masses in excess of 10^5 $M_{\odot}$. The clouds seen in these images are not tracing the hot, low-density gas expelled through interstellar chimneys. Although it is possible these images are showing the dense, swept-up walls of the chimneys through which this hot material flows, Howk and Savage suggest that the morphological structure of the material, its density, and lack of associated ionized material argue that the picture cannot be this simple. Instead, it is believed that the WIYN images are showing dense, probably molecular, material in the thickened interstellar disks of spirals. Such clouds could form via cooling instabilities at the intersections between the walls of several chimneys, or as expelled matter falls back toward the disks of the galaxies, sweeping up and shocking material in front of it.

Whatever the method of forming these high-z clouds, Howk and Savage estimate that 10% of the dense phase of the ISM in most spirals is found at large distances from the plane. In addition, there is preliminary evidence in the WIYN images for the presence of young OB associations at heights of 600–2000 parsecs from the planes of some of these spirals. If their identifications are confirmed spectroscopically in an upcoming program with the KPNO 4-m, the observed heights of these objects from the midplane are too large to be explained by formation in and subsequent ejection from the thin Population I disk. Instead, these objects may represent a newly identified mode of star formation in spiral galaxies: star formation in the thickened disks of interstellar material.



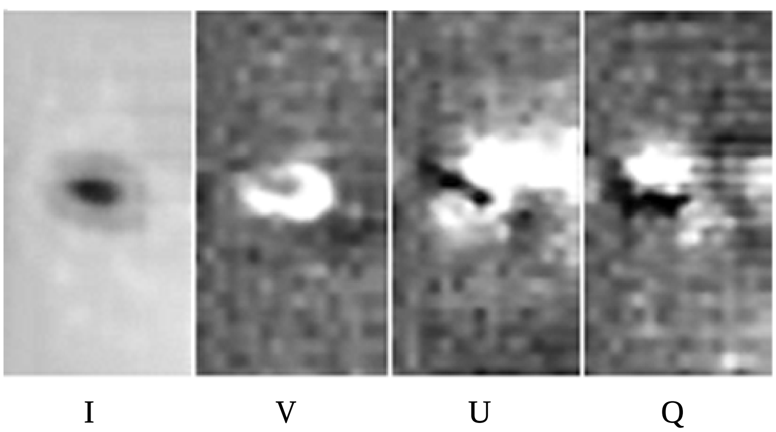
A close-up of the central regions of NGC 891. The insets (each 350 parsecs on a side) show a possible OB association and associated H II region centered approximately 1400 parsecs above the midplane of the galaxy, as seen in the V-band and Hα images.

Stokes Mapping of Solar Magnetic Fields at 12 μm Wavelength

Don Jennings

Full Stokes parameter mapping of magnetic fields in active regions has recently become possible in the mid-infrared. The cryogenic spectrometer Celeste on the McMath-Pierce telescope has produced the first 12 μm measurement of all four Stokes parameters (*I*, *V*, *U*, and *Q*) in sunspots. The magnesium (Mg I) line at 12.3 μm wavelength exhibits a large Zeeman splitting that is resolved at field strengths above a few hundred gauss. In general, fields measured with this line originate in the upper photosphere at heights above those measured in the visible and near infrared. The measurements are at each point along a 2.4' slit. Data cubes of two spatial dimensions, one spectral dimension are created for each Stokes parameter by stepping the slit across the portion of the Sun being imaged.

In general, the Stokes parameter *I* is dominated by the solar continuum. Images in the *V*, *U*, and *Q* Stokes parameter show structure that is not apparent in the continuum image. The complete vector magnetic field can be constructed by combining the azimuth, elevation, and strength information contained in this type of data.



Images in the Stokes parameters *I*, *V*, *U*, and *Q* in an isolated sunspot that was located near the center of the solar disk. The four images shown are each approximately 1.0 × 1.7 arcminutes in size. Each image is a slice of a data cube at a wavelength corresponding to a Zeeman splitting from a field of 1430 gauss. The maximum field observed in this sunspot was 1970 gauss.

made by optically selecting each Stokes parameter in sequence using 1/2- and 1/4-wave plates, followed by a chopping linear polarizer.

The spectra are recorded with Celeste, a high-resolution liquid helium cooled grating spectrometer built by NASA Goddard Space Flight Center. Individual measurements record the Mg I spectrum

This research is a NASA-sponsored effort to exploit the 12 μm Mg I line in measuring magnetic structure. The unique infrared capability of the McMath-Pierce telescope, and its large aperture, make this work possible. This investigation is a collaboration between Goddard Space Flight Center (D. Jennings, D. Deming, G. McCabe, and T. Moran), Dickinson College (R. Boyle), and the Universidad de Monterrey, Mexico (P. Sada).

DIRECTOR'S OFFICE

An Observing System—What Does It Mean and How Do We Get There?

Sidney Wolff

The recently published report of the Astronomy and Astrophysics Survey Committee (AASC) makes a number of recommendations for ground-based O/IR astronomy. Two major new facilities are recommended—the 30-m Giant Segmented-Mirror Telescope (GSMT) and the Large-aperture Synoptic Survey Telescope (LSST). It is fairly easy to see how to go about defining the scientific requirements for these facilities and identifying the technical issues that must be addressed before construction could be initiated with some reasonable confidence about cost and schedule.

Much more challenging is the recommendation that "all facilities, whether nationally or independently operated, should be viewed as a single integrated system . . . " What does this really mean? How do we get from where we are today to this new paradigm? How do we balance greater coordination and planning for facilities as a whole with support of truly creative ideas that could never arise out of some bureaucratic process?

The next article in this newsletter describes several community workshops that we are sponsoring to begin to try to understand this issue, as well as to begin to define the requirements for the GSMT and LSST.

There are other projects that will by their nature require contributions from many institutions. Two examples are the development of adaptive optics—both for today's telescopes and for the GSMT—and the National Virtual Observatory (NVO). In each case, there are a series of tasks and activities that must be completed in order to achieve the overall set of goals, but these activities will necessarily be funded by multiple proposals from many different institutions.

It is important to have an overall road map that shows where we are trying to go and milestones to measure progress along the way so that we do not lose sight of our destination. To this end, NOAO worked with members of the community active in the adaptive optics program and the NVO to prepare white papers outlining the requirements for both programs and to present them to the NSF. Look for them at the NOAO Web site and please send me comments since these roadmaps should be viewed as evolving documents that will be updated regularly based on actual accomplishments of the many institutions that are contributing to these programs.

White papers such as these, which have the goal of defining what will best serve the community as a whole, can play an important role in moving toward greater optimization of the overall investment being made in what will remain a distributed system of capabilities, facilities, and programs.

NOAO—A Partnership with the Community

Todd Boroson

One of the important principles of the new paradigm for O/IR astronomy set out in the AASC report and the associated O/IR Panel report is that NOAO should work in partnership with the community. We take this principle to mean that efforts on specific projects—including instrument development—should include participation from outside NOAO. We also take it to mean that the activity of identifying NOAO's new directions should take into account what is being done at other institutions and should involve the community. We have found that a particularly effective way of doing this is to hold community workshops. Over the next six months, we plan to hold three workshops aimed at discussing (1) the system of public and private facilities for O/IR astronomy, (2) the science case for the Giant Segmented-Mirror Telescope, and (3) the science and operations for the Large-aperture Synoptic Survey Telescope. Following each of these workshops, a report will appear on the NOAO Web site.

Workshop on the "System"

The McKee-Taylor Decadal Survey report lays out a new paradigm for ground-based O/IR astronomy: that "all facilities, whether nationally or independently operated, should be viewed as a single integrated system . . ." The report argues that this view should guide discussions about what new capabilities are needed and how resources can be most effectively used. Most broadly, the "system" comprises all the capabilities that end-to-end allow scientific research to be carried out. Examples of such capabilities are telescopes, instruments, observing modes, data archives and analysis software, and funding that supports research.

As an initial step toward an understanding of the components of this system, how they work together and what capabilities are desirable over the next decade, NOAO is organizing the first workshop on the Ground-Based O/IR System. The strength and evolution of the system will be considered in the context of the international astronomy landscape, and desirable new capabilities will be identified based on the scientific aspirations of the participants, representing the broad community. The NSF Astronomy division has indicated interest in this workshop and plans to send a representative. The workshop will be jointly chaired by Alan Dressler (Chair of the AASC O/IR Panel) and Todd Boroson. Contact Todd Boroson (*tyb@noao.edu*) for further information.

Workshop on the Science Case for the GSMT

The Giant Segmented-Mirror Telescope is a 30-m class O/IR telescope recommended as a high priority for the coming decade by the McKee-Taylor Decadal Survey report. NOAO, through its New Initiatives Office, has initiated an effort to develop viable design concepts for this telescope. This work depends on substantial community involvement in all phases and aspects, from understanding the scientific drivers to carrying out the technical design studies. One of the early challenges is to achieve a deeper understanding of the scientific capabilities that will drive design decisions for GSMT and its instruments.

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A workshop is being organized for mid-September to bring together groups who will discuss how broad science goals of the future translate into prioritized capabilities of the telescope and instruments (e.g., wavelength optimization, field of view, AO requirements). As a result of these discussions, the groups will identify the scientific trade studies needed to improve the prioritization of telescope and instrument capabilities. In order to enable a focused discussion, the panels will consider science goals in the fields of galaxy evolution and large-scale structure, stellar populations, and star and planet formation. The group discussions will be chaired by Frank Shu, Marc Postman, and Rosemary Wyse. NOAO contacts for the workshop are Steve Strom (*sstrom@noao.edu*), Joan Najita (*jnajita@noao.edu*), and Arjun Dey (*adey@noao.edu*).

Workshop on Science and Operations for the LSST

The Large-aperture Synoptic Survey Telescope is a special-purpose facility, envisioned to conduct repetitive imaging surveys of the entire visible sky in search of moving, transient, or variable objects and to build up deep images of selected regions. The database generated will have a myriad of uses and will also provide a basic resource for observations in other parts of the electromagnetic spectrum and for outreach. The concept for data distribution is to make all data available to qualified researchers as quickly as possible, though of course the sequence of telescope pointings must be determined by some scientific strategy.

In order to understand the facility design and operations requirements of various scientific programs that could be carried out with the LSST and how they could be combined into a coherent approach, NOAO is organizing a workshop on Science and Operations for the LSST. This workshop will bring together groups representing the major scientific programs that are being considered for LSST: (1) time-domain studies such as discovering Earth-crossing asteroids, searches for high-redshift supernovae, and microlensing surveys; (2) moderately deep very wide field studies such as searches for rare types of stars in the halo; and (3) very deep narrower field studies such as mapping dark matter through weak lensing. These groups will discuss the requirements of their various programs to better understand what combinations could be effectively merged—in terms of both the expected performance of the facility and its operations strategy. NOAO contacts for this workshop are Todd Boroson (*tboroson@noao.edu*) and Richard Green (*rgreen@noao.edu*).

How to Contact the Director's Office

The Web	*http://www.noao.edu/director*
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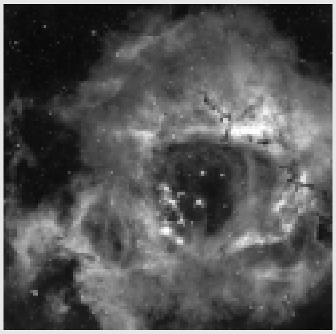

OBSERVATIONAL PROGRAMS

NOAO Nighttime Proposals Due for 2001A

The NOAO Proposal Team

Proposals for observing time for Semester 2001A (February–August 2001) at the Gemini North telescope, the Cerro Tololo Inter-American Observatory, and the Kitt Peak National Observatory, and for community access time at the Hobby-Eberly Telescope are due by Saturday evening, 30 September 2000, midnight MST. Articles in this section provide specific information on the capabilities provided at each facility.

Proposal materials and information are available on our Web page *(http://www.noao.edu/noaoprop/)*. Investigators should use the Web form to initiate all proposals. Although the Web form is the starting point for all proposals, we do provide both e-mail and Web options for submission.

- *Web submissions*. The Web form may be used to complete and submit 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.
- *E-mail submissions*. If you prefer to prepare your proposal locally as a LaTeX file and then submit it by e-mail, that option is still available. Investigators using the Web form are requested to fill out certain information on the general information, investigator information, and run information pages (what is required through the Web form varies with each facility, so read the instructions carefully). After these pages have

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2001A Gemini Proposals

Bob Schommer

We expect that Gemini will issue a call for proposals on 1 September 2000 for the 2001A semester on Gemini North (see additional details in call for proposals). The telescope will be scheduled up to 50% of the time for science during this semester, as remaining system and instrument verification and commissioning will still occupy significant resources. The instruments available will be the facility instrument NIRI, in both imaging and spectrographic modes, and the visitor instruments OSCIR and Hokupa'a/QUIRC. NIRI will be available primarily as a queue instrument, while the others will be "classically" scheduled (i.e., astronomers will travel to the telescope for assigned nights). Because of demand and the possibility of short blocks of time allocation, the US will run a mini-queue for some fraction of the time on both OSCIR and Hokupa'a/QUIRC. Please indicate on the normal NOAO proposal form whether you want queue or classical observations.

Please note that these details are subject to a Gemini system readiness review scheduled in August. Check our Web pages (*www.noao.edu/usgp/*) for current information.

The three nights of community access time on KECK with NIRSPEC are scheduled for 14–16 December 2000, with a call for proposals likely to be in mid-October. See the Gemini Web site for information about how to apply.

been completed, a "customized" LaTeX file can be downloaded or returned to you by e-mail for completion and submission by e-mail. Follow the instructions in the LaTeX template for submitting proposals and figures.

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

Web proposal materials and information.	***http://www.noao.edu/noaoprop/***
Request help for proposal preparation.	***noaoprop-help@noao.edu***
Address for thesis and visitor instrument letters, as well as consent letters, for use of PI instruments on the MMT.	***noaoprop-letter@noao.edu***
Address for submitting LaTeX proposals by e-mail.	***noaoprop-submit@noao.edu***
Gemini related questions relating to operations or instrumentation.	***usgemini@noao.edu* and *http://www.noao.edu/gateway/gemini/support.html***
The official Gemini HelpDesk.	***http://www.us-gemini.noao.edu/sciops/helpdeskhelpdeskIndex.html***
CTIO-specific questions related to an observing run.	***ctio@noao.edu***
KPNO-specific questions related to an observing run.	***kpno@noao.edu***
HET-specific questions related to an observing run.	***het@noao.edu***

The Gemini Time Allocation Process—A New Game

Todd Boroson

For the first time, the recent series of TAC meetings included proposals for Gemini North. The manner in which time is assigned and observations carried out on the Gemini telescopes is somewhat different from that of the NOAO-operated telescopes, and it was clear that some of the implications of that were not appreciated by proposers. First, let's acknowledge that many things were atypical about this semester. We had only 17.5 nights to give out. The 78 proposals that we received oversubscribed this time by a factor of 6.4. Instruments available were limited to two—University of Hawaii's Hokupa'a/QUIRC and University of Florida's OSCIR. All observations were to be obtained through queue scheduling by Gemini staff. Predictions about sensitivities and efficiencies were only guesses.

continued

However, even with all these special conditions, there are several aspects, particularly of the Gemini queue, that determine who gets data and who does not. Here's how the process works.

1. *Proposers write and submit proposals using the forms and process set up by each country's national Gemini office or national TAC. For the US, this is the standard NOAO LaTeX proposal form that is available on the Web and submitted electronically to NOAO. Information about the capabilities Gemini is offering and expected performance comes from the Gemini Web site (mirrored by NOAO for US astronomers). In addition to the instrument desired, proposers must indicate what quality of observing conditions they need. For this first semester, the conditions were limited to image quality and sky transparency, and the choices were limited to one or two for each.*

2. *Proposals undergo a technical review by US Gemini Program (USGP) scientific staff at NOAO. They are evaluated scientifically by the NOAO TAC panels (membership of which is listed on our Web site) and merged into a ranked list based on scientific assessment.*

3. *A US Gemini merging TAC (with representatives from the various discipline panels) then goes through the list in detail. Our 17.5 nights are divided into two, half for each instrument, and are further subdivided into the different bins defined by observing conditions. Once the merging TAC is satisfied that the proposals are in the proper ranked order, these bins are filled by going down the ranked list. When a bin is filled, a proposal that needs those conditions cannot go to the telescope unless it can be put into a bin with better conditions. To give us some latitude, the bins were initially overfilled by a factor of two.*

4. *The resulting ranked list of proposals (about twice as many as were needed to subscribe the US time) is sent to Gemini. The Gemini North operations team takes these lists from the seven partners plus host (Hawaii) and Gemini scientific staff, and merges them into a single ordered list of programs. This list is filled top to bottom using a scheme that allows approximate balance of the partner shares to be maintained.*

5. *The International Time Assignment Committee (ITAC), including representation from each country, meets to discuss the merged queue of programs. The main charge to this committee is to deal with conflicts, such as proposals that went to more than one country (typically, the "cost" is split among the countries involved) or identical proposals from two or more countries (typically, an attempt is made to form a collaboration). The ITAC also decides how to deal with proposals for which a Gemini technical review has identified a problem. Finally, the ITAC decides how to divide the list into "bands." The bands are meant to be ranges of programs that can be considered of equal scientific priority, so that the staff executing the programs have a simple way to pick the best observation to make at any given time from a pool of reasonable size. This time, the ITAC divided the queue into three, roughly equal bands. The final list is forwarded to the Gemini Director for approval.*

6. *For each approved program, a contact scientist at Gemini is designated. The contact scientist works with the PI to ensure a complete understanding of the observations desired. As the semester proceeds, the staff execute the observations, attempting to complete all the Band 1 observations before the Band 2 observations are started. At any given decision point, weight will be given to the best match between program and conditions, completing programs that have been started, and maintaining the balance of partner shares. Partner shares can only be expected to balance over two to three semesters.*

In working through this process from beginning to end, it became clear that the constraints on conditions play a major role in determining which programs get into the queue. Proposers should understand that the tighter the constraints they put on the quality of the conditions for their program, the less time is available for that program. In the most recent round, several proposals requested more than 100% of the time that would be available to US programs with the conditions specified! In the merging TAC, we had to skip over a number of excellent programs because the conditions they requested were already used up by higher ranked programs.

continued

Why don't we select programs purely on the basis of scientific merit and use however much good quality time as there is? We have agreed with the other Gemini partners that we will share the time in an equitable way. We won't try to load the queue with programs that will use up all the best time, but will limit our request of the best time to the same proportion as we get of the total time. Alternatively, we could put a lot of good quality time proposals at the bottom of the queue, with the idea that these will get executed if there is an excess of good quality time in a given semester. Our experience with the WIYN queue convinced us that this is a bad idea. Leaving programs in the queue all semester and never executing them results in (justifiably) upset proposers. If we run out of programs to execute midway through the semester, we can always go back to our list and contact proposers to see if they are still interested in getting data—the usual response is, "Are you kidding?"

And so the advice that comes from the results of this first semester is:

- *Do the math*. Divide the number of nights you are asking for by the frequency of the conditions you require to calculate an "equivalent nights requested." See if this is a rational request.
- *Think carefully about the data quality you need*. Make sure that you specify conditions that will allow you to get that data quality, but not better. Read the instrument and telescope information carefully to ascertain what that is.
- *Don't be discouraged*. Recognize that this semester was a special case that made things a lot harder than they will be in the future.

Proposals for the Hobby-Eberly Telescope

Tom Barnes and Caty Pilachowski

Again for the 2001A semester, observers may request time on the 9.2-m (effective aperture) Hobby-Eberly Telescope (HET) at McDonald Observatory, under an agreement with the National Science Foundation.

Proposals should be submitted through NOAO using the standard NOAO proposal form. Proposals will be reviewed by the NOAO TAC, and those approved will be forwarded to the HET for queue-scheduling. For further details concerning the use of HET for observations and the preparation of observing proposals, see NOAO's Web pages for HET information (*http://www.noao.edu/gateway/het*).

Current Status

During the 2000B semester, the amount of time devoted to science observations on the HET will be scaled back from 14 to 10 nights per month to concentrate engineering efforts on the improvement of image quality. This increase in engineering time follows encouraging developments in image quality improvement and recognizes that all science observations are hamstrung by poor image quality. The commissioning of instruments will take second priority during the semester, and the acquisition of science data will be the HET's third priority. Observations through the NSF Public Access programs will continue through the 2000B semester, however. The NOAO TAC recommended several programs to forward to the HET for observations, and the investigators are, as of this writing, preparing their Phase II programs, which NOAO will forward to the HET staff.

continued

Instrumentation Status

Instrumentation available on the HET in the 2001A semester will be the Marcario Low Resolution Spectrometer (LRS) and the High Resolution Spectrometer (HRS). These are described in *NOAO Newsletter*, No. 60, and at *http://www.noao.edu/gateway/het/*. The LRS is a grism spectrometer with imaging and long-slit modes in operation now. The field of view is 4′ in diameter. The two grisms provide resolving powers of 600 and 1300 in wavelength regions 410–1000 nm and 430–740 nm, respectively. The LRS has achieved 1.6″ images on the HET, although imaging in the 2.0″–2.5″ range is more typical at this time. Researchers planning to use the LRS are asked to consult current performance measures documented at *http://www.noao.edu/gateway/het/*. Upgrades to the instrument, including electronics and a new CCD, are planned this summer.

Commissioning of the HRS is also planned this summer, but may slip until September. The HRS is a fiber-fed spectrometer with resolving powers of 30,000, 60,000, and 120,000 by means of three slit widths. Spectral coverage is 420–1100 nm. Projected performance characteristics of the HRS are available at *http://www.noao.edu/gateway/het/* and will be updated as commissioning proceeds.

MMT Begins Scientific Observations—
No Call for New MMT Proposals This Semester

Todd Boroson and Craig Foltz

The 6.5-m MMT saw first light at its f/9 Cassegrain focus on 17 May 2000. The telescope was dedicated on 20 May 2000, and limited scientific observations began shortly thereafter. During the very first observing run, an NSF Public Access night was scheduled with the MIRAC/BLINC mid-infrared camera. In fact, this was the first program on the new telescope to be awarded time by a telescope allocation committee. Much remains to be done, but the telescope's optical performance exceeded expectation.

Because the pace of construction and commissioning has been a little slower than our (optimistic) hopes, we intend to carry over the Public Access programs that had been approved for the 2000A semester to be executed in the 2001A semester. Consequently, we will not be soliciting new MMT Public Access programs for the upcoming proposal deadline. We expect to solicit new proposals for the next deadline, in March 2001.

Activities being carried out during the summer shutdown of the telescope include: (1) tuning and optimization of the mount servos, (2) installation of the instrument rotator and its control system, (3) installation of the primary mirror thermal control system, and (4) optimization of the primary mirror figure. It is anticipated that scientific observing will begin in earnest after Labor Day 2000, with more than 50% of the time being scheduled for scientific programs and instrument integration.

Keck/NIRSPEC Time Available to US Community

Caty Pilachowski

Observing time on the Keck II Telescope with the Near-IR Spectrograph (NIRSPEC) continues to be available to the US community (and other Gemini partners) through a trade of a Gemini InSb infrared array. In Semester 2000B, the Gemini/NIRSPEC nights will be 14–16 December 2000. This will be a non-AO run to allow observing at 3–5 μm, which was unavailable in 2000A, as well as programs for shorter wavelengths. The program will continue with three nights per semester through the 2001B semester; observations are carried out in queue mode by Gemini Observatory staff.

Investigators interested in applying for NIRSPEC should keep a close eye on the Gemini Observatory Web site (*http://www.us-gemini.noao.edu/sciops/instruments/nirspec/nirspecIndex.html*) for further information. A call for proposals is expected imminently, with a due date in late October. Based on experience in the 2000A semester, Gemini anticipates changing the application form and the rules for applications. Please do not submit proposals for 2000B until further advised.

NIRSPEC is a moderate- to high-resolution, near-infrared (1-5 μm), cross-dispersed, echelle, and grating spectrometer at the Keck Observatory on Mauna Kea. The instrument is equipped with a 1024 × 1024 Aladdin InSb array detector capable of resolving powers of R ~ 1,500–3,000 or R ~ 15,000–75,000. At any single setting of its grating or echelle, NIRSPEC covers a wavelength range of approximately 0.18 λ_{center}. For example, with λ_{center} set to 2.25 μm, the wavelength coverage is 2.05–2.45 μm.

NOAO Observing Time through HST Cycle 10 Proposals

Caty Pilachowski and Steve Strom

We are pleased to announce a collaboration with STScI through which investigators can obtain time on NOAO facilities (not including Gemini) through accepted Cycle 10 proposals for HST time. The amount of time available is limited to 5% of NOAO's available time. Investigators interested in including NOAO ground-based observations as part of their HST proposals should refer to instructions in the Cycle 10 Call for Proposals.

The goal of this collaboration is to allow proposers to avoid the double jeopardy inherent in having to pass through two separate TAC processes, and to provide access to facilities essential to obtaining complementary ground-based O/IR data without regard to institutional affiliation.

STScI joins two other NASA observatories, Chandra and SIRTF (through the SIRTF Legacy Program), in providing investigators with complementary ground-based observations in support of their programs.

New Surveys to Begin

Todd Boroson

NOAO makes available for surveys up to 20% of the time on the telescopes to which it provides access. Our second solicitation for surveys yielded 17 proposals for new programs. A cross-disciplinary survey panel evaluated the new proposals as well as progress reports on the five ongoing surveys. Following the discipline panel evaluation of the standard proposals, the merging TAC discussed the recommended new survey proposals in comparison with the merged ranked lists. The five continuing surveys are:

- *Deep Imaging Survey of Nearby Star-Forming Clouds*, PI: John Bally (Colorado)
- *In Search of Nearby Stars: A Parallax Program at CTIO*, PI: Todd Henry (Harvard-Smithsonian CfA)
- *The NOAO Deep Wide-Field Survey*, PI: Buell Jannuzi and Arjun Dey (NOAO)
- *Deep Lens Survey*, PI: Anthony Tyson (Bell Labs, Lucent Technologies)
- *A Fundamental Plane Peculiar Velocity Survey of Rich Clusters within 200 h^{-1} Mpc*, PI: Michael Hudson (Waterloo)

The new surveys that were recommended for scheduling are:

- *ChaMPlane: Measuring the Faint X-ray Binary and Stellar X-ray Content of the Galaxy*, PI: Josh Grindlay (Harvard-Smithsonian CfA)
- *Toward a Complete Near-Infrared Spectroscopic and Imaging Survey of Giant Molecular Clouds*, PI: Elizabeth Lada (Florida)
- *The Resolved Stellar Content of Local Group Galaxies Currently Forming Stars*, PI: Phil Massey (NOAO)
- *Star Formation in HI Selected Galaxies*, PI: Gerhardt Meurer (Johns Hopkins)
- *Southern Standard Stars for the u´g´r´i´z´ System*, PI: Allyn Smith (Michigan)

Instruments Available in 2001A

Todd Boroson

The following tables summarize instruments available (or expected to be available) in the 2001A semester at the Gemini North Telescope, the Cerro Tololo Inter-American Observatory, the Kitt Peak National Observatory, and the Hobby-Eberly Telescope. For further information about the capabilities and performance of these instruments, and links to instrument manuals, check the NOAO Web site (*http://www.noao.edu/gateway/facilities.html*).

CTIO Instruments Available

Spectroscopy		Detector	Resolution	Slit
4-m	Hydra + Fiber Spectrograph	SITe 2K CCD, 3300-11,000Å or	300-2000	Fiber
		Loral 3K CCD, 3300-11,000Å		120+fibers, 2 arcsec aperture
	R-C CCD Spectrograph	Loral 3K CCD, 3100-11,000Å	300-5000	5.5'
	Echelle Spectrograph + Blue Air Schmidt	Loral 3K CCD, 3100-11,000Å	15,000	5.2'
	Echelle Spectrograph + Long Cameras	SITe 2K CCD, 3100-11,000Å	98,000	5.2'
	CTIO IR Spectrometer (restricted)	InSb (256^2, 0.9-5µm)	450-98000	0.3'
	OSIRIS IR Imager/Spectrometer	HgCdTe (1024^2, 1.0-2.4µm)	1200 or 2900	1.2'
1.5-m	Cass Spectrograph	Loral 1200x800 CCD, 3100-11,000Å	<1300	7.7'
	OSIRIS IR Imager/Spectrometer	HgCdTe (1024^2, 1.0-2.4µm)	1200 or 2900	4'
Curtis Schmidt	Objective Prism Imaging	SITe 2K CCD, 3100-11,000Å	<900	NA

Imaging		Detector	Scale (″/pixel)	Field
4-m	Mosaic II Imager	8Kx8K CCD Mosaic	0.27	36'
	OSIRIS IR Imager/Spectrometer	HgCdTe (1024^2, 1.0-2.4µm)	0.15 or 0.4	1.2' or 3'
	CTIO IR Imager (restricted)	HgCdTe (256^2, 1-2.5µm)	0.4 or 0.22	1.7' or 0.9'
1.5-m	Cass Direct Imaging	SITe 1K/2K CCD	0.44/0.24	14.8'/8.2'
	CTIO IR Imager (restricted)	HgCdTe (256^2, 1-2.5µm)	1.15/0.64	4.9'/2.8'
	ASCAP Optical Photometer			
	OSIRIS IR Imager/Spectrometer	HgCdTe (1024^2, 1.0-2.4µm)	0.4 or 1.1	4' or 10'
0.9-m	Cass Direct Imaging	SITe 2K CCD	0.40	13.6'
Curtis Schmidt	Direct Imaging	SITe 2K CCD	2.3	79'
YALO	ANDICAM Optical/IR Camera	Loral 2K CCD	0.3	10'
		HgCdTe 1K IR	0.2	3.3'

KPNO Instruments Available

Spectroscopy		Detector	Resolution	Slit	Multi-object
Mayall 4-m	R-C CCD Spectrograph	T2KB CCD	300-5000	5.4'	single/multi
	CCD Echelle Spectrograph	T2KB CCD	18000-65000	2.0'	
	IR Cryogenic Spectrograph	InSb (256x256, 0.9-5.5µm)	300-1500	0.8'	
	FLAMINGOS	HgCdTe (2048x2048, 0.9-2.5µm)	1000-3000	10'	single/multi
	High Resolution IR Spectograph (Phoenix)	InSb (256x1024, 0.9-5.5µm)	45000-70000	0.5'	
WIYN 3.5-m	Hydra + Bench Spectrograph	T2KC CCD	700-22000	NA	~100 fibers
	DensePak (1)	T2KC CCD	700-22000	IFU	~90 fibers
2.1-m	GoldCam CCD Spectrograph	F3KA CCD	300-4500	5.2'	
	FLAMINGOS	HgCdTe (2048x2048, 0.9-2.5µm)	1000-3000	20'	single/multi
	High Resolution IR Spectograph (Phoenix)	InSb (256x1024, 0.9-5.5µm)	45000-70000	1.0'	

Imaging		Detector	Spectral Range	Scale (“pixel)	Field
Mayall 4-m	Prime Focus CCD Camera (2)	T2KB CCD	3300-9700Å	0.42	14.2'
	IR Imager (2)	HgCdTe (256x256, 1-2.5µm)	JHK + NB	0.60	2.5'
	CCD Mosaic	8Kx8K	3500-9700Å	0.26	35.4'
	SQIID	InSb (4 512x512, 0.9-3.3µm)	JHK + L (NB)	0.39	3.3' circular
	FLAMINGOS	HgCdTe (2048x2048, 0.9-2.5µm)	JHK	0.3	10'
WIYN 3.5-m	Mini-Mosaic	4Kx4K CCD	3300-9700Å	0.14	9.3'
2.1-m	CCD Imager	T2KA CCD	3300-9700Å	0.305	10.4'
	IR Imager (2)	HgCdTe (256x256, 1-2.5µm)	JHK + NB	1.1	4.7'
	SQIID	InSb (4 512x512, 0.9-3.3µm)	JHK +L(NB)	0.68	5.8' circular
	FLAMINGOS	HgCdTe (2048x2048, 0.9-2.5µm)	JHK	0.6	20'

(1) Integrated Field Unit: 30" x 45" field, 3" fibers, 4" fiber spacing.
(2) Limited to narrow-band filter work and scheduling backup.

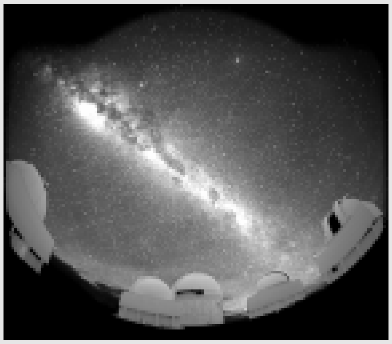
HET Instruments Available

Spectroscopy	Detector	Resolution	Slit	Multi-object
Marcario Low-Res Spect.	Ford 3072x1024 CCD, 4100-10,000Å	600	1.0"-10"x4'	to be added
	or 4300-7400Å	1300	1.0"-10"x4'	to be added
High Resolution Spectrograph	(2) 2Kx4K CCD's, 4200-11,000Å	30,000-120,000	2"or 3"	single

Gemini Instruments Expected to be Available

Imaging	Detector	Spectral Range	Scale ("/pixel)	Field
NIRI F/32 Camera	1024x1024 Aladdin Array	1-5µm	0.022	22.5"
NIRI F/14 Camera	1024x1024 Aladdin Array	1-5µm	0.050	51"
NIRI F/6 Camera	1024x1024 Aladdin Array	1-5µm	0.116	119"
Hokupa'a AO Camera	QUIRC 1024x1024 HgCdTe	1-2.5µm	0.020	20"
OSCIR	128x128 Si:As IBC	8-25µm	0.084	11"

Spectroscopy	Detector	Resolution	Slit	Multi-object
NIRI	1024x1024 Aladdin Array, 1-5µm	800-4200	0.1-0.46"	grism
OSCIR	128x128 Si:As IBC, 8-25µ	100	0.2-0.8"x11"	single



C T I O
O P E R A T I O N S

CTIO TELESCOPE AND INSTRUMENT COMBINATIONS—THE FUTURE

Alistair Walker

CTIO presently operates the Blanco 4-m, the 1.5-m, and the 0.9-m, and has shares in the YALO 1.0-m and the Curtis Schmidt. The SOAR telescope (30% share for NOAO) should begin science operations early in 2003, preceded by Gemini South in 2001B. Other southern-hemisphere facilities soon to come on-line and be available to US investigators are Magellan I (2001) and Magellan II (2003). We note that CTIO will be operating SOAR out of its present budget. Therefore, we need to make radical changes in our Cerro Tololo operations to compensate for the extra responsibilities.

Some three years ago we formulated plans to evolve our instrumentation, particularly on the Blanco 4-m, to complement the new facilities. At the same time, we actively pursued creative ways of running the smaller telescopes, which led to the MACHO agreement on the 0.9-m telescope and the YALO consortium running the 1.0-m in fully queue-scheduled mode. We are now only a few months away from the initial ramp-up of CTIO staff at SOAR. The pressure is not only on the Telops and ETS staff; the scientific staff are stretched thin as well, with participation in US Gemini, SOAR, and various activities newly being undertaken by NOAO as recommended by the AASC report "Astronomy and Astrophysics in the New Millennium."

We are moving rapidly to a model for the Blanco 4-m where we offer a suite of state-of-the-art wide-field instruments, with few or no instrument changes. We no longer make available the f/30 chopping secondary, as its installation (for visitor instruments) involves removing both the Mosaic Imager and the prime focus corrector assembly. The Blanco will continue to be run in classical mode, with astronomers coming to the telescope to observe. Its instruments will complement both SOAR and Gemini, which will have instruments optimized for relatively narrow fields at high resolution.

We will continue to operate the 1.5-m and are considering two low-maintenance operational modes. The first would involve transferring the YALO operation from the 1.0-m to the 1.5-m. This mode, referred to as YALO II, would operate the dual IR-CCD Imager ANDICAM built by Ohio State University in queue-scheduled mode, with Yale and Obs. Lisbon as partners, and with a much greater NOAO share of time (approx 60%) than at the 1.0-m. The partners would pay for two telescope operators who would run the queue. YALO II would start after the present YALO agreement terminates in December 2001. The second operational mode being considered would be to schedule the telescope classically, with two instruments offered in

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SOAR UPDATE

Construction of the SOAR enclosure is now progressing rapidly after a three-week delay due to late delivery of fabricated steel and inclement weather. Current images of the site can be viewed with SOARCam (*http://www.soartelescope.org*). At the same time, substantial progress has been made on fabrication of the telescope mount at RSI Universal Antennas facility in Richardson, Texas, and Raytheon has begun figuring of the primary mirror at their plant in Danbury, Connecticut. The project continues on track for first light in June 2002.

severely blocked mode. Large, long-term programs would be encouraged or mandated; there would be no telescope operator, and Telops assistance would be limited. The instruments under construction are the Cassegrain spectrograph and a CCD imager. In any case, we will retire the Bench-Mounted Echelle (BME) spectrograph at the end of Semester 2000B, ASCAP at the end of 2001B, and IR imaging when ISPI is available on the Blanco.

The smaller telescopes (1.0-m, 0.9-m, and Curtis Schmidt) will be either completely privatized, i.e., operated under shared agreements that require essentially zero CTIO operations load, or closed. The Curtis Schmidt telescope will be last offered to NOAO users for Semester 2001A, with 2001B reserved for Michigan users only as discussed in an accompanying article. We fully realize that some science programs will be difficult or impossible with these changes; hence, we will make every effort to avoid disrupting long-term and survey programs. These types of programs will, if needed, be provided with extra time in the last two semesters of an instrument that is to be retired. Alternatively, we will try to make the transition to another telescope-instrument combination as seamless as possible. We are also very keen to hear from groups who might be interested in operating the smaller telescopes, and we will act as brokers in assembling consortia if need be.

We are sure that the new facilities will create many opportunities. The infrared imager ISPI will mount at an f/8 sideport on the Blanco, delivering a 10 × 10 arcmin field and 0.3 arcsec pixels with a 2K HgCdTe array, while the IFU (Integral Field Unit) feed to the Hydra Bench Spectrograph will provide a finely sampled focal plane to the virtual slit of the bench-mounted spectrograph, which can be configured to simulate many of the present capabilities of the RC and Echelle spectrographs. We will continue to operate Hydra and Mosaic for at least another five years. A mid-life upgrade of CCDs and controllers for Mosaic that permits much faster read time is a possibility, as is moving to a 16K array with new corrector. The latter is an expensive proposition, and one we would not contemplate if an 8-m class wide-field telescope were to be built on Cerro Pachón. Such a telescope is recommended in the Decadal Survey Report.

Two instruments under study by the NOAO–Tucson instrumentation group are of future interest—NGOS and NEWFIRM. NGOS (Next

continued

Generation Optical Spectrograph) is a high-efficiency beam-fed multi-object spectrograph, which could replace Hydra. NEWFIRM is a 4K IR imager. It is likely that one or both of these instruments would be shared with KPNO or other partners.

For SOAR, there is strong interest in adaptive optics within the partner community; CTIO has an instrumentation development wedge opening for this project in 2001 and is in the process of forming a project team. Gemini South and SOAR would then be the only US-accessible facilities with AO in the Southern Hemisphere. Another desirable instrument in the SOAR initial instrument complement is an IR multi-object spectrograph; discussions on how best to procure such an instrument are underway. An interim spectrograph will either be an upgrade of CTIO-IRS or OSIRIS. The latter could also provide an IR imaging capability close to first light, which might otherwise be lacking.

Gemini, of course, has an active instrumentation program for the Gemini South telescope. In addition to the instruments in the accompanying table, Gemini plans to install NICI (Near-IR Coronographic Imager) in 2004 and a Multi-Conjugate Adaptive Optics (MCAO) system in 2004–2005. Their program is presently under review and likely to change. For instance, Gemini now proposes to go straight to MCAO on Gemini South rather than Hokupa'a South as an interim AO facility. Consequently, the instrument complement for Gemini South is being reevaluated.

CTIO will continue to have a strong instrumentation program, both to support present instruments and to provide future instruments. We hope to be able to expand the program so that we can participate in providing instrumentation for the US 6–10 m telescopes. Instruments may also be procured by partnerships with universities or built by NOAO–Tucson.

The accompanying table depicts our instrumentation plan for the CTIO telescopes through 2003. For reference, we also include the Gemini South instrumentation plan. Details will almost certainly change, and we are interested in specific suggestions. The Blanco instruments mentioned that may be unfamiliar to most readers are IFU and ISPI. IFU is an Integral Field Unit feed that is permanently mounted to the Hydra bench spectrograph. First engineering tests are scheduled for November 2000; project manager is Tom Ingerson. ISPI is a 2K all-transmission IR imager with 2K HgCdTe array, mounted permanently at the f/8 RC focus to give a 10×10 arcmin field with 0.3 arcsec pixels; project manager is Ron Probst. See the CTIO Web site at *http://www.ctio.noao.edu* for updated information.

continued

CURTIS SCHMIDT TELESCOPE CLOSURE

Alistair Walker and Pat Seitzer

CTIO and the University of Michigan regret to inform you that the Curtis Schmidt telescope on Cerro Tololo will be available to general users only through the end of the 2001A semester. For the 2001B semester, it will be used by University of Michigan astronomers only, and at the end of that semester it will be closed. The global situation regarding the facilities available at CTIO is discussed in the accompanying article, "CTIO Telescope and Instrument Combinations—The Future."

The Schmidt telescope with SITe 2K CCD covering 1.5 deg^2 has proven to be a powerful combination for many programs and is a facility still unique in the Southern Hemisphere. Parties interested in the future of the Curtis Schmidt should contact Pat Seitzer at the Department of Astronomy, University of Michigan (*seitzer@astro.lsa.umich.edu*).

CTIO, SOAR, and Gemini South Instrumentation 2000–2003

Telescope	2000B	2001A	2001B	2002A	2002B	2003A	2003B	Comments
Gemini South								
T-ReCS			x	x	x	x	x	Deliver Q2 2001
Phoenix			x	x	x	x	x	Share with SOAR
HROS						x?	x?	Deliver Q3 2002?
GMOS					x	x	x	Deliver Q4 2001
Flamingos I			x (June-Nov)		x		x	Share with KPNO
GNIRS						x	x	Deliver Q3 2002
Flamingos II							?	
Abu	x	x						Commissioning only
SOAR								
Optical Imager					x:	x	x	Commissioning instrument
IR Imager						x?	x?	Not yet funded
Goodman Sp.					x:	x:	x	
IFU Sp.					x:	x:	x	
CTIO IRS						x:	x	Or Osiris
Phoenix						x:	x	Share with Gemini
Blanco								
Mosaic II	x	x	x	x	x	x	x	| These four instruments
Hydra	x	x	x	x	x	x	x	| can all be mounted
ISPI				x	x	x	x	| simultaneously.
IFU			x	x	x	x	x	
RC Spec	x	x	x:	x:	x:			| Replaced by GMOS, | Goodman Sp., IFU
Echelle	x	x	x:					Replaced by IFU, HROS(?)
IRS	x:	x:	x:					| One of these two instruments
Osiris	x	x	x	?	?			| will likely go to SOAR
VISITOR								Only in campaign mode?
1.5-m								
CFCCD	x	x	x	x				Retire| or severely blocked
CSCCD	x	x	x	x				Retire| if no Andicam option
Osiris/Cirim	x	x	x	?				Retire
ASCAP	x	x	x					Retire
BME	x							Retire
Andicam					x?	x	x	Dual IR and CCD imager
1.0-m								
Andicam	x	x	x					Present YALO agreement ends after 2001B.
0.9-m								
CFCCD	x	x	x	?				Close or operate with partners.
Schmidt								
NFCCD	x	x						Close after 2001A.

x: designates restricted scheduling

1.5-m BME Spectrograph to be Retired

The 1.5-m telescope Bench-Mounted Echelle (BME) spectrograph will be retired at the end of the present semester, 2000B. The BME was built by Tom Ingerson in 1995, with scientific support provided by Nick Suntzeff. With a 200-mm fiber and slit, resolutions in the range 15000-60000 could be achieved with SITe 2K CCD. Total system efficiencies of typically 0.5–1.5% restrict the use of the BME to bright stars. In recent semesters, demand for the BME has been very low. Therefore, we have reluctantly decided to cease offering this instrument after the end of the present semester.

NEW ARRIVALS

Malcolm Smith

AURA Observatory personnel have seen many new faces around the "Recinto" recently, and more new staff members will be joining us shortly. All of us in Chile welcome these new members of AURA-O.

Now that Gemini is ramping up to its final stages before entering operational mode, several new International Gemini South employees have arrived or will be arriving, as follows:

Pedro Prado (from Argentina), System Support Associate, started work in April.
Claudia Winge (Brazil), Gemini Fellow, May 5.
Eric Hansen (US), Systems Engineering Manager, June 1.
Gelys Trancho (Spain), System Support Associate, July 1.
Marie Claire Hainaut-Rouelle (Belgium), System Support Associate, July 1.
Michael Ledlow (US), Gemini Fellow, July 6.
Bryan Miller (US), Assistant Astronomer, July 17.
Jeff Cox, (US), System Support Associate, August 1.
Tom Hayward (US), Associate Scientist, will arrive on September 18.
Phil Puxley (UK), Associate Director of Gemini–Cerro Pachón, January 1, 2001.

continued

SOAR project employees will also start arriving early next year; the first arrival is expected to be Oliver Wiecha.

CTIO is also going to be welcoming several new scientific staff members. One of them, Don Hoard, has been at CTIO since 1998; he will become a Postdoctoral Research Associate on August 1. Don will continue in his role of Research Experiences for Undergraduates Site Director. His areas of scientific interest are cataclysmic variables and other interacting binary stars, accretion disks, mass inflows and outflows, planetary nebulae, pre-main sequence binary stars, and globular cluster systems.

Both Tom Hayward (mentioned above) and James De Buizer, who will take up a Postdoctoral Research Associate position, will arrive on September 18 while we are all celebrating the Chilean national holidays. Jim is currently a NASA Space Grant Fellow at the Infrared Astrophysics Group in the Department of Astronomy at the University of Florida. He has been working with Charlie Telesco's team and has visited CTIO three times since 1998. His main scientific interests are massive star formation, circumstellar disks, and infrared instrumentation.

On November 1, Hugo Schwarz and Nicole van der Bliek arrive to take up positions of Associate Astronomer and Assistant Scientist, respectively. Hugo is from the Netherlands and is well known to most of the CTIO staff, as he worked at La Silla from 1986 to 1995. From La Silla, Hugo went to the Nordic Optical Telescope at La Palma, where he was Astronomer in Charge of the 2.6-m telescope. Hugo's main interests are the late stages of stellar evolution, with emphasis on (proto)PNe, symbiotic stars, and AGB stars, especially mass loss in carbon stars. Nicole van der Bliek is also from the Netherlands. She comes to us from the IR group at the Stockholm Observatory where she is on a Postdoctoral ESA fellowship (having obtained her Ph.D. at Leiden). Nicole is familiar with Chile as she was on a student fellowship at La Silla between 1993 and 1995. She is currently participating in a follow-up program for the ISOCAM survey of nearby star formation regions with G. Olofsson and L. Nordh and their group from Stockholm Observatory. Her main research interests lie in the field of star formation, IR astronomy in general, and IR instrumentation.

Andrei Tokovinin, CTIO's new Associate Astronomer, is scheduled to arrive in February 2001. Andrei, from Moscow, USSR, is currently working with the Adaptive Optics Group at ESO, Garching, carrying out theoretical studies of multi-conjugate adaptive optics concepts. Andrei's main interests are astronomical instruments, astrophysics of binary and multiple stars, and atmospheric propagation.

How to Contact CTIO

The Web	*http://www.noao.edu/ctio*
Questions	*ctio@noao.edu*
E-mail a staff member	*first initial+last name@noao.edu*

Undergraduates Wanted for the 2001 CTIO REU Program!

Donald W. Hoard

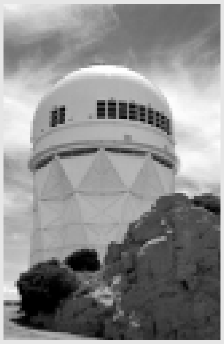
The year 2000 saw another successful National Science Foundation-funded Research Experiences for Undergraduates (REU) program at CTIO. Two students presented posters at the June 2000 AAS meeting in Rochester, and the other two will attend the January 2001 AAS meeting in San Diego. We're looking forward to another outstanding program for 2001 when we anticipate offering four undergraduate Research Assistant positions for a ten-week program starting in January 2001. Donald W. Hoard is the CTIO REU Site Director.

CTIO hosts the only NSF-funded REU program that takes place during the US academic year, which is the Chilean summer (January through March). This schedule provides an alternative for students who can take advantage of a quarter or semester away from their home campuses, and who are interested in participating in an overseas program. The CTIO REU program offers students the unique opportunity to gain observational experience studying objects in the rich Southern Hemisphere sky (e.g., the Magellanic Clouds, the Galactic Center), while also providing them with a chance to work alongside Chilean astronomy and engineering students who come to CTIO to participate in the "Practicas de Investigación en Astronomía" (PIA) program of summer engineering internships.

The application deadline for the 2001 CTIO REU program is 2 October 2000. The program is open to US citizens or permanent residents who will be enrolled as full-time undergraduate students through January 2001. Please check the CTIO REU Web page (*http://www.ctio.noao.edu/REU/reu.html*) for application materials and the latest news about our 2001 program, as well as for more information about the CTIO REU program, projects, and participants from previous years.

Please direct inquiries to *ctioreu@noao.edu*.

2000 CTIO REU student Melanie Blackburn (West Virginia) observes with the CTIO Curtis Schmidt telescope during two nights of orientation on the mountaintop.



K P N O

O P E R A T I O N S

Time of Many Changes

Richard Green

Phil Massey will be leaving Kitt Peak and NOAO at the end of September to take up an astronomer position at Lowell Observatory in Flagstaff. Phil joined KPNO in 1984, and has filled an invaluable role as 4-meter Telescope Scientist. His attention to the full range of performance issues for the telescope, including the extraordinarily important details of interfaces, guiders, and GUIs, has been critical in maintaining the scientific data quality. The telescope engineering and operations teams respect Phil enormously for his exacting standards and his clear priorities that operational performance be only enhanced and not jeopardized. We were also kept on our toes by "astronomer in residence" reports by Phil originating not from Kitt Peak, but from other observatories. The comparisons showed us the way to several improvements in operations. Phil's critical look at operations investments in general formed the basis for spirited scientific staff discussions and honest assessments of our priorities. Those of us who have benefited over the years from Phil's dedication to the telescope and to the observatory are grateful for the outcome, and his impact on our science.

We are still trying to regain our operational equilibrium following the retirements of three of KPNO's core team: Bob Barnes, Jim De Veny, and Bill Schoening. Bob joined Kitt Peak in 1963, Jim in 1967, and Bill in 1968. From beginnings as telescope operators, and research and laboratory assistants, they each developed indispensable expertise and knowledge of the instrument suite and observatory operations. As an observer, you know the confidence you felt when Jim would set up the spectrograph for you, or Bill got you going with CCD imaging. I have been extremely fortunate as Kitt Peak Director to enjoy that same degree of confidence that the KPNO finances and resource tracking were in Bob Barnes' expert hands. We are fortunate that Jim and Bill will continue to be available on a part-time basis. These three epitomize the skill and dedication that made Kitt Peak premier in scientific productivity. On behalf of generations of observers, I offer thanks and well wishes for active and enjoyable retirement.

With George Jacoby (see "New Director for WIYN") and Phil Massey turning to other positions, there are major responsibilities at Kitt Peak to be filled. The task of watching over the 4-meter will be divided between Steve Ridgway as Telescope Scientist and Nigel Sharp as Operations Scientist. Steve will concentrate on system performance, delivered

continued

Reminders about Observing Opportunities

Richard Green

As detailed here and in the Observational Programs section, a number of enhanced or changed observing opportunities are now available at KPNO. Three superb infrared instruments are available for use on the 4-m and 2.1-m—SQIID, FLAMINGOS, and Phoenix. As reported previously, ONIS will no longer be offered, and IRIM is available only for narrow-band work or as a backup for scheduling conflicts. The WIYN queue is no longer in operation for the majority of programs; synoptic and target-of-opportunity programs may still be proposed, as well as observations for a "2-hour" queue. The 0.9-m and Coudé Feed telescopes are not open for proposal-based access. As a reminder, the WIYN integral field unit, DensePak, provides an alternate to Hydra for the bench spectrograph. Good luck with your proposals!

image quality, and upgrade planning, while Nigel will monitor day-to-day issues and focus on instrument and other focal plane interfaces and software. Chuck Claver will retain his responsibility for mountain-wide delivered image quality and hands-on optical alignment. Buell Jannuzi will take over from George as Mosaic Instrument Scientist; George continued in that capacity through completion of this summer's upgrades. To assure both organization and continuing scientific usefulness of the Kitt Peak filter collection, Bruce Bohannan has agreed to take on the job of Filter Scientist. The eight-day weeks prevailing throughout NOAO facilitate the staff taking on these additional responsibilities.

New Director for WIYN

Richard Green

The WIYN Consortium is pleased to announce that George Jacoby will become director of the WIYN Observatory as of September 18th. The Search Committee was impressed with George's credentials, as stated in their recommendation:

George Jacoby has been appointed the first director of the WIYN Observatory.

George Jacoby brings a record of successful project and operations management, as well as a strong scientific reputation. George was project scientist (along with Taft Armandroff) for NOAO's CCD Mosaic imagers; these instruments are now the most heavily subscribed, and run with good reliability and stability. That project required coordination among several technical groups, both in Tucson and La Serena. George also served as the IRAF program scientist, successfully defending the program, and managing the scientific priorities of a six-person software operations group. He also served limited terms as 4-meter telescope scientist, WIYN telescope scientist, and co-director of KPNO. George Jacoby brings scientific reputation and management experience. As George put it, the dedication of one energetic individual can make a big difference to WIYN right now. We concur.

To the WIYN Board of Directors, President Bob Mathieu announced,

I think we have done very well, and I look forward to a bright future for the WIYN Observatory under George Jacoby's leadership.

I would like to express my appreciation to Jeff Alberts, Richard Green, Kent Honeycutt, and Jeff Kenney for serving the Board so well as the Search Committee during the course of this long process. With luck it will be a while before we again see Room 263 at the O'Hare Best Western!

A major responsibility for the new director is focusing WIYN's development resources and partner talent into a successful (i.e., funded!) plan for new instrumentation. That need was highlighted by the five-year performance review committee, and was one of the strongest motivations for appointing a director. I very much look forward to working with George as he molds the scientific future of the telescope that, in the reviewers' words, "delivers the best images over a wide field of view of any continental US facility."

FLAMINGOS on Kitt Peak, Maybe!

Jay Elias, Richard Elston, and Richard Green

FLAMINGOS is coming to Kitt Peak. No, this is not a statement about bird life—with bad grammar—but rather an announcement of the possible availability of the University of Florida Wide-Field IR Imager/Spectrometer in Semester 2001A. The availability of FLAMINGOS will be defined after the first engineering run in late August. Information necessary to submit an observing proposal to use this instrument will be available on the NOAO Web page no later than September 6th.

FLAMINGOS is a wide-field IR imager and multi-slit spectrometer designed and built by Richard Elston (Florida), with some collaboration and support from NOAO. The imaging mode is provided by a fairly conventional optical train, consisting of a refractive collimator, filters, cold stop, and a camera which images the focal plane onto a 2K × 2K HgCdTe detector. The instrument can be used on both the 2.1-m and 4-m telescopes; pixel scale and field of view values for each telescope are summarized below:

FLAMINGOS Imaging Parameters

Telescope	4-m	2.1-m
Arcsec/Pixel	0.30	0.60
Field of View (arcmin)	10×10	20×20

J, H, and Ks filters will be available for imaging. Because the filters are located in a fast beam, narrow-band filters, which will not work very well over the full field, will not be provided.

The cold stops are on a wheel, so that an optimized cold stop is available for each telescope. The image quality of the optics (as designed and toleranced) is well matched to typical image quality on the 4-m, and is about 2 pixels FHWM over most of the field (a little worse at the corners). Imaging on the 2.1-m will mostly *not* be seeing-limited.

The spectroscopic mode is provided by a cold slit mask placed at the telescope focal plane, which is inside the dewar, and by a grism placed after the cold stop. The slit masks are mounted in a wheel in a separate "sub-dewar" within the instrument. The sub-dewar can be warmed up and cooled down quickly, allowing the masks to be changed during the day. The wheel holds several slit masks (enough for a reasonable night's program), in addition to permanently mounted long slits.

The highest resolution available is R~3000, which is sufficient to cover most of an atmospheric "window" with the slit at the center of the focal plane. Lower resolution modes will provide full coverage even for off-center slit locations. A complete listing of the resolution/wavelength combinations that will be provided will be included in the Web posting.

Interested readers will have noted that no information on performance is given above. This is because FLAMINGOS has not yet been tested on the telescope. The first engineering run will take place August 21–23 on the 2.1-m telescope. This run will be with an engineering-grade array, which appears to be almost science grade. Based on the success of the engineering run and the performance of the instrument, we—KPNO and Florida, jointly—will make a decision regarding availability of the

continued

instrument. This information will be available on the NOAO Web site no later than September 6. Information on performance sufficient to allow proposal writing will also be provided.

Note that if the instrument is offered, spectroscopic modes may initially be unavailable on one or both telescopes (in particular, the multi-slit mode). Part of the engineering run will be devoted to establishing the procedures needed to produce useful slit masks, including mapping celestial coordinates to focal plane coordinates to detector (pixel) coordinates.

Rough estimates of imaging performance suggest that FLAMINGOS' sensitivity for individual targets will be slightly worse than SQIID. Because of its larger format array, FLAMINGOS will be the preferred instrument for mapping large areas. For smaller areas, such as individual targets, SQIID would likely be the better choice. A better idea of the trade-offs will be available once the engineering run has been completed.

The current thinking is that FLAMINGOS will be shared between Kitt Peak and Gemini South. The tentative agreement is that the instrument will spend six months per year at each site, with a rotation schedule based on access to key regions of the sky. FLAMINGOS will be available at Kitt Peak typically from mid-December through late May. That plan allows access to M31 and companions (for first half-nights), Orion and other star formation regions in the Northern Galactic plane, and the North Galactic Polar Cap. We will therefore solicit proposals each semester; the half-year cycle places about one-third of the time in the B semester and about two-thirds of the time in the A semester.

Upgrades to KPNO Mosaic CCD Imager

George Jacoby, for the Mosaic Upgrade Team

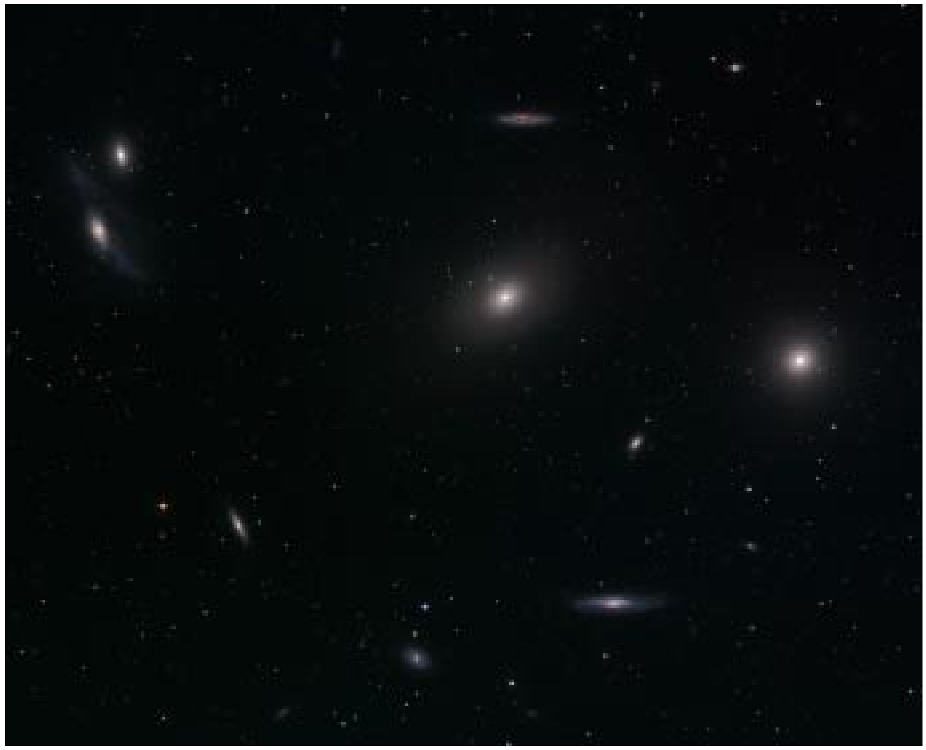
NOAO is currently upgrading the hardware on the Kitt Peak Mosaic CCD imager to improve the performance and reliability of the system. Significant hardware changes were made to the four controllers to read each of the eight CCDs from two amplifiers (16-channel mode) instead of only one amplifier (8-channel mode). This would reduce the readout time by 40%. Unfortunately, two of the CCDs have secondary amplifiers that do not perform adequately and, because the readout rate is limited by the slowest CCD, we must continue to work in the slower 8-channel mode.

In addition, the power supplies on the four Arcon controllers have been replaced to enhance their rated output. This change will improve the longevity of the supplies and allow for better stabilized thermal control of the CCDs.

continued

Margaret Edmondson Fellowship

Anna Katherina Vivas (Yale) is the recipient of the first Margaret Edmondson Fellowship. Kathy will be in Tucson in September, working with Abi Saha on WIYN instrument characterization and stellar population studies.



The KPNO Mosaic CCD camera is used for a variety of wide-field galactic and extra-galactic research and surveys. This 0.8 × 1 degree Mosaic image of the Virgo Cluster, including the giant S0 galaxy, M86, and the giant elliptical, M84, was taken by George Jacoby with the KPNO 0.9-m telescope.

As an improvement to our operations, bar codes are being added to the edges of each optical filter to identify them uniquely. As each filter is loaded into the filter track, its code will be scanned and sent to the acquisition computer to verify that the proper filter is loaded in the desired track position, and to eliminate typing the special filter ID that is needed for subsequent processing.

A new version of the manual should be available, by the time you read this article, from the Mosaic Web page (*http://www.noao.edu/kpno/mosaic*).

In closing, after six years with the NOAO Mosaic project, I will be taking on a different set of responsibilities in mid-September. Effective with this last newsletter article from me, Buell Jannuzi will assume the duties of the Kitt Peak Mosaic scientist. You can reach Buell at *bjannuzi@noao.edu*, or by phone at 1-520-318-8353.

The NOAO Mosaic Upgrade Team consists of Marco Bonati, Bill Ditsler, Dave Dryden, Mike Fitzpatrick, Buell Jannuzi, Bob Marshall, Rich Reed, Roger Smith, Doug Tody, Frank Valdes, and Tom Wolfe.

How to Contact Kitt Peak National Observatory

The Web	*http://www.noao.edu/kpno*
Questions	*kpno@noao.edu*
E-mail a staff member	*first initial+last name@noao.edu*

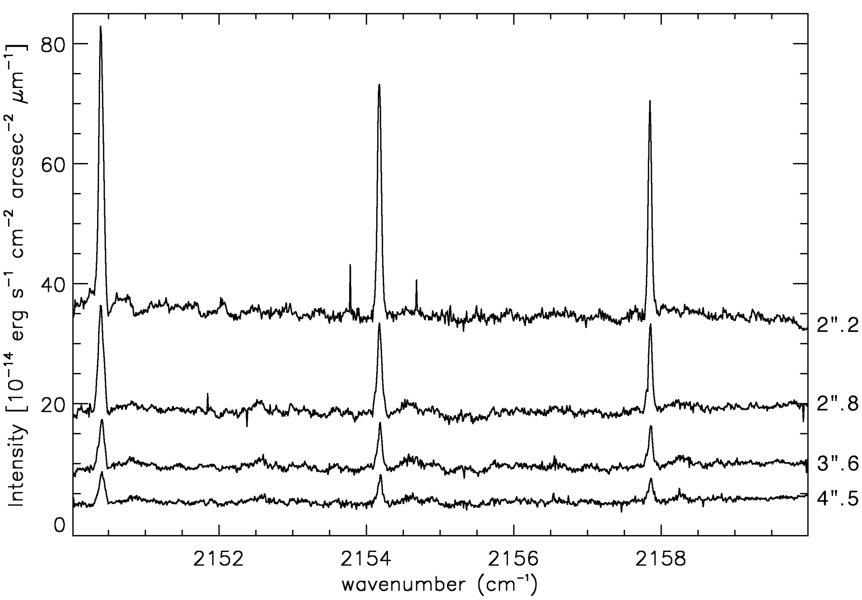
Phoenix Continues at Kitt Peak

Ken Hinkle

Phoenix, which is to be offered as a first-light instrument at Gemini South, will be available on the KPNO 2.1-m and Mayall 4-m telescopes in February and March 2001 before shipment to Chile. By January, Phoenix will be fitted with a new InSb array, which will improve the instrument's sensitivity. Observers are encouraged to apply for KPNO time with Phoenix for projects that can be completed within this time frame or for observations that will enhance the use of Phoenix at Gemini South.

Use of Phoenix on Gemini South is expected to begin in June 2001, with Phoenix to be delivered to Gemini South in May 2001. As previously announced, work on Phoenix to prepare it for Gemini South will be completed by January 2001. As a result, we are pleased to be able to offer Phoenix on the Kitt Peak 2.1-m and 4-m telescopes in February and March 2001. It may also be possible to schedule Phoenix into the April bright period, April 1-15, if permitted by the shipping deadline.

As part of the loan arrangement to Gemini South, Gemini will loan NOAO an InSb array. We anticipate installing this new detector in the 2000B semester. The array will be in the instrument in the 2001A semester for on-telescope calibration before shipment to Gemini. Obviously, this is a major benefit to Kitt Peak users in the 2001A semester. The sensitivity of Phoenix observations on all but the brightest sources in the 1-3 µm region was limited by the current detector (see *NOAO Newsletter,* No. 59).



Phoenix in long-slit mode is used to map the physical conditions in the shell surrounding o Ceti. A set of 4.6-µm CO spectra recorded at the positions (top to bottom) marked in arcsec west of the star. The CO emission results from resonant scattering in the circumstellar shell. These spectra, obtained with Phoenix on the KPNO 4-m in October 1998, will appear in "Mira's Wind Explored in Scattering Infrared CO Lines" by N. Ryde, B. Gustafsson, K. Eriksson, and K. H. Hinkle (*Ap. J.*, in press).

SQIID Begins Science Observations

Mike Merrill

Since the start of science observation in May 2000 at the KPNO 2.1-m, the Simultaneous Quad Infrared Device (SQIID) has been employed 21 nights during 2000A and is scheduled for 73 nights of science observations during 2000B. Before the start of 2000B, we intend to correct the slight focal plane tilt seen in the J channel, establish PAH channel operation, and make assorted software improvements to ease operations. This article outlines the anticipated performance of SQIID for the coming semesters.

The NOAO infrared camera SQIID produces simultaneous images of the same field in the J, H, K, and narrow-band L passbands, using individual 512×512 quadrants of ALADDIN InSb arrays. The observations are generally background (photon statistics) limited. The designated array for each channel is selected for characteristics (read noise, settling time, and dark signal) appropriate to background-limited operation under actual observing conditions for its single filter. SQIID, which serves as its own acquisition camera, is a good match to "point and shoot" observing at the 2.1-m without a telescope operator. The filters are fixed in place; dark slide and window covers are the only moving parts. SQIID employs closed cycle refrigeration instead of liquid cryogens and, in its prior configuration, operated flawlessly for periods as long as 40 days, providing an unparalleled degree of system stability.

SQIID is operated from a Sun workstation through the same NOAO Wildfire system and TCL scripting language employed by Phoenix, IRIM, and CRSP. It is useful to understand that the JHK integration times are identical. Since SQIID is background limited and co-addition is highly efficient, matching the total integration time to the needs of the most demanding channel does not compromise the results in other channels. In like fashion, one can afford to co-add shorter integrations to maintain dynamic range.

SQIID has returned to Kitt Peak with enhanced capabilities. This composite SQIID multi-wavelength IR image of M17, a region of massive star formation known as the Omega Nebula, was formed by K. M. Merrill to illustrate the potential of the new PAH channel. PAH dust emission strongly dominates in this region. The dust is in emission in response to the UV radiation of newly formed hot, luminous stars. The 540-sec composite JK exposures were taken at the KPNO 2.1-m telescope on 11 May 2000. The PAH data are archival COB data.

continued

The UPSQIID package, a set of IRAF procedures designed to facilitate the reduction of SQIID data sets, is available to process each individual source frame and to combine multiple frames from the individual channels into spatially registered composite images. The UPSQIID package is not an officially released and supported IRAF package. Although specifically targeted for SQIID, the routines are suitable for other image data as well.

For further information contact Michael Merrill (*merrill@noao.edu*, 1-520-318-8319) or visit the SQIID Web site (*http://www.noao.edu/kpno/sqiid/*).

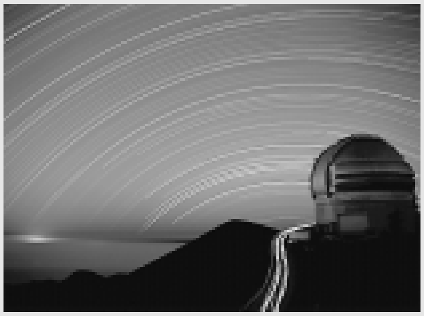
SQIID Performance Characteristics

KPNO Telescope	2.1-m		4-m	
Plate Scale (arcsec/pixel)	0.68		0.39	
Unvignetted FOV (arcsec)	306x320		176x183	
Estimated limiting magnitude*	point	diffuse	point	diffuse
J	19.43	20.38	20.60	20.94
H	18.55	19.55	19.72	20.07
K	18.00	18.96	19.17	19.52
PAH	12.15	13.10	13.31	13.66

S/N = 3 in 60 sec integration time for a point-source (point: mag) and a diffuse-source (diffuse: mag/square arcsec) (T = 50F; 3mm PWV; midrange OH background)

Channel Characteristics	J	H	K	PAH	Units
Conversion gain	10	10	10	11	electrons/adu
Applied bias	600	600	700	-	mv
Full well	>2e5	>2e5	>2e5	-	electrons
Dark	<1	<5	<5	-	adu/sec
Read noise	40	40	35	40	electrons rms
Integration time	0.732	0.732	0.732	-	sec miminum
Relative pointing	(5E,2S)	(3E,2N)	(0,0)	-	pixels on sky
Typical extinction	0.15	0.06	0.08	-	mag/airmass
Background (varies)	100	400	740	-	adu/sec/airmass @ 2.1m
10.0 mag star	2.86e4	2.77e4	1.65e4	-	adu/sec @ 2.1m
Filter manufacturer	Barr	Barr	Barr	Barr	
Filter HPshort	1.131	1.535	2.027	3.262	µm
Filter midpoint	1.267	1.672	2.224	3.299	µm
Filter HPlong	1.402	1.809	2.421	3.336	µm
Filter FWHM	0.271	0.274	0.394	0.074	µm

J filter data are estimated from the manufacturer's warm tracing by applying 1.63% shortward shift. Other data are from manufacturer's 77K tracings. Dichoric transparency has not been applied.



U S G P

U.S. GEMINI PROGRAM

Status of the Gemini Telescopes

Bob Schommer

News from the frontlines continues to be very positive. The TACs have met and telescope time apportioned, and the QuickStart queue results posted on the Gemini Web site. As of this writing (mid-July), the first demonstration science program on Gemini North has begun (with Hokupa'a and QUIRC), and successful data have been taken over several nights (see accompanying article). The 10-μm demonstration science effort is to occur in August with OSCIR, and the first QuickStart observations for the community are scheduled for September. The performance of the Gemini North telescope system in the early July runs has been very good, and efficiencies and system overheads are being evaluated. Pointing tests with a new model show an rms scatter of 0.6". While there are good and not so good moments, the prognosis looks very encouraging for the early science efforts.

The 75% of the telescope time that is assigned to engineering will also be used to commission NIRI, the University of Hawaii 1-5 μm imager and grism spectrometer (see accompanying instrumentation article). These on-telescope tests begin in August. Many interactions must be analyzed, as this is the first facility instrument Gemini will implement. Near the end of the semester, GMOS should be delivered, and testing of that facility instrument on Gemini North should occupy parts of early 2001. The Gemini North AO system, ALTAIR, is expected a few months later.

On Gemini South, the telescope is being fully wired and assembled, and windshake and dome tests are proceeding. The secondary is due to be aluminized at CTIO in early August, and first light is expected in September or October. The commissioning instrument is the NOAO infrared camera Abu, returned from the SPIREX program at the South Pole. The Gemini South science start is scheduled for June 2001. The first instruments are expected to be an 8-25 μm thermal camera, T-ReCS, and two shared visitor instruments—FLAMINGOS, provided by the University of Florida team led by Richard Elston, and Phoenix, a 1-5 μm high-resolution spectrograph from NOAO, with instrument scientist Ken Hinkle leading the effort.

The Gemini personnel and science staffs continue to be assembled, and the first astronomers are arriving in Chile; two Gemini fellows and a staff astronomer have recently docked in La Serena. While they and the telescope have experienced a chilling (and snow covered) Chilean winter, the southern effort remains significantly ahead of schedule.

How to Contact the US Gemini Program

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Gemini Demonstration Science Programs

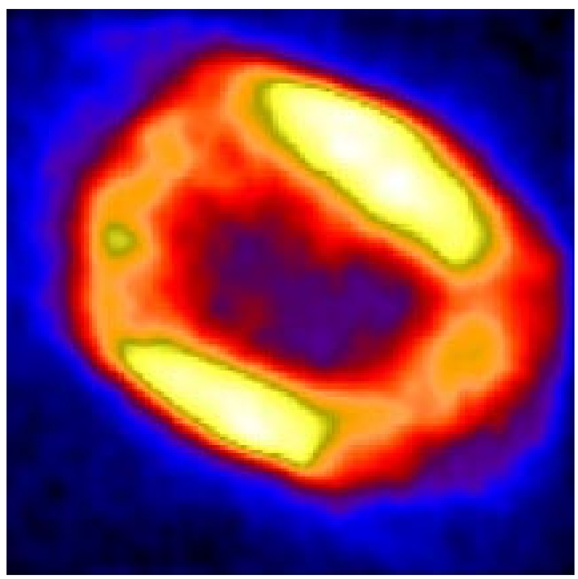
Bob Schommer, R. Blum, and Patrice Bouchet

Over the past several months, two international teams have been assembled, led by Phil Puxley and François Rigaut of the Gemini Observatory. These teams are exploring the science capabilities of the Gemini telescopes with the two visitor instruments provided by the University of Hawaii and the University of Florida. These instruments are available for the QuickStart first semester, but their performance on the Gemini telescope was only known from predictions and extrapolations. The teams have targeted two science programs, the Galactic Center and a 10-µm deep field, and will devote about a week of observations to each target. The data will be made available to the international community as soon as feasible; updates of the system performance will be placed on the Web sites and in instrument manuals in time for the September proposal cycle for the 2001A semester.

The Galactic Center Demonstration Science team completed a successful first run (during 1–9 July 2000) using the University of Hawaii Hokupa'a adaptive optics system and the QUIRC near-infrared imager on the Gemini North 8-m telescope. The team, led by François Rigaut of Gemini, obtained H (1.65 µm) and K-band (2.2 µm) images over nearly a square degree (the FOV of QUIRC is 20 arcsec).

The Demo Science team will reduce the data set (including narrow-band images in the 2.3-µm CO bandhead to be taken at the end of July and beginning of August) and release it to the Gemini community in mid-October. Science topics that will be addressed with the data set include the star formation history in the Galactic Center, the distribution of late-type stars and the dynamical relaxation in the nuclear cluster, variability of the IR counterpart to the radio source SgrA* (commonly thought to be associated with the central black hole), and investigations of the stellar content of the SgrA* stellar cluster (see for example, Ghez et al. 1998, *ApJ*, 509, 678), to name just a few.

Led by Gemini scientist Phil Puxley, the second Demonstration Science program will focus on producing deep 10-µm images of four SCUBA/ISO sources using the University of Florida's OSCIR 8-25 µm imager/spectrometer. These observations will begin in August. The science goals include identifying the sources and detecting structure and morphology.



The first successful engineering run on Gemini North in June for OSCIR demonstrated that both guiding and chopping work effectively. For this 10-µm image of the planetary nebula NGC 7027, Gemini North executed precise 10 arcsec "chopping" at 3 Hz. The field of view here is about 9 arcsec on a side.

US Gemini Instrumentation Program Update

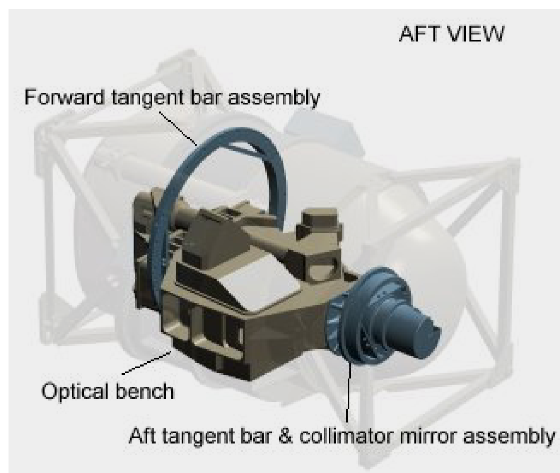
Taft Armandroff and Mark Trueblood

USGP activities to provide instrumentation for the Gemini telescopes, both in-house at NOAO and in the wider community, continue to progress. This article gives status updates as of late July.

NIRI is a 1-5 µm imager with three pixel scales, designed and built by Klaus Hodapp and his team at the University of Hawaii. In *NOAO Newsletter* No. 62, we described a series of NIRI cold cycles to carry out tests and check fixes to problems discovered in previous cycles. Since that time, all significant NIRI issues have been successfully resolved. NIRI passed its Pre-Ship Acceptance Test in Honolulu in May. NIRI was then shipped to the Gemini Northern Operations Center in Hilo and set up in the instrument lab. A team of controller and detector experts from NOAO traveled to Hilo in June and successfully resolved problems with ringing in the NOAO-supplied NIRI array controller. Delivery of the one frame-per-second upgrade to the NIRI controller by NOAO is planned for early fall. On-telescope final acceptance testing of NIRI is planned on Mauna Kea in August.

T-ReCS, the Thermal Region Camera and Spectrograph, is a mid-infrared imager and spectrograph for the Gemini South telescope, under construction at the University of Florida by Charlie Telesco and his team. The majority of the T-ReCS optics have been received and inspected, including the critical diamond-turned mirrors. Also, mechanical parts fabrication is nearing completion and mechanical assembly has begun. A USGP Quarterly Review of T-ReCS took place on July 18. The team plans acceptance testing on Gemini South in May 2001.

GNIRS, the Gemini Near-Infrared Spectrograph, is a long-slit spectrograph for the Gemini North telescope that will operate from 1 to 5 µm and will offer two plate scales and a range of dispersions. The project is being carried out at NOAO in Tucson under the leadership of Neil Gaughan (Project Manager) and Jay Elias (Project Scientist). GNIRS held a Pre-Fabrication Review on May 11 and 12. The review committee examined the GNIRS team's progress on mechanical design, mechanical analysis, thermal analysis, software design, and prototyping efforts in the areas of cold motors, mechanism drives, and lens mounts; they delivered a positive report. The project is now completing the detailed design stage, while initial fabrication has begun for those sub-assemblies for which design is complete. The critical optics have been ordered and somewhat over one-third have been delivered and accepted. GNIRS delivery is planned for July 2002.



The Gemini Near InfraRed Spectrograph (GNIRS) passed Pre-Fabrication Review, and fabrication of some sub-assemblies has begun at NOAO.

NICI, the Near Infrared Coronagraphic Imager, is funded by monies directed via a proposal from the NASA Origins Program to NOAO. NICI will provide a 1-5 μm infrared coronagraphic imaging capability on the Gemini South telescope. Mauna Kea InfraRed (MKIR) was the successful competitive bidder for the NICI conceptual design study and the only respondent to an RFP for building the instrument. As described in *NOAO Newsletter* No. 62, a conceptual design review of MKIR's concept for NICI, followed by a procurement review of their proposal, was conducted on April 18 and 19. Currently, MKIR is honing its concept for the instrument and its project plan, based on feedback from the review committee. NOAO and MKIR are negotiating the contract for NICI procurement.

FLAMINGOS 2 is a concept for a near-infrared multi-object imaging spectrograph for the Gemini South telescope, developed by Richard Elston and his team at the University of Florida. The FLAMINGOS 2 concept builds on the heritage of the FLAMINGOS imaging spectrograph (FLAMINGOS will be offered as a visitor instrument on Gemini). FLAMINGOS 2 has been developed in response to the "Gap Filler" opportunity for Gemini South, wherein the relatively rapid deployment of a near-infrared spectroscopy and imaging capability is sought. A conceptual design review of FLAMINGOS 2 was held on April 28. A parallel review was conducted for a competing instrument, IRIS-2g (proposed by the Anglo-Australian Observatory). The Gemini review committee judged FLAMINGOS 2 to be more suitable for Gemini's needs and aspirations. Currently, the International Gemini Project, USGP, and Florida are discussing strategies for procuring FLAMINGOS 2, subject to Gemini's financial and programmatic constraints.

How to obtain more information on these instrument projects.

Gemini	*http://www.us-gemini.noao.edu/sciops/instruments/instrumentsIndex.html*
NIRI	*http://kupono.ifa.hawaii.edu/WEB/NIRI/NIRI1.html*
T-ReCS	*http://t-recs.astro.ufl.edu/*
GNIRS	*http://www.noao.edu/ets/gnirs/*
FLAMINGOS	*http://www.astro.ufl.edu/~elston/flamingos/flamingos.html*

US Gemini SAC Meets in Pasadena

R. Schommer and C. Pilachowski

The US Gemini Science Advisory Committee, which advises the US Gemini Program on issues related to the Gemini Observatory, met at the Observatories of the Carnegie Institution of Washington in Pasadena in May. The primary issues for discussion included a review of NOAO's allocation process for Gemini telescope time and plans for Gemini instrumentation.

The US SAC offered congratulations to the International Gemini Observatory on the upcoming start of scientific observing. Committee member Suzanne Hawley writes, "We were very pleased to see the large number of excellent US Demo Science and Quick-Start proposals for Gemini time during this first shared-risk semester. The community is clearly very interested in using the Gemini telescopes early and often! The proposal response is especially gratifying for those working behind the scenes to get the telescopes up and running with visitor instruments as early as possible."

The SAC urged NOAO to continue its efforts to provide a level of Gemini investigator support consistent with the quality of service that NOAO already provides to users of its other facilities. The SAC wished particularly to see improvement in the documentation for observers, including instrument calibration requirements; definition of standard,

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recommended calibration procedures; and a grid of calibration stars for AO instruments. It is understood that documentation on instrument performance will improve as experience is gained.

Concerning instrumentation, the US SAC found that the ongoing instrumentation program offers compelling and exciting scientific opportunities to the Gemini community. This program comprises the instruments under construction (NIRI, GNIRS, GMOS, Michelle, HROS, T-ReCS, and NICI), as well as visitor instruments and proposed instruments such as a wide-field, IR, multi-object spectrograph MOS, and a high-stability laboratory spectrograph. The SAC urged continued support for this suite of instruments as the highest priority of the Gemini instrumentation program, both to allow productive use of telescope time and to establish a broad-based user community for Gemini.

The SAC also reviewed Gemini plans for a Multi-Conjugate Adaptive Optics (MCAO) system, which would provide adaptive optics correction with stable point-spread functions over fields of view on the order of 1´. Such a system would provide exciting scientific opportunities for the US community. The US Gemini SAC encouraged the Gemini Observatory to convene a science workshop to consider the MCAO science capabilities and instruments, with wide input from all Gemini communities. (This international workshop will be held in October, jointly with the Center for Adaptive Optics.)

There was also sentiment among the US SAC that a workshop should be held on the role of Gemini in the next decade. With the recent release of the US, Canadian, and Australian decadal reviews, and the coming and current satellite (Chandra, SIRFT, MAP) and millimeter wavelength facilities (e.g., ALMA), the possible strategy for 8-m and larger telescopes in the next decade, both for AO and for wide-field survey science, has become a significant topic.

Finally, we wish to convey our thanks to both Suzanne Hawley and Buell Jannuzi, who are rotating off the US Gemini SAC after several years of service. We are grateful to them, for the US community has gained much from their wisdom and commitment to Gemini. We also welcome Bob Williams, a new member of the US Gemini SAC. The full membership of the US Gemini SAC can be found at *http://www.noao.edu/usgp/org/ussac.html*.

US SAC members Robert Joseph (Hawaii), Larry Ramsey (Penn State), and Suzanne Hawley (Washington) continue discussions during lunch in Pasadena.

N S O

NATIONAL SOLAR OBSERVATORY

From the NSO Director's Office

Steve Keil

The frontiers of high-resolution solar imaging continue to be pushed by NSO and our partners at the Kiepenheuer-Institut für Sonnenphysik (KIS) and New Jersey Institute of Technology (NJIT)/Big Bear Solar Observatory (BBSO). The low-order adaptive optics system spent the spring months at the KIS-Vacuum Tower Telescope (VTT) on Tenerife, where it was used to feed the KIS Triple-Etalon Solar Spectrometer (TESOS). The accompanying article describes the observations and gives WWW links to some of the results. The system is now back in Sunspot to support observing runs in the July–September quarter. Experiments with Multi-Conjugate Adaptive Optics (MCAO) are underway at both NSO and KIS. In collaboration with KIS and NJIT/BBSO, NSO has started to develop a high-order AO system that will fully correct the Dunn Solar Telescope at Sacramento Peak, the planned German GREGOR Telescope, and the 64-cm telescope at BBSO.

Progress towards a new large-aperture (~4-m) solar telescope is beginning to accelerate. Because of a conflict in acronyms with the NSF Astronomy Division (NSF/AST), we have slightly modified our acronym from the Advanced Solar Telescope (AST) to the Advanced Technology Solar Telescope (ATST). The scientific goals remain unchanged. NSO hosted an open community workshop in conjunction with the AAS/SPD meeting at Lake Tahoe in June. The workshop focused on science objectives for the ATST and the telescope parameters driven by those goals. The issue of site testing to locate the ATST was discussed in depth and the formation of a site-testing team was begun.

NSO is now spearheading the development of a proposal to the NSF to begin the ATST design and development phase. If you are interested in participating but have not yet been approached, please contact us as soon as possible.

Mechanisms for community involvement in ATST were discussed at the June community workshop. There was considerable interest in community involvement in instrumentation development and in the overall telescope design. More than a dozen scientists gave overviews of what they saw as the main telescopes drivers for developing an Advanced Technology Solar Telescope. Various means of community participation were considered, including internal competition among partnering institutions for instrument packages, funded co-investigators for specific telescope development tasks, and funding for parallel development of the models and theory needed to refine science requirements and to fully exploit the ATST.

The NSO Long Range Plan (LRP) is now available. If you would like a copy, please e-mail *nso@noao.edu* or visit our WWW site at *http://www.nso.noao.edu/LRP*. The LRP covers plans for the ATST, upgrading of the GONG network to high-resolution helioseismology observations, continued development and operations of the SOLIS instruments, implementation of high-order solar adaptive optics, our infrared program, and operation of the current NSO facilities.

On 11–15 September 2000, the 20th NSO/Sac Peak Summer Workshop on "Advanced Solar Polarimetry—Theory, Observation, and Instrumentation" will focus on the recent progress made in the investigation of solar

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magnetic fields and on future projects in the framework of solar polarimetry and modeling of solar magnetic fields. You'll hear more about the meeting in the next (December) newsletter.

Several personnel changes have taken place over the past few months. K. S. Balasubramaniam (Bala) has joined the NSO staff at Sunspot. Bala worked for the USAF at Sunspot prior to taking an eight-month sabbatical to sample the Chicago stock market. Bala's research interests encompass origins of solar activity and high-resolution imaging. Haosheng Lin left NSO–Sunspot to join the staff at the University of Hawaii. Alexei Pevtsov joined the NSO staff at Sunspot in July. Alex comes to us from Montana State University, where he was engaged in modeling and observing solar magnetic fields and activity. Han Uitenbroek joined the NSO staff at Sunspot in August. Han has spent the last several years at the Harvard-Smithsonian Center for Astrophysics in Cambridge, working in the areas of radiative transfer for chromospheric lines and IR observations of chromospheric structure. Han is an experienced user of the IR systems on the McMath-Pierce Telescope.

Doug Rabin Joins NASA

Steve Keil and Mark Giampapa

After 15 years with NSO, Doug Rabin left in July to take on a new position as the Solar Branch Chief at NASA Goddard Space Flight Center in Greenbelt, Maryland.

During his tenure at NSO, Doug made many important scientific and organizational contributions. Chief among these was Doug's creation of a strong infrared program that revitalized the McMath-Pierce telescope. Doug's leadership in the application of modern IR array systems to solar observations opened up new regimes in the high-precision study of the solar magnetic field and a new view of the solar chromosphere. His community activity in this area included organizing the IAU Infrared Solar Physics Symposium. Furthermore, Doug left NSO with a firm foundation for a major step forward in infrared solar research using a large format ALADDIN array.

Doug also laid the groundwork for a program for extracting useful information from the synoptic magnetic field archive of KPVT data. He stimulated a rigorous look at the data and what should be done to maximize useful science data products. Doug subsequently organized the 1997 NSO Summer Workshop on Synoptic Solar Physics and served as a guiding hand behind the idea of SOLIS.

At a critical juncture in the history of NSO, Doug served as Acting Director for the better part of FY 1996 and did a uniformly praised, outstanding job.

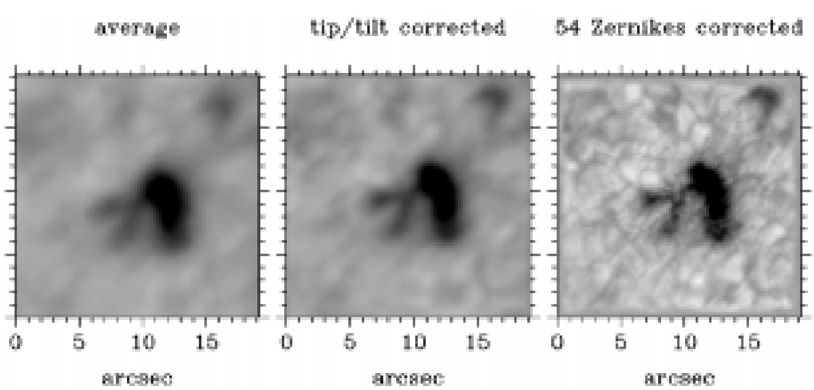
NSO is grateful to Doug Rabin for all his contributions to the Observatory and to solar science. We wish him the best as he faces new challenges and new opportunities at NASA.

Toward AO at the McMath-Pierce Telescope — Part II

Christoph Keller and Claude Plymate

In the last newsletter (*NOAO Newsletter*, No. 62), we reported the successful installation of a prototype Shack-Hartmann wavefront sensor with over 300 subapertures. That was the first step in our efforts to implement a low-order adaptive optics system for the infrared at the McMath-Pierce main telescope over the next few years. We have since added a science camera that takes simultaneous images with the wavefront sensor. The measured wavefront can be used to determine the instantaneous point-spread function and deconvolve the simultaneous images acquired by the science camera. The resulting image is a good approximation of what an adaptive optics system with the same wavefront sensor would deliver.

In addition to improvement to the visibility of sunspots and pores (see figure), we were also able to successfully measure the wavefront aberration in the quiet granulation and deconvolve the corresponding images. While the present data set has both images and wavefront measured at the same wavelength, the next step will be the addition of an infrared science camera operating at a longer wavelength than the wavefront sensor, which will remain at 1000 nm.



The tremendous improvement of image quality from adaptive optics is illustrated by 100 simultaneous short-exposure images of a small sunspot at 1000 nm and the corresponding wavefront sensor data. The left image corresponds to the average of all 100 images; the center image represents the average after correcting for image motion (which simulates the effect of a correlation tracker); and on the right is the deconvolved image assuming an adaptive mirror that corrects the first 54 Zernike components of the measured wavefront aberration.

SOLIS

Jack Harvey

The SOLIS project continues toward initial operational capability in 2001. Work on the mount is underway at the GONG prototype site a few kilometers from the Tucson offices. The next milestone for the mount is to run the motors and track the Sun. Progress on the highest priority instrument, the Vector SpectroMagnetograph (VSM), suffered a setback when it became clear that the custom CCD cameras would be delivered much later than expected. The project, with the help of its outside Science Advisory Group, considered a number of options for dealing with this delay. The present strategy is to arrange with the vendor for a staged delivery of increasingly more capable CCD and camera systems to enable the project to perform its early camera integration testing without falling very far behind the original schedule. Other aspects of the VSM are progressing well. The primary mirror is finished, and the secondary is expected to be done by the end of July. Mechanical parts are either finished or under construction. Electronic and software testing of several of these mechanisms are in progress. A commercial data acquisition board capable of handling the "fire hose" of data from the VSM is being prepared for use. The software algorithms for reducing VSM data continue to be developed and tested.

The software group has completed the first phase of the Observation Control System (the means of scheduling and managing observations) and the Instrument Control System (the software that actually controls the instruments to acquire observations). On the calibration front, a version of the Kuhn-Lin flat-field algorithm optimized for use with spectra has been developed and tested using Integrated Sunlight Spectrometer (ISS) data. The results are very good. The ISS CCD had become contaminated as a result of a seal failure. The vendor, however, fixed the seal and cleaned the CCD successfully. The lowest priority instrument is the Full Disk Patrol (FDP). The FDP preliminary mechanical design was reviewed and upgraded to a nearly final design. A minor change in one of the three parallel optical paths was made as a result. All of the off-the-shelf optics for the FDP are in hand, and orders for custom optics are underway.

Two REU summer students, Jessica Erickson and Jose Ceja, have been working with Jack Harvey and Harrison Jones, respectively, to calibrate the existing synoptic data sets with primary and secondary alternate sources of similar data. This is in preparation for cross-calibration of the existing instruments with SOLIS before the former are replaced. A third REU student, Rebecca Pifer, is working with Christoph Keller in testing and optimizing the polarization modulator packages for the VSM.

Research Experiences for Teachers at NSO

Frank Hill

In conjunction with the NOAO Educational Outreach program, NSO is hosting two science teachers, Travis Stagg from Girard College High School (Philadelphia, PA) and Thomas Seddon from Alamogordo High School (Alamogordo, NM), as part of the NSF-funded Research Experiences for Teachers (RET) program.

The RET program is funded through the NSF as a supplement to the Research Experiences for Undergraduates (REU) program. Travis Stagg has participated previously in the NOAO Research-Based Science Education (RBSE) program and builds on that experience with this RET partnership. The goal of his RET experience is to develop a scientifically interesting research project that can be performed by a large number of students in a middle or high

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school classroom. Conceivably, students who participate in solar research resulting from this RET project could apply for the REU program a few years later!

This summer, Travis is working with Frank Hill on developing an idea initiated by Carl Henney (NSO) to measure the latitude and longitude of many solar active regions observed in the NSO/Kitt Peak Vacuum Telescope magnetograms. A QuickTime movie showing the full set of magnetograms, with accompanying classroom materials, is under development by NASA scientist Harry Jones and Hawaii teacher Mike Gearen, funded through a NASA E/PO supplement. Stagg and Hill will have students create a database of active region positions from the movie, and then analyze the results to determine the location of active longitudes, bands where activity tends to occur repeatedly. Measurements over the 25-year time span of the observations will provide an estimate of the rate at which these zones rotate. This rotation rate is not necessarily the same as that seen on the solar surface, since it is thought that active regions are connected to the material inside the Sun. Since we know how the solar interior rotates from helioseismology (the study of solar oscillations), comparing the rotation rate of the active longitudes to the internal rotation rate will allow us to determine how deep the active regions extend below the surface. This, in turn, will provide clues about the cause of solar activity.

Thomas Seddon has more than 30 years of teaching experience. In addition to teaching physics, physical science, and mathematics at Alamogordo High School, he teaches computer science and occupational education computer science at NMSU in Alamogordo. This summer, Thomas has been engaged in the ongoing research at NSO–Sac Peak, getting an overview of the research conducted with an end product of a series of exercises and laboratory experiences based on WWW-accessible solar data at NSO and elsewhere. He has been tailoring these exercises for use in high school physics classrooms. The exercises will be produced in a readily available format and accessible via NSO's WWW site. Thomas has been cataloging, sorting, and developing available Web sites that are primarily involved in solar studies. Many of these Web sites include hands-on experiments and activities. These digested and annotated resources will be made available through links on the NSO Web site, New Mexico science teachers' list serve, and other Internet physics/science teacher resources. Thomas has been assisting the Sunspot Astronomy and Visitor Center by connecting it to many of the above solar research sites and making these available to the public on a daily basis.

Another Busy Summer for Students at NSO

NSO 2000 Summer Student Advisors

This summer, NSO hosted five NSF-funded Research Experiences for Undergraduates (REU) students and one graduate student, or Summer Research Assistant (SRA), at NSO–Tucson, as well as three REUs and three SRAs at NSO–Sac Peak.

Lynn Carlson (REU, Michigan State) has been modifying IDL codes, originally written by Marc Buie of Lowell Observatory, to construct computer simulations of the full disk Sun. The objective is to explain the discrepancies observed between the amplitudes of variation of the Sun and those of solar-type stars, which may be dependent upon the angle of observation. Some of these models take into

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account facular, sunspot, and photospheric contributions to the Sun's total irradiance, while others focus on plage and network components of the Ca II K line. Such models allow her to explore the effects of varying the angle from which the Sun is viewed. She can compare the flux from the Sun in either the full spectrum or the Ca II K line, looking at the Sun from any viewpoint, and hopefully gain some insight into the reason for the difference in amplitudes. Lynn's advisor is Richard Radick.

Jose Ceja (REU, Cal State Northridge) has been working with Harry Jones to compare magnetograms from the KPVT NASA/NSO spectromagnetograph (SPM) with observations from GONG+ and SOHO/MDI. The purpose of these comparisons is to establish the mappings between the measurement scales of each of the instruments, both as a matter of intrinsic interest and in preparation for the replacement of the SPM with the SOLIS Vector Spectromagnetograph (SPM), especially if circumstances prevent a direct comparison between the VSM and SPM. Preliminary results suggest that GONG+ data (which are not in Gauss) need to be multiplied by a factor of about one-third to agree with SPM data, while the corresponding factor for SOHO/MDI is about two-thirds. A poster paper discussing the progress of this activity will be presented at the NSO–SP summer workshop on advanced polarimetry.

NSO–Tucson REU 2000 students. From the left: James Roberts, Jessica Erickson, Kathryn Roscoe, Rebecca Pifer, and Jose Ceja.

Jessica Erickson (REU, Wisconsin at Platteville) is working with Jack Harvey to improve the calibration of some of NSO's synoptic data products. Jessica has derived the coefficients of linear relations from 1977 through 2000 between two different measures of the strength of the 1083-nm helium line integrated over the solar disk. One of these series of measurements, used as a fundamental reference, consists of 3-day-per-month spectra of the 1083-nm line reduced to equivalent width and corrected for blending by water vapor lines. The second series consists of images of the Sun in the 1083-nm line taken daily at the Kitt Peak Vacuum Telescope (KPVT) and reduced to an average disk value of line strength. This is the first time that the cross-calibration has been done consistently over the entire available time period. The work has shown that the KPVT measurements need to be re-calibrated. After this is done, we will compare the (KPVT) results with measurements of the total solar irradiance from 1977 to the present. There is some evidence that this important flux is behaving differently during the present solar cycle than in previous cycles. Jessica has also used the same software to study variations in the zero point of KPVT measurements of the mean magnetic flux of the Sun. Again, corrections are required. This work is important for tying the existing data archive into forthcoming SOLIS observations.

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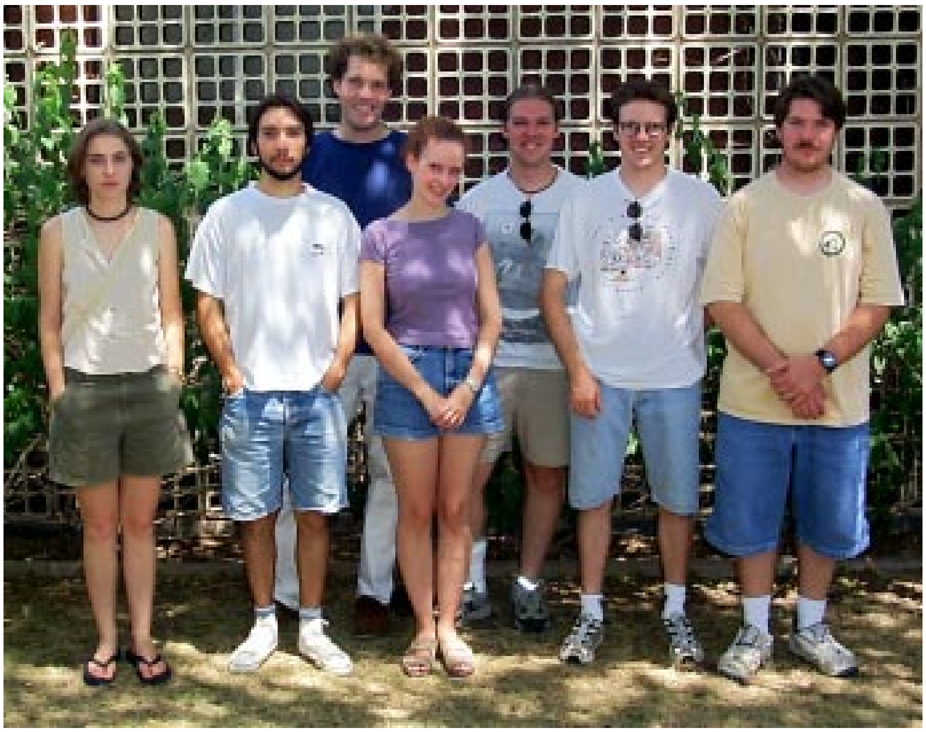
Mike Eydenberg (REU, New Mexico Institute of Mining and Technology) has been working with Michael Sigwarth and Steve Keil in developing and applying image-processing techniques for analyzing images taken at the NSO Evans Facility and the Dunn Solar Telescope. With Michael Sigwarth, he has worked on a 45-minute time series of two-dimensional spectroscopic data of a complex active region obtained with the NSO dual Fabry-Perot spectrometer and the NSO Adaptive Optics system. He has applied interpolations and auto-correlation kernal-tracking algorithms for correcting the residual image motion and image distortion. From the spectral line scans, he obtained line-of-sight velocities. Together with horizontal flows, obtained by tracing continuum features, the three-dimensional velocity map can be obtained in order to investigate the interaction of magnetic fields and convection. With Steve Keil, Mike has developed and fine-tuned image-correction algorithms for Ca K spectroheliogram data taken by the Evans facility. The images are digitally circularized, de-streaked, and calibrated. The goal is to have a set of processed Ca K data spanning over two full solar cycles for use in the further implementation of algorithms for correlating active region areas with Ca K line features and solar flux, as well as for the possibility of using the solar variations caused by these active regions as a means for measuring solar differential rotation.



NSO–Sac Peak REU 2000 students. From the left: Erica Raffauf, Eric Tatulli, Kai Langhans, Lynn Carlson, Robert Gutermuth, Axel Settele, and Michael Eydenberg.

Robert Gutermuth (SRA, Rochester) was an NSO–REU student last summer (1999) and graduated from Alfred University in May of 2000. He has investigated vorticity signatures calculated from chromospheric surface flows as precursors to solar activity. The data used were full disk Hα images taken with the NSO Hilltop Facility's flare patrol telescope during several days in the Spring and Summer of 2000. The data were scanned from 35-mm film, and the desired region of study was projected to disk center. The surface velocities in these projected images are determined from local correlation tracking of kernels within the active region. The results are obtained by comparing time sequences of intensities, velocity magnitudes, vorticities, and divergences of several particularly active sub-regions, and determining how far their peak values precede each other. Robert used line-of-sight magnetograms obtained by the Kitt Peak Vacuum Telescope, as well as images from the *Yokhoh* SXT and SoHO EIT space-based instruments, to evaluate the correlation between the vorticity signatures

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detected and magnetic fields in the active regions. Robert is working under the supervision of Steve Keil and K. S. Balasubramaniam, and plans to pursue his Ph.D. at the University of Rochester in the fall.

Kai Langhans (SRA, Kiepenheuer Institute) is working on his Ph.D. thesis on the thermal structure of G-Band bright points and their formation. He is working with Thomas Rimmele on data obtained during the campaign at the German VTT in Tenerife, where the NSO low-order AO system was installed. At the Dunn Solar Telescope in August, Langhans and Rimmele carried out simultaneous observations at 430.5 nm with the horizontal spectrograph and a fast camera to acquire time series of G-Band spectra with high resolution both in space and time. The goal was to obtain information on possible reasons for the brightness of the G-Band bright points (increased dissociation of CH?) and the altitude of formation of the CH lines.

Erica Raffauf (REU, Indiana) has been working with Steve Keil on the comparison of disk-integrated Calcium II K-line spectra and K-line spectroheliograms. The project goals are to understand how chromospheric features contribute to the K-line spectrum, attempt to use the line as a ground-based proxy for solar UV and EUV emissions, determine the disk-integrated flux's sensitivity to surface differential rotation, and use the disk-integrated flux to monitor the Sun as a star for comparison with similar stellar measurements. Changes in K-line parameters are indicative of chromospheric heating as well as solar activity levels. The data, covering 2.5 solar cycles, was obtained at NSO-SP—the disk-integrated data with the Littrow Spectrograph located in the Evans Solar Facility (ESF) and the disk-resolved spectroheliograms with the ECF spectroheliograph. Erica has developed algorithms to standardize digitized spectroheliograms, identify active regions, and compare image parameters with spectral line parameters. Erica is a physics major with minors in astronomy, mathematics, and Spanish. She has also had research experience in high-energy physics and photometry of open clusters.

James Roberts (REU, Virginia Tech) has been working with Mark Giampapa on the reduction and analysis of nightly photometry of the solar-age and solar-metallicity open cluster, M67. A small (0.5-m), automated telescope operated by Eric Craine of the Global Network of Automated Telescopes (GNAT) was utilized to monitor with CCD photometry the solar-type stars in M67. The objective of this program was to characterize the intranight and internight precisions that could be attained with the GNAT telescope and CCD. James reduced and analyzed approximately 25 nights of unfiltered, CCD photometry of a portion of the M67 cluster that includes many solar-type stars. This project is a prelude to a long-term program to detect and characterize short-term and long-term, low-amplitude variability in the solar counterparts in M67. He made a valuable contribution toward this goal by developing a systematic approach to the reduction of the numerous CCD images that are obtained for this kind of long-term program.

Kathryn Roscoe (REU, Cal State Chico) has been working with Rachel Howe on short-term temporal variations in the frequencies of solar modes measured by GONG. The aim of the project is to determine whether the solar cycle-related changes seen in data averaged over the usual 2- or 3-month periods can be followed on shorter time scales. Kathryn has analyzed six months of GONG data in 1-month and half-month chunks, covering two 3-month periods at different activity levels.

Markus Roth (SRA, Albert-Ludwigs University, Freiburg) is working on his Ph.D. thesis at the Kiepenheuer Institute for Solar Physics. He has been working with Rudolf Komm and Rachel Howe, studying the influence of velocity fields, located in the solar convection zone, on the frequency of *p*-modes. The goal is to determine whether it is possible to detect large-scale organized structures in the solar convection zone, so-called giant cells, by measuring mode frequencies. The existence of these giant cells is postulated, but they have not been unambiguously observed. Markus, building on his thesis work,

continued

developed a computer program to calculate the frequency shifts caused by a velocity field of a given geometry and strength, in addition to the shifts caused by the solar rotation. He calculated these shifts for complete mode sets, as observed by GONG, which allows him to compare the numerical results with observations. In addition, Markus determined *p*-mode parameters from a 108-day MDI data set to compare them with the corresponding GONG data set.

Axel Settele (SRA, Astrophysical Institute Potsdam) has concentrated on the oscillation of the magnetic field in sunspots and the transmission of waves through sunspots. Working with Michael Sigwarth, Axel obtained data at the Dunn Solar Telescope in June 2000 with the Advanced Stokes Polarimeter (ASP). He calibrated the data and analyzed a time series of one hour of a 6.3-arcsec segment of Active Region 9036. Each scan took about one minute and recorded the Stokes spectra in Fe 6301.5, Fe 6302.5, the line profiles of Fe 5691, and the Ca K line center. He calculated power spectra and phase shifts between the photospheric and chromospheric lines to compare these with his theoretical work, and looked for oscillations in the magnetic field.

Understanding Spectroheliograms—Insights from Spectral Line Analysis

K. S. Balasubramaniam

In an effort to seek newer diagnostic tools for monitoring solar activity, L.A. Smaldone and O. Scognamiglio (University of Naples), and K. S. Balasubramaniam (NSO) have reconstructed spectroheliograms in various spectral lines in the range 3900–3940Å (around the Ca II K line) from high spatial and spectral resolution measurements. In active regions, they find that the spectroheliogram features in a number of spectral lines are similar to the Ca II K1v spectroheliogram features. In plages, on the contrary, only spectroheliograms in a few spectral lines correlate with the Ca II K1v. In plages, the best correlation is with the Si I 3905. From these measurements, they have developed contrast functions to isolate various active phenomena as seen in Ca II and compare its formation contribution of relative velocities, magnetic fields, and intensity as seen in Fe I and Si I spectral lines. These indicators provide insight into the formation of the Ca II K line.

Solar Spectrum Atlases

Bill Livingston

Lloyd Wallace (KPNO) and colleagues have prepared a series of atlases from FTS archives. These are available in soft-cover form for libraries and in digital form.

NSO Report No.	Cover Color	ftp file	Wave Number (cm^{-1})	Wavelength (μm)	Source
91001	yellow	photatl	850 to 9000	5.4 to 1.1	center disk
93001	pink	niratl	8900 to 13600	1.123 to 0.735	center disk
98001	green	visatl	3500 to 28000	0.740 to 0.357	center disk
94001	pale-blue	spot2atl	460 to 630	22.0 to 16.0	center disk
			470 to 1233	21.0 to 8.1	umbra
92001	orange	spot1atl	1970 to 8460	5.1 to 1.16	center disk
98002	dark blue	spot3atl	8900 to 15050	1.12 to 0.66	center disk
00-001	buff	spot4atl	15000 to 23000	0.666 to 0.435	center disk

The digital atlases are available in an FTP archive, which was prepared by Frank Hill.

```
ftp argo.tuc.noao.edu
(anonymous)
(email address)
cd pub/atlas
cd <atlas>
get README
mget <files>
bye
```

The README file in the archive explains the details of the data format (which varies from atlas to atlas). In general, there is a wave number *vs* intensity listing and, recently, postscript files for direct plotting. Usually there are four data columns: wave number, solar component, atmospheric component, and the 1 airmass raw spectrum. Solar identifications are given in the bound atlases, which may be obtained from either *wlivingston@noao.edu*, *fhill@noao.edu*, or *lwallace@noao.edu*. Since many copies have already been distributed, check your library (e.g., Wallace, L. et al., 1996, *ApJ* Supp 106, 165).

How to Contact the National Solar Observatory

The Web	*http://www.noao.edu/nso*
Questions	*nso@noao.edu*
E-mail a staff member	*first initial+last name@noao.edu*

NSO Observing Proposals

Note Change in Deadline for the First Quarter 2001

Dick Altrock

The current deadline for submitting observing proposals to the National Solar Observatory is 15 November 2000 for the first quarter (January–March) of 2001. Forms and information are available from the NSO Telescope Allocation Committee at P.O. Box 62, Sunspot, NM 88349 for Sacramento Peak facilities (*sp@sunspot.noao.edu*) or P.O. Box 26732, Tucson, AZ 85726 for Kitt Peak facilities (*nso@noao.edu*). A TeX or PostScript template and instruction sheet can be e-mailed at your request; obtained by anonymous FTP from *ftp.sunspot.noao.edu* (cd *observing_templates*) or *ftp.noao.edu* (cd *nso/nsoforms*); or downloaded from the WWW at *http://www.nso.noao.edu/*. A Windows-based observing-request form is also available at the WWW site. Users' Manuals are available at *http://www.sunspot.noao.edu/telescopes.html* for the SP facilities and *http://www.nso.noao.edu/nsokp/nsokp.html* for the KP facilities.

NSO Telescope/Instrument Combinations

Dunn Solar Telescope (SP):

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

Evans Solar Facility (SP):

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

Razdow (KP):

- Hα patrol instrument

Hilltop Dome Facility (SP):

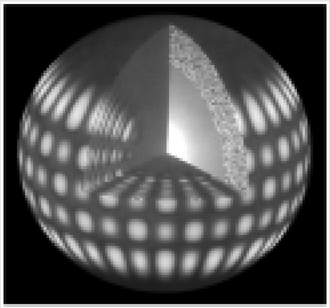
- Hα Flare Monitor
- White-Light Telescope
- 20-cm Full-Limb Coronagraph
- White-Light Flare-Patrol Telescope (Mk II)
- Sunspot Telescope
- Fabry-Perot Etalon Vector Magnetograph
- Mirror-Objective Coronagraph (5 cm)
- Mirror-Objective Coronagraph (15 cm)

McMath-Pierce Solar Telescope Facility (KP):

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

Vacuum Telescope (KP):

- Spectromagnetograph
- 1083-nm Video Filtergraph



G O N G

GLOBAL OSCILLATION NETWORK GROUP

John Leibacher

The Global Oscillation Network Group (GONG) Project is a community-based activity to operate a six-site helioseismic observing network, perform the basic data reduction and provide the data and software tools to the community, and coordinate analysis of the rich data set that is resulting. GONG data are available to any qualified investigator whose proposal has been accepted. Information on the status of the project, the scientific investigations, as well as access to the data, is available on our WWW site (*http://www .gong.noao.edu*).

With the Sun continuing to develop the most spectacular magnetic active regions of the solar cycle, the GONG team is working feverishly to put the finishing touches on the new, high-resolution GONG+ camera system and to get it deployed around the world by the end of the year. With a bit of luck and lots of hard work, we should be installing the new system on Tenerife during the GONG 2000/ SOHO 10 meeting hosted there by the Instituto de Astrofísica de Canarias in October.

Operations

The GONG network of telescopes continued operating well during the second quarter of 2000. In anticipation of the GONG+ upgrade visits, no preventive maintenance trips occurred during this quarter, restricting all instrument downtime to equipment failure and weather-related events. The Udaipur site suffered most of the downtime as a result of the failure of both the primary and backup air conditioning units. The site was shut down for approximately one week before repairs were made and the site was brought back on line. Several days of additional downtime were incurred due to failures of the backup power systems. Because the internal batteries in the uninterruptable power supply (UPS) have failed, the UPS can no longer pick up the electrical load. Utility power dropouts bring the instrument down, and it will not return to normal operation until someone can restart the system after power is restored. There has also been an instance where the backup diesel generator failed to transfer power to the instrument.

Downtime, which is ultimately weather related but results in the failure of the turret to unstow, has been occurring at the El Teide and CTIO sites. These sites have nights during which precipitation falls and freezes, causing ice to form around the moving parts of the turret. When the time arrives to acquire the Sun, the motors need so much current to move the iced-up turret that a breaker on the power supplies trips, or on rarer occasions, fuses in the drive circuit blow. The instrument remains down until someone can get to the site to reset or replace the hardware. At least two days of downtime have accumulated at both of these sites. Fortunately, these events often occur in conjunction with poor weather conditions, so that most of the images lost would likely be unacceptable for data analysis.

continued

The Mauna Loa and El Teide sites experienced power-supply voltages that had drifted too far from their nominal -5.2V value. Site personnel replaced them, adding about three hours of downtime at each site. The same supply was replaced last year at Big Bear, and we expect it to be nearing the end of its lifetime at the remaining three sites. Good news, however, is that these power supplies will be eliminated with the GONG+ upgrade. We hope that no additional failures occur in the meantime.

Other short periods of lost images occurred during the replacement of a bank of Exabyte drives at Big Bear (~20 min.) and a system reboot at Learmonth (~83 min). The Exabyte drives have given us less trouble this quarter than in any previous quarter. Nevertheless, these devices will be replaced with the larger capacity DLT7000 drives during the GONG+ upgrade.

Data Management and Analysis

During the past quarter, the Data Management Acquisition Center (DMAC) produced month-long (36-day) velocity, time series, and power spectra for GONG months 45, 46, and 47 (ending 991223), with respective fill factors of 0.85, 0.84, and 0.88. Tables of mode frequencies which were computed from the power spectra using the three-month-long time series centered at GONG months 44 and 45.

The main development activity currently underway in the DMAC is related to the development and testing of the GONG+ camera and data system upgrade.

Data Algorithm Developments (and Some Science)

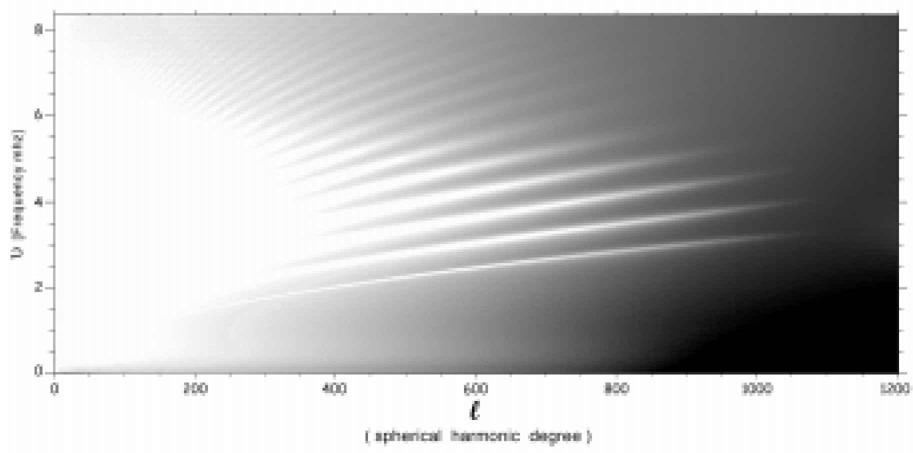
Peakfitting has progressed up through month 46, and analysis of the results continues to show the evolving dynamics in the solar interior as the cycle progresses. Analysis of the even splitting coefficients is now providing a look at the sound speed as a function of depth, latitude, and time. Preliminary analysis suggests that the temporally evolving component of the sound speed is purely a surface phenomenon, with no significant depth structure. This is somewhat surprising since it is thought that active region magnetic fields extended below the surface. Also surprising is the time-averaged sound speed perturbation, which appears to be relatively negative near the equator and positive at mid-latitudes. This pattern is inconsistent with the idea that meridional flows are thermally driven.

The current numerical interpolator used in the remapping step, central to both global and local helioseismology, is a cubic convolution. While this has been adequate for GONG Classic, it is not accurate enough at the higher spatial frequencies present in GONG+ data, thus we have implemented a sinc-function interpolator. Tests show that this interpolator can be applied twice without introducing artifacts into ring diagrams. The new algorithm greatly simplifies the organization of a local helioseismology pipeline using merged images. The current sinc interpolator algorithm is unacceptably slow, but we expect that it will be relatively easy to increase the speed of the code.

GONG+ Camera Development

The DNA video data acquisition system design has been rigorously tested and found to be acceptable for our design purposes. The fixes provided by DNA Enterprises appear to have been effective, and we are now proceeding with certification of the components for deployment. A temperature regulation problem with the SMD cameras has also been corrected, which will permit them to operate indefinitely in the environment of the GONG shelters without loss of temperature control.

continued



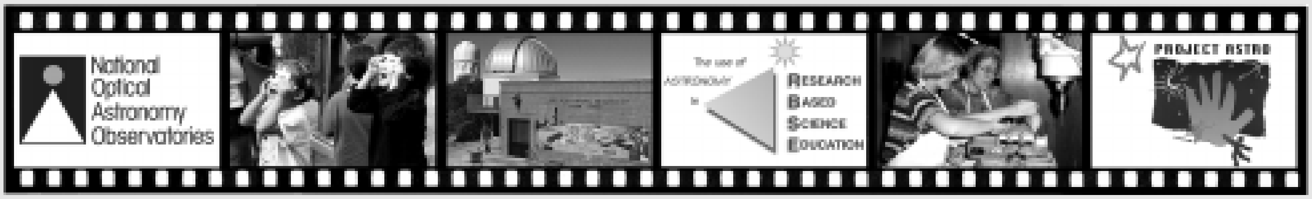
A two-dimensional power spectrum from the GONG+ prototype shows good sensitivity beyond ℓ = 1000, with the absence of spatial aliases at high ℓ. Classic GONG was limited to the left-hand quarter of this figure (ℓ < 250).

Our current investigation of a problem related to the camera serial communications has prompted the implementation of a much more robust error detecting camera interface capability than that provided by the vendor. Although we are still working on a complete solution, the software error-checking upgrade should permit us to proceed with component certification and deployment.

In preparation for the deployment, the project will stage two reviews to demonstrate that the system works to specification, that it is reliable, that the data are of high quality and meet expectation, and that the DMAC is ready to capture and process the data. It has been a long road, but we are now on track for a system deployment this Fall.

How to Contact GONG

The Web	*http://www.noao.edu/gong*
Questions	*gong@noao.edu*
E-mail a staff member	*first initial+last name@noao.edu*



Staffing, Grants, and Supplements

Suzanne Jacoby

This is the time of year when managers review the previous year and forecast the future. Newsletter readers may be interested to know how Educational Outreach at NOAO is funded. There are currently 5.2 full-time-equivalent (FTE) employees in the group, up from the original half-time employee in 1995. Of these 5.2 FTEs, 2.83 are supported by core NSF/NOAO funding and 2.37 are funded by external grants, which include our RBSE grant from the NSF Education and Human Resources Directorate, supplemental funding from NSF/Astronomy to support Project ASTRO-Tucson, a NASA IDEAS grant, and NASA E/PO supplements to NOAO-affiliated research grants.

With nearly half the group funded outside the core program, obtaining ongoing funding is always a priority. Recent efforts are described below.

- Funding has been received through a supplement to Robin Ciardullo's NASA LTSA grant to develop Kitt Peak Visitor Center materials and NOAO public Web pages illustrating "The Origins and Properties of Intracluster Stars." This is a five-year grant, with a $10K supplement for E/PO expected each year. During the first year, Web pages, hands-on demonstrations, and a StarDate/Universo radio program (through McDonald Observatory) will be developed.

- Two additional E/PO supplements have been submitted with NASA research proposals involving NOAO staff: "A Public Web Interface for Exploring Multiwavelength Surveys," Arjun Dey, PI, in response to NRA 00-OSS-01, and "Student Interns Investigating Limiting Performance of Candidate NGST Near-IR Arrays," K. Michael Merrill, PI, in response to NRA 00-OSS-03. We're waiting to hear on the success of both these proposals.

- A preliminary proposal was submitted to the NSF Education and Human Resources Directorate to build on the RBSE Teacher Enhancement program and fund its continued development for the next five years. A full proposal has been encouraged and is due in October.

How to Contact Educational Outreach

The Web	*http://www.noao.edu/outreach/*
Questions	*sjacoby@noao.edu* *Suzanne Jacoby, Educational Officer* *(520-318-8364)*
E-mail a staff member	*first initial+last name@noao.edu*

Project ASTRO–Tucson Seeking Astronomers and Teachers, Locally and Nationwide

Ginny Beal

Project ASTRO is an exciting program that links professional and amateur astronomers with educators to enhance the teaching of astronomy and increase students' interest in science. Led by NOAO, Project ASTRO–Tucson is recruiting for its fifth annual workshop, which will take place 13–14 October 2000 in Tucson.

A few slots at this workshop are being reserved for astronomers from outside the Tucson area who wish to attend, possibly with a teacher they would like to work with as a Project ASTRO partner. If this interests you, please contact Ginny Beal, Senior Program Coordinator, for details as soon as possible.

Gina Rester-Zodrow and Joni Chancer, authors of *Moon Journals: Art, Writing and Inquiry through Focused Nature Study*, will facilitate parts of the workshop. The two-day workshop will also include observation on Kitt Peak with the Visitor Center 16" telescope and presentations by Tohono O'odham storyteller Danny Lopez, all within the context of observing and understanding the Moon.

How to Get Information on Project ASTRO

The Web	*http://www.noao.edu/outreach/astro/*
Questions	*gbeal@noao.edu*
	Ginny Beal, (520-318-8535)
E-mail a staff member	*first initial+last name@noao.edu*

Fourth Annual RBSE Workshop Under Way

Suzanne Jacoby

The integration of education and research is a powerful paradigm for improving science education, bringing the excitement of discovery and the discipline of scientific inquiry effectively to the classroom. The NOAO Teacher Enhancement Program, The Use of Astronomy in Research-Based Science

continued

Education (RBSE), is a four-week workshop for middle and high school teachers who are interested in incorporating astronomy research within their science classes. As we go to press, this year's sixteen RBSE participants are observing on Kitt Peak as the fourth annual workshop unfolds.

Independent evaluation of the RBSE program tells us that the teacher-participants made statistically significant gains in 15 of the 18 Internet and image processing skills they were taught. Classroom data obtained from teachers indicated all had adopted several "best practices" strategies advocated by science education reform as a result of their participation in RBSE. Best practice strategies include students working on long-term projects, students engaging in out-of-class activities, using computers as a tool for data display and analysis, teachers using student logs or concept maps for assessment, and greater use of the Internet and computers in general. RBSE teacher-participants also used fewer traditional practices, which research shows are less effective if overly used, including: lecture as a mode of instruction and students completing worksheets.

As RBSE matures, it has achieved a high level of visibility with professional astronomers and the media. This recognition has been instrumental in RBSE participants successfully obtaining funding on their own. In one RBSE program, teachers and their students have so far discovered 73 novae in the Andromeda galaxy and presented their results at the January 2000 meeting of the AAS. The *Philadelphia Inquirer* ran a story about a local classroom's involvement in this effort; the June issue of *Sky & Telescope* featured a story about RBSE participant Tom Gehringer and his students' work.

Professional astronomers are needed to serve as mentors to RBSE teachers in their local area, working with the teachers as they implement the program in their classrooms. This may be the opportunity you've been looking for to make a contribution to science education reform. A list of RBSE 2000 participants and their schools was included in the March 2000 newsletter *(NOAO Newsletter,* No. 61). Please contact Suzanne Jacoby or Travis Rector (contact information below) if you are interested.

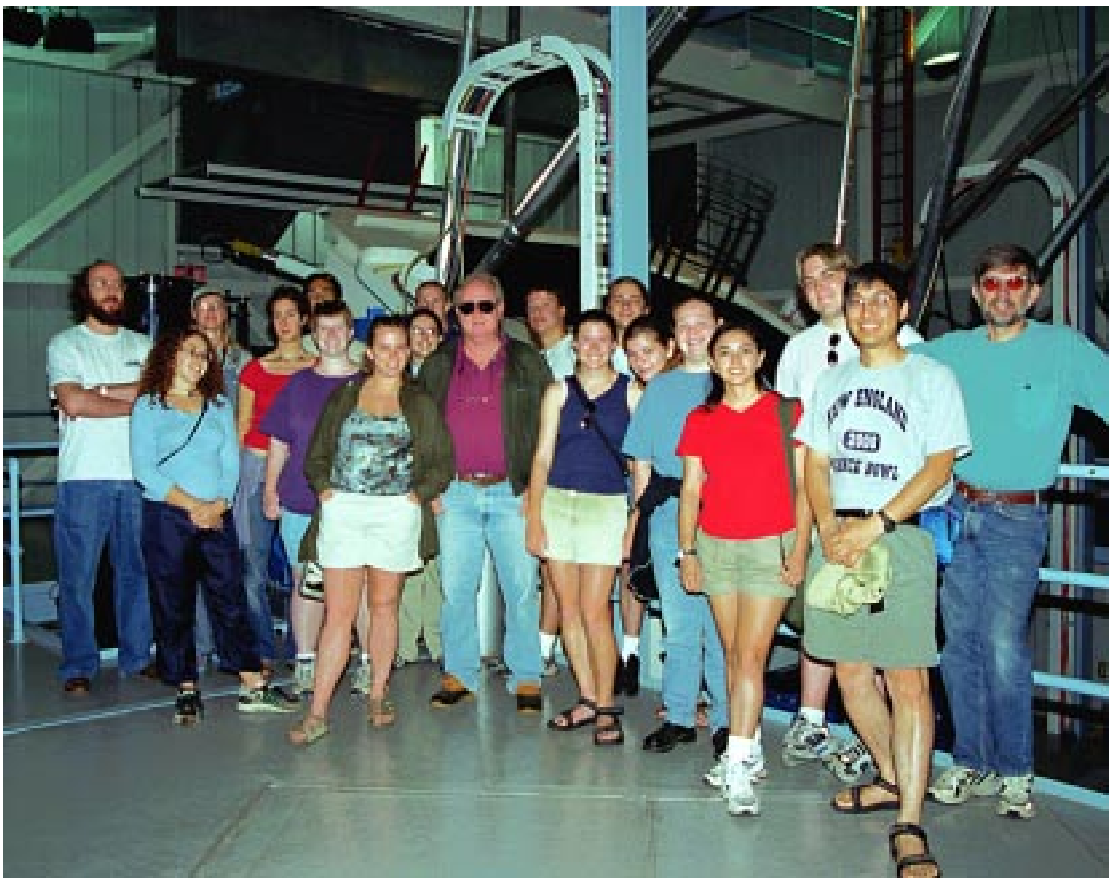
Since our funding for RBSE winds down in the spring of 2001, we are working now to develop another proposal that would allow us to continue the best elements of the program for another five years. We intend to have RBSE reach a larger numbers of teachers and to support more novice teachers in their efforts to integrate research and inquiry into their classrooms.

How to Get Information on RBSE

The Web	*http://www.noao.edu/outreach/rbse/*
Questions	*sjacoby@noao.edu or trector@noao.edu*
	Suzanne Jacoby, (520-318-8364) or Travis Rector (520-318-8256)
E-mail a saff member	*first initial+last name@noao.edu*

Research Experiences for Undergraduates and Teachers

Eight KPNO REU students, five NSO–Tucson REU students, and four teachers (funded through a supplement to the REU grants from the National Science Foundation) have arrived in Tucson and settled into their summer research experiences. The REU/RET program includes observing opportunities on Kitt Peak telescopes, a lecture series, and working closely with a mentor on the scientific staff.



How to Get Information on REU

The Web	*http://www.noao.edu/reu*
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E-mail a staff member	*first initial+last name@noao.edu*

NOAO Preprint Series

The following preprints were submitted during the period 10 May through 30 June 2000. Please direct all requests for copies of preprints to the NOAO author marked.

878 *Najita, J.R., Tiede, G.P., Carr, J.S., "From Stars to Super-planets: the Low-Mass IMF in the Young Cluster IC348"

879 *Kinman, T., Castelli, F., Cacciari, C., Bragaglia, A., Harmer, D., Valdes, F., "A Spectroscopic Study of Field BHB Star Candidates"

880 *Kinman, T.D., "Kapteyn and the Selected Areas: A Personal Perspective," in *The Legacy of J. C. Kapteyn*

881 *Dolphin, A.E., "WFPC2 Stellar Photometry with HSTphot"

882 *Dolphin, A.E., "The Charge Transfer Efficiency and Calibration of WFPC2"

883 Burris, D.L., *Pilachowski, C.A., Armandroff, T.E., Sneden, C., Cowan, J.J., Roe, H., "Neutron-Capture Elements in the Early Galaxy: Insights from a Large Sample of Metal-Poor Giants"

Other NOAO and NSO Papers

Preprints that were not included in the NOAO preprint series but are available from staff members are listed below.

Bertello, L., Varadi, F., Ulrich, R.K., *Henney, C.J. , Kosovichev, A.G., García, R.A., Turck-Chièze, S., "Identification of Solar Acoustic Modes of Low Angular Degree and Low Radial Order"

Dewangan, G.C., Singh, K.P., Szkody, P., *Hoard, D.W., "A New Narrow-line Seyfert 1 Galaxy: RX J1236.9+2656"

González Hernández, I., *Patrón, J., Cortés, T.R., Bogart, R.S., *Hill, F., Rhodes, E.J. Jr., "A Synoptic View of the Subphotospheric Horizontal Velocity Flows in the Sun"

Haisch, K.E. Jr., Lada, E.A., Lada, C.J., "A Near-Infrared L Band Survey of the Young Embedded Cluster NGC 2024"

*Howard, R.F., Sivaraman, K.R., Gupta, S.S., "Measurement of Kodaikanal White-Light Images. V. Tilt-Angle and Size Variations of Sunspot"

Knigge, C., Long, K.S., *Hoard, D.W., Szkody, P., Dhillon, V.S., "A Self-Occulting Accretion Disk in the SW Sex Star DW Uma"

*Komm, R. W., Howe, R., Hill, F., "Width and Energy Solar *p*-Modes Observed by GONG"

Kriss, G.A., *Green, R.F., Brotherton, M., Oegerle, W., Sembach, K.R., Davidsen, A.F., Friedman, S.D., Kaiser, M.E., Zheng, W., Woodgate, B., Jutchings, J., Shull, J.M., York, D.G., "Fuse Observations of Intrinsic Absorption in the Seyfert 1 Galaxy MRK 509"

Peterson, R.C., Terndrup, D.M., Sadler, E.M., *Walker, A.R., "Hot Horizontal Branch Stars in the Galactic Bulge. I."

Szkody, P., Desai, V., Burdullis, T., *Hoard, D.W., Fried, R., Garnavich, P., Gaensicke, B., "The Effects of Superoutbursts on TOADS"

Toomre, J., Christensen-Dalsgaard, J., *Howe, R., Larsen, R.M., Schou, J., Thompson, M.J., "Time Variability of Rotation in Solar Convection Zone from SOI-MDI"

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