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Comments concerning this Newsletter are welcome and will be forwarded to the appropriate editors.
Newsletter Posted: 25 August 1996

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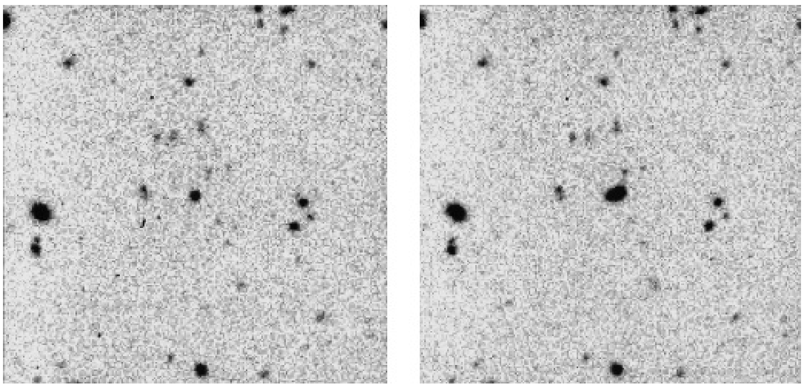
Observing the Geometry of the Universe

The classic approach to measuring Ω, the ratio of the universe's actual density to the critical density, is to observe the apparent magnitudes of objects believed to be "standard candles" as a function of redshift. The difficulty of this measurement lies in finding the standard candle at the high redshifts needed to be sensitive to deceleration of the Hubble flow, as well as understanding how to correct for any evolution in the characteristic luminosity of the candle over the age of the universe. Type Ia supernova offer the possibility of such an evolution-free candle, since they are self-contained thermodynamic events that broadcast detailed information about their internal physical states in the form of time-dependent spectra and lightcurves. Unfortunately, although supernovae are bright enough to be studied at high redshifts, they make a poor choice for a telescope time assignment proposal since they are rare, transient, and unpredictable. The Supernova Cosmology Project, run by Saul Perlmutter (Berkeley) and an international team of collaborators, however, has developed an approach to solve these problems and turn supernovae into predictable, practical cosmological tools (Perlmutter et al. 1995).

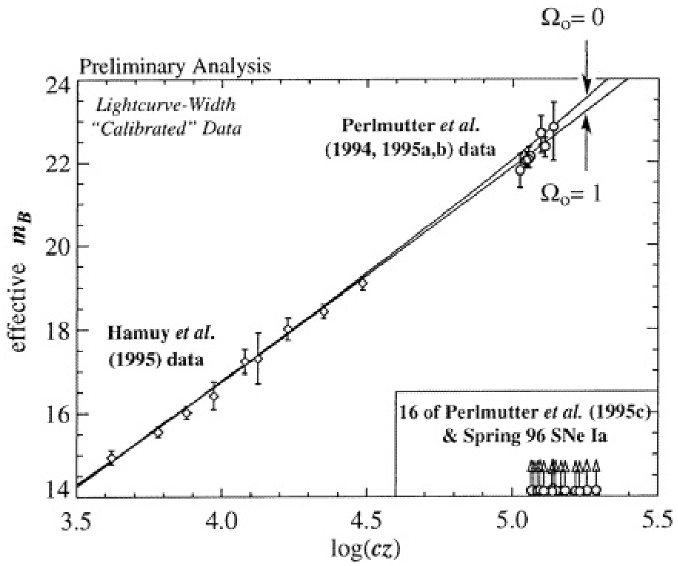
Just after a new moon, Perlmutter and collaborators observe dozens of high-galactic-latitude fields on telescopes such as the CTIO 4-m. With a wide-field camera, each image contains hundreds of galaxies at redshifts 0.3 to 0.7. Just before the next new moon, the same fields are reobserved and the images are compared, thus checking tens of thousands of high redshift galaxies to find the ten or so showing the new light of a supernova that was not there on the previous observation (Figure 1). The supernovae generally do not have time to reach maximum light, with only ~3 weeks (~2 weeks in the supernova rest frame) between the after- and before-new-moon comparison images. Rapid data analysis makes it possible to identify the supernovae within hours of the observation, so that the follow-up photometry and spectroscopy can begin immediately. In short, this search technique allows "batches" of pre-maximum- light supernova discoveries to be "scheduled" just before new moon, the ideal time to begin follow-up spectroscopy and photometry; the follow-up can be scheduled as well.



Caption: Figure 1: The discovery of a supernova at high redshift. The pair of images show a distant galaxy observed one month apart. The supernova is clearly visible in the image on the right. (454 Kb image)

This strategy has now been used to discover ~30 supernovae at redshifts z = 0.35 to 0.65, in three observing campaigns with NOAO telescopes, and coordinated work at telescopes around the world. The well-corrected wide-field prime-focus camera at the CTIO 4-m provides the excellent image quality necessary to detect the supernovae. The novel queue-scheduling of the WIYN 4-m is well-suited to following the light curves for the "batches" of supernova discoveries that this technique provides--and the data especially benefits from the image quality of this new telescope.

The first results from the Supernova Cosmology Project are now beginning to be reported. Figure 2 shows the first seven supernovae discovered plotted on a magnitude-redshift diagram (Perlmutter et al. 1995, 1996). (For comparison, the relatively low-redshift supernovae studied at the CTIO telescopes by the Calan/Tololo project (Hamuy et al. 1995) are also plotted.) The first high-redshift supernovae suggest that we live in a relatively high-mass universe, with Ω near unity. If the universe is flat, the data also imply that the cosmological constant is not an appreciable factor in the expansion of the universe--an important point, given the current discrepancy between the estimated ages of the oldest globular clusters and the higher values of the current range for the Hubble constant.



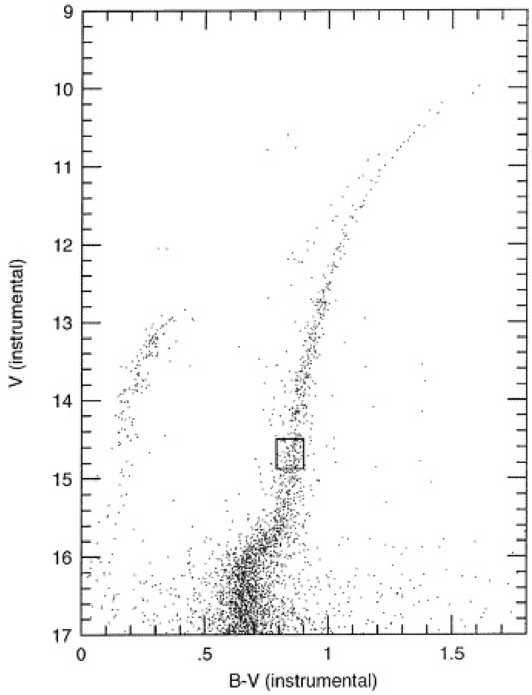
Caption: Figure 2: The supernova Hubble diagram: Apparent luminosities of the supernova as a function of redshift. The Perlmutter et al. supernova define the high redshift end, with the Hamuy et al. sample holding down the low redshift end. The inset shows the redshifts of the 16 supernovae discovered by Perlmutter et al., yet to have complete reductions.

The results from these seven supernovae will soon be strengthened by the inclusion of the next ~20 supernovae, discovered by this project in two scheduled "batches" at the CTIO 4-m on 19-20 November 1995 and 16-17 March 1996. Each batch of ~10 supernovae was found using two search nights compared to two previous nights. These supernovae are currently being followed with photometry and spectroscopy at the WIYN and Keck telescopes. As soon as they have faded enough that the host galaxy can be observed, we will hear the next installment of information on these cosmological measurements.

Digging for Oxygen

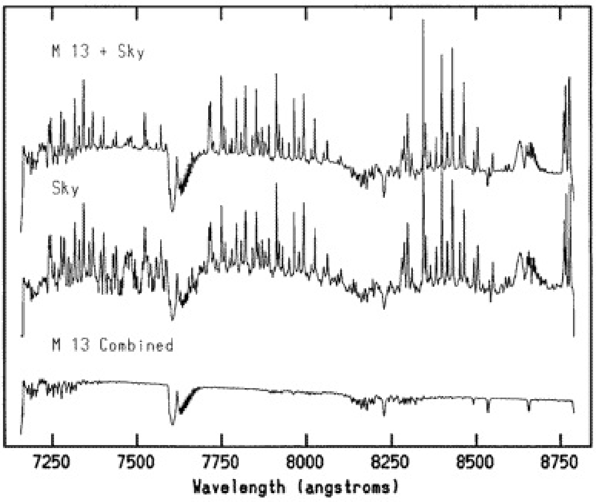
The abundance of oxygen in globular clusters is important for determining cluster ages, and for understanding the early chemical enrichment and star formation history of the Galaxy. Oxygen is also critical for understanding the source of carbon, nitrogen, and oxygen abundance changes (and related CN and CH strong and weak stars) in low mass stars--particularly those in globular clusters.

Stars in the galactic halo have about ~3x excess oxygen compared to iron than for standard solar composition. In globular cluster giants, oxygen is also enhanced relative to iron, but some clusters also contain a few bright giants *deficient* in oxygen. This deficiency of oxygen in luminous giants is attributed due to deep mixing and ON-cycle burning. Observations of the abundance of oxygen in less evolved stars in globular clusters would thus be helpful in testing this conclusion. Caty Pilachowski and Taft Armandroff (NOAO) investigated the abundance of oxygen in low luminosity giants in the globular cluster M13 (Figure 1) using the high excitation, permitted O I triplet at 7770 . Because the lines are closely spaced, they become blended at low resolution, and resolutions of a few times 10^3 are suitable for measuring the blended equivalent width.



Caption: Figure 1: This preliminary, instrumental, color-magnitude diagram for M13 was provided by Mike Bolte from images obtained with the KPNO 0.9-m telescope. The low-luminosity giants observed by Pilachowski and Armandroff are found within the box.

Spectra of 40 M13 stars with similar temperatures and magnitudes near the base of the giant branch were obtained during three nights on the KPNO 4-m telescope using the Hydra fiber positioner. Spectra of metal poor field stars of similar temperature and luminosity were observed both with Hydra and with high spectral resolution with the CoudÃ© Feed Telescope for comparison. The individual spectra were combined into a single spectrum for analysis, which has a signal-to-noise ratio (per pixel) of 300 (Figure 2). For the 40 stars included in the average spectrum, the average V magnitude is 16.65 and the average B-V color is 0.66. The B-V color gives an effective temperature of 5300K. The distance modulus, V magnitude, and assumed mass yield a surface gravity of log(g) = 3.0.



Caption: Figure2: The average star+sky, sky, and reduced spectra for 40 stars in M13 found within the box in Figure 1.

Adopting a 1σ upper limit of 9 mÃ… to the equivalent width of the blended O I triplet, Pilachowski and Armandroff concluded that the average oxygen abundance among relatively unevolved stars in M ~ 13 must have [O/Fe] $\lesssim$ 0.1. An average oxygen abundance of [O/Fe] = $\pm$ 0.3 is excluded at the 4σ level. If [O/Fe] = $\pm$ 0.3, the equivalent width of the OI blend would be about 40 mÃ….

The luminosity of the composite M13 "star" is M_{Bol} = 1.56, which places it in the vicinity of the first dredgeup. The first dredgeup is likely to affect the carbon isotope ratio and the C/N ratio, but is predicted not to change the oxygen abundance. Stars of this magnitude should retain the original surface oxygen abundance with which they formed. That the average oxygen abundance is low suggests either that nucleosynthesis and mixing change the surface abundance of oxygen in M13 giants at an earlier evolutionary phase than previously anticipated, or that M13 does not share in the general oxygen enhancement found in the halo population.

It may not be appropriate to assume uniform [O/Fe] or [CNO/Fe] ratios in the halo for the derivation of globular cluster ages. Such assumptions could be particularly troublesome for age comparisons of second-parameter pairs of clusters. For M13, age estimates may need to be revised to slightly older ages.

A detailed report of this work appeared in the March 1996 issue of the Astronomical Journal.

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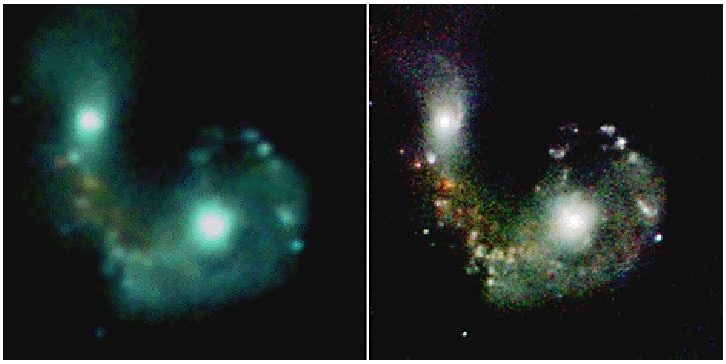
IR Imaging with the 1024 ALADDIN Array

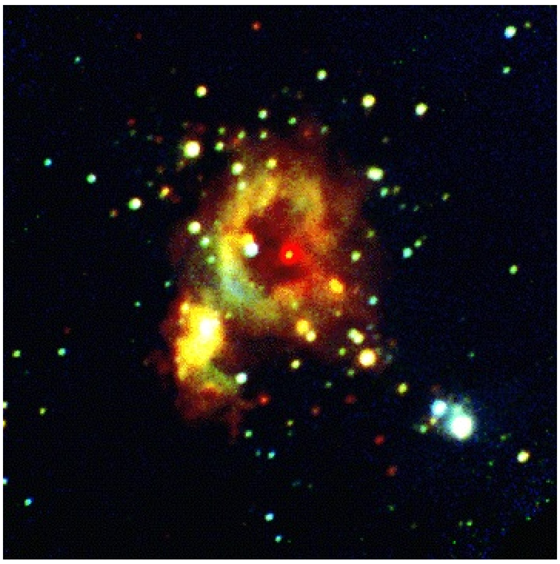
In March of this year we took the best of the first batch of ALADDIN arrays to the 2.1-m telescope to evaluate its astronomical performance. Our USNO colleagues have particular interest in astrometry, and were simultaneously observing many of the same fields from their Flagstaff observatory. The observing team consisted of Fred Vrba and Arne Henden (USNO), and Al Fowler and Ian Gatley (NOAO). The IR camera was a modification of the retired CTIO IR Imager, which was originally designed for the 58 x 62 InSb array. This dewar looks a lot like IRIM, and is very small compared to more modern instruments. Because of these space limitations in the dewar we were obliged to use 1:1 reimaging optics, giving 0.2"/pixel, thus oversampling the seeing, and restricting the field of view. However, the much larger array format still gave a field of view similar to that of SQIID. The resultant improvement in spatial resolution is dramatically obvious in Figure 1, which compares SQIID and ALADDIN images of the interacting galaxy pair NGC 4038/9.



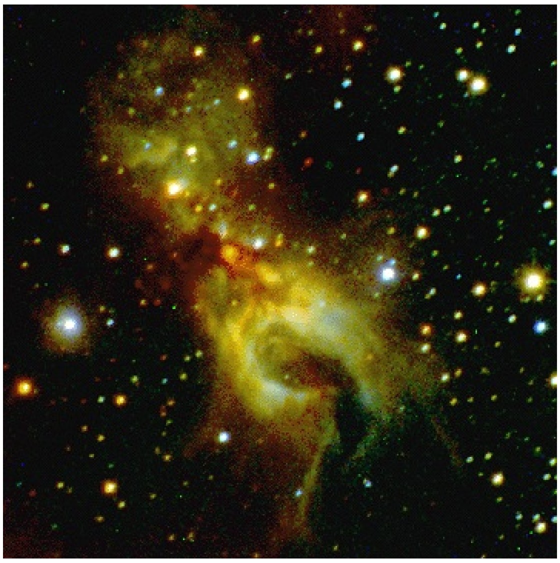
Caption: Figure 1: SQIID image (left) and ALADDIN image (right) of NGC 4038/9

Even though the weather was mediocre we were able to image several fields at three wavelengths (JHK), and so make color images demonstrating the power of this new generation of infrared detectors. As is always the case when making the initial tests of a system with radically improved capabilities, the excitement level in the dome was very high both for the observing team and for the many and frequent visitors who dropped in to join the fun.

Figures 2 and 3 show two of the more striking new images of well-known infrared targets, Mon R2 and GGD27, which serve to illustrate the kind of detail that future users can anticipate. Both Mon R2 and GGD27 are young and dusty, and so are invisible at optical wavelengths because of extinction. The color versions of these images are available on the NOAO homepage; they are far more impressive than these black and white versions, and we encourage you to browse them.



Caption: Figure 2: ALADDIN image of Mon R2



Caption: Figure 3: ALADDIN image of GGD27

NOAO has already installed an ALADDIN array in the Phoenix high resolution spectrometer, greatly extending its capability beyond the 256 x 256 InSb array for which it was originally designed. The ALADDIN pixels are 27 μm, only slightly smaller than the 30 μm of the older array, which translates into almost a factor of four increase in spectral coverage over the original design. The next use of an ALADDIN array at KPNO will be in an Ohio State imager, expected to be available to users in the spring of 1997, as described elsewhere in this Newsletter.

Al Fowler

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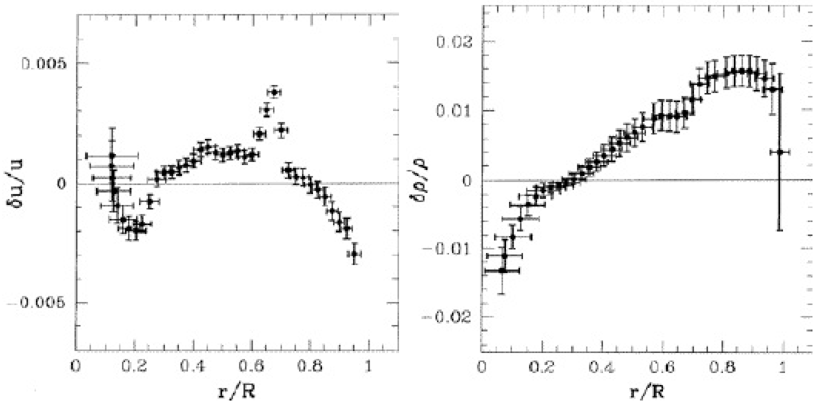
First Results from GONG

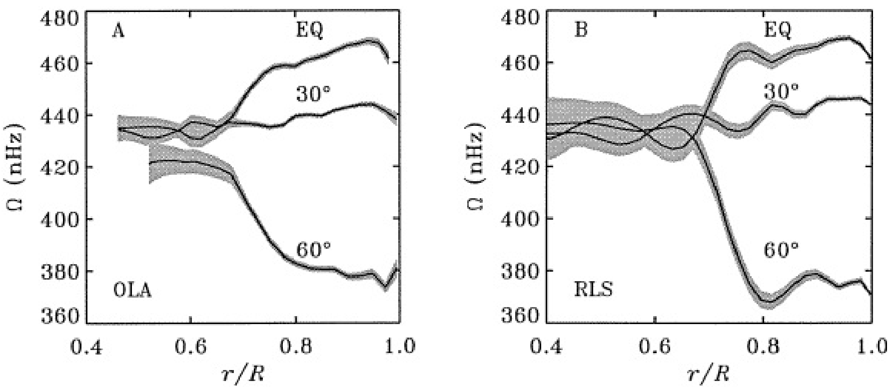
Not only do the GONG instruments and data reduction system work, but the Global Oscillation Network Group works! The scientific community, organized in a number of teams, has been working together since the conception of GONG to define the scientific program and to prepare the analysis techniques. Thus they were able to quickly apply their efforts to the first look of full-network data. The fruits of their labors were published in a special issue of the journal *Science*, which appeared on 31 May. In addition to a spiffy--and intriguing--cover, the GONG special issue contains seven articles, covering 29 pages, resulting from the contributions of 71 different authors, and a cast of hundreds more.

These first results are just scratching the surface, in terms of the accuracy and precision that will progressively improve as the data collection, and our understanding of its interpretation, proceeds. Nevertheless, they are extremely heartening in terms of what they already show, and what they promise for the future. It is clear that we are entering a whole new realm of analysis in terms of the care and subtlety required to pursue inference from data with this high frequency resolution and low noise.



Caption: Figure 1: The left panel shows the relative deviation deduced from GONG observations of local sound speed (squared) as a function of radius from pre-GONG solar models. The right panel shows the deduced deviation in relative local mass density.

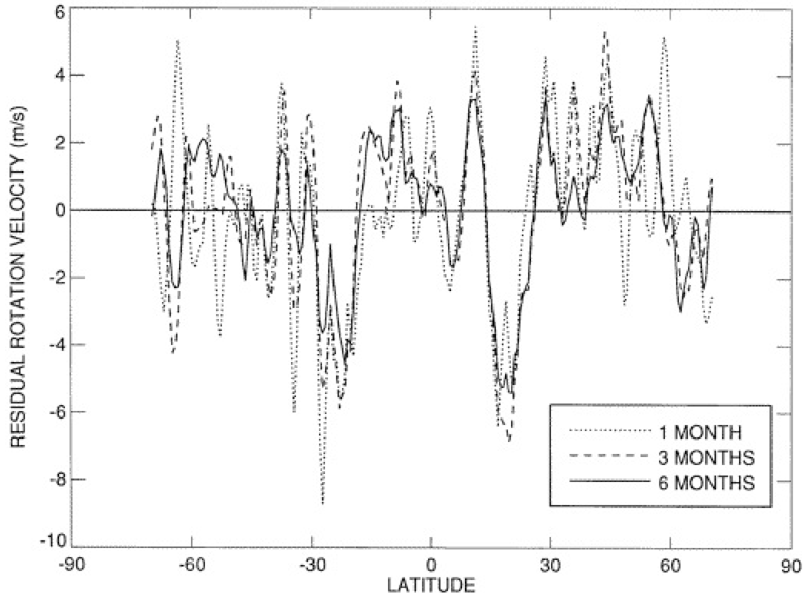
The GONG Project was undertaken to test models of stellar structure. Figures 1a and b show the differences between inferences from GONG observations and models for the variation of sound speed (squared) $u = p/\rho$ and ρ as functions of depth within the Sun. There are indeed important differences. First of all, the adiabatic stratification in the Sun appears to penetrate more deeply than in the model. Part of the difference in u between Sun and model could be that the model convection zone may be too shallow. However, the excess u caused by that property is of lesser magnitude than that in the figure, and extends more deeply. The small positive value of $\delta u/u$ between 0.3 R and 0.6 R might be accounted for in this manner, but the relatively sharp bump between 0.6 R and 0.7 R cannot. The decrease in u locally may indicate that immediately beneath the convection zone the accumulation of helium, which augments the mean molecular mass, has been overestimated in the reference model. The bump could in principle have been produced by an opacity error that drops abruptly to zero immediately beneath the base of the convection zone. However, such a fortuitous occurrence is unlikely. The discrepancy in the core is the third prominent feature. Most secure is the negative region of du/u between about 0.1 R and 0.2 R, which implies that the variation of u itself is flatter than in the model. Once again this would be a symptom of there being too steep a composition gradient in the model, which has been produced here by nuclear reactions. The density inversion (Figure 1b) is consistent with this interpretation: the regions of relatively steep positive slope in $\delta\rho/\rho$ in the core and immediately beneath the convection zone imply that the magnitude of the (negative) gradient of density is too high in the model.



Caption: Figure 2: Solar rotation frequency (in nano-Hertz) as a function of depth at the equator, 30, and 60 latitude. GONG data in the left panel were reduced by the method of Optimized Local Averages, while the right panel was reduced using Regularized Least Squares.

The area of stellar structure where helioseismology has made a unique mark is the study of internal rotation. Figures 2a and 2b show two different analyses of the solar internal rotation rate, based on four months of GONG data, which are in hearteningly good agreement. Figure 2a utilizes a method known as "Optimized Local Averages," while Figure 2b utilizes another known as "Regularized Least Squares." In the convection zone above latitude $\gg 30^{\circ}$, the data show that the rotation rate at fixed latitude is roughly independent of depth, so that the variation with latitude is similar to that seen at the surface. Near the equator, the rotation rate increases just below the surface and reaches a maximum at roughly 0.95 R. It then gradually decreases with depth in the convective envelope. At the base of the convection zone near 0.7 R there is a pronounced transition at all latitudes to nearly uniform rotation at greater depths. The structure of the transition is not yet resolved. Thus the GONG data support earlier deductions that the surface-like differential rotation is smoothed out near the base of the convection zone and the rotation below appears to become independent of latitude. The data from GONG currently permit reliable inferences only to a depth of about 0.4 R, and the use of global modes yields progressively less information toward the poles. Our confidence in the inferences made from the nearly continuous GONG data is enhanced by the improved determination of frequency splittings of individual modes, because GONG spectra do not suffer from daily sidelobes, which plague single-site, ground-based observations.

In addition to helioseismic inferences of the solar interior structure, GONG's measurements of the velocity of the solar surface are of interest for the measurement of its nearly steady motions--large scale flows and convection, as well as rotation--all of which are thought to play important roles in generating the Sun's magnetic field. The differential rotation stretches meridional magnetic field lines to form strong toroidal fields; that is, field in longitudinal rings about the Sun's rotation axis. The meridional circulation transports magnetic flux and angular momentum across parallels of latitude and from one radius to another. The nonaxisymmetric convective motions also redistribute magnetic flux and angular momentum in more complex and subtle ways. The Sun's differential rotation is accurately determined from single GONG observations. The rotation profile with latitude agrees well with previous measures, but also shows a slight north-south asymmetry. Rotation profiles averaged over 27 day rotations of the Sun reveal torsional oscillation signal--weak, 5 m/s, jet-like features associated with the sunspot latitude activity belts. Figure 3 shows the difference between the measured rotation signal and the spherical harmonic fit to that signal as a function of latitude, averaged over three time intervals. The jet-like torsional oscillation signal appears as the fairly broad ($\gg 15^{\circ}$ wide) features that are seen in all three averages. The latitudes of these features (18° north and 22° south) are slightly poleward of the latitudes where sunspots were found during this period. The smaller features seen in the shorter averages are attributed to signal leakage from the nonaxisymmetric cellular flows.



Caption: Figure 3: The difference between the measured rotation signal and the spherical harmonic representation of the signal as a function of latitude as averaged over 1, 3, and 6 months.

These are just three snippets from the Science articles. For the whole story, *and color too*, check the original!

John Leibacher

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Access to the Independent Observatories

One of the major recommendations of the NRC Panel on Ground-Based Optical and Infrared Astronomy was that the NSF should augment funding for facility instruments for the powerful new telescopes at those independent observatories that agree to provide national peer-reviewed access to their facilities. I am pleased to announce that this program has been initiated. Steward Observatory has agreed to provide 24 nights of community access per year on the converted 6.5-m MMT for a period of six years. I will be working out the details of this access program, including when it will begin, with Peter Strittmatter over the next few months. Peter has already indicated that any facility instrument, not just the three funded by the NSF under this new program, will be made available to the community.

The NSF has also funded fiber-fed medium and high resolution spectrographs for the Hobby-Eberly telescope, and 27 nights per year for six years will be made available to the national community. Both the converted MMT and the Hobby-Eberly telescope will be equipped with instruments that are not included in the Gemini first-light suite of instruments, and so this new program will substantially increase the opportunities available to the community.

Future Newsletters will describe when and how to submit applications for the time at the independent observatories, and NOAO will also provide descriptions of the instrumental capabilities that are available. The time will be scheduled through an NOAO-managed TAC. Note, however, that neither of the two telescopes involved is completed yet, and access is probably 18-24 months away.

Sidney Wolff

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SONG Update

We are pleased to announce a new electronic newsletter devoted to asteroseismology of solar-type stars. This newsletter is founded to disseminate timely information on programs, meetings, and results related to asteroseismology, and to assist in the development of a world-wide network for the study of acoustic oscillations in solar-type stars. The first issue of *SONGNews* includes a report on our Special Session at the AAS meeting in Madison in June, recent abstracts related to asteroseismology, meeting announcements, and an invitation to participate in the Procyon Campaign in early 1997.

Initially, we hope to distribute SONGNews quarterly. If you are interested in subscribing, send e-mail to songnews@noao.edu. The first issue was distributed in early July, and is available via the NOAO homepage at http://www.noao.edu (click on SONG).

During the last three weeks of January 1997, the Stellar Oscillations Network Group at NOAO will conduct a campaign to monitor the star Procyon for p-mode oscillations. Observations will be obtained on the CoudÃ© Feed telescope on Kitt Peak near Tucson, Arizona, at a reciprocal dispersion of 0.4 Ã…/pixel, covering the region from 3800-5200 Ã…. Primary emphasis will be on the measurement of the equivalent widths of Hβ, Hγ, and Hδ for asteroseismology. The actual dates of the campaign are 11 January-1 February (UT). Some additional time during the first weeks of February may also be scheduled.

We are interested in developing collaborations with other observatories during this period, both to extend coverage to times when Procyon cannot be observed from Kitt Peak, and to monitor the star using other techniques such as Doppler velocity variation or photometric variation.

If you are interested in participating in this campaign, please contact one of us at NOAO or e-mail to song@noao.edu for details.

S. Barden, M. Giampapa, J. Harvey, F. Hill, C. Keller, C. Pilachowski

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Use the New Observing Proposal Templates

Two years ago KPNO and CTIO implemented a new, LaTeX-based template for submitting observing proposals over the Internet. From our perspective and, we hope, from that of our users, the process has gone well--more than 90% of observing proposals come in electronically. Two good reasons for electronic submission are to ease the process of submitting proposals, and to enable more automated processing of your proposals to reduce the workload and to shorten the time it takes for CTIO and KPNO staff to ingest, sort, and schedule your proposals based on TAC review.

The old, homebrew, proposal database software we have been using for years has required laborious data entry from printed proposals, and has been difficult to modify and upgrade as our needs have changed. We are now setting up a new process for handling proposals that is based on a commercial database. The database software we have chosen (Access) works in conjunction with the other office software in use by the support staff. In preparation for the new system, we have made a few changes in the LaTeX template (see accompanying article in the KPNO section by Phil Massey) so that information from proposals can be automatically entered more easily into the database.

We will begin testing parts of the new database software in parallel with the old starting with the September 1996, proposal cycle. If all goes well, we hope to switch to the new system during 1997. To help this process along, we ask all users of CTIO and KPNO facilities to obtain the new LaTeX template and .sty file. KPNO users can obtain the new template by anonymous ftp to ftp.noao.edu, cd kpno/kpnoforms; over the Web via the NOAO homepage (http://www.noao.edu), or by sending mail to *kpnoprop-request@noao.edu*. CTIO users can get the new template files from the CTIO Web pages via the NOAO home page; by ftp to ctios1.ctio.noao.edu, cd pub/ctioforms; or by sending e-mail to *ctioprop- request@noao.edu*.

Caty Pilachowski

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Visitor Center Telescope to Be Opened

The NOAO Public Information Office and the Kitt Peak Visitor Center are proud to announce a new addition to the world's largest collection of optical telescopes, the 0.4-meter Visitor Center Telescope. Located at the Visitor Center on the summit of Kitt Peak, the wheelchair-accessible public telescope facility will feature a state-of-the-art LX200 telescope provided by Meade Instruments Corporation of Irvine, California. Delivery, installation, and start-up of the telescope is expected by this autumn 1996. The Visitor Center Telescope is linked to the initiation of the Public Observing Program (POP), which will offer visitors a variety of authentic observing experiences.

The Visitor Center Telescope combines both traditional and high-tech observing equipment to allow visitors a look into the universe with several astronomical "eyes." Traditional eyepiece observing will offer direct, breathtaking views of the cosmos as early astronomers would have seen it. Objects will also be imaged using a CCD camera, one of the ways professional astronomers currently study the sky. Real- time video displays of planets and the Moon will allow an entire group to share in a guided sky-tour, while recording the experience to enjoy again later. With the facility's multi-media computer system, a planetarium program assists in displaying constellations, creating animations of celestial phenomenon, operating the telescope and cameras, and posting images taken by visitors on the internet. The contrast between high-tech and traditional observing is highlighted by a flip-mirror system that permits an instant switch from an eyepiece to a CCD or video camera.

Two observing programs for the general public are currently in development. A new monthly "Public Evening" program will offer visitors a rare behind the scenes look at Kitt Peak at night. Public Evenings will include sunset observations, a popular "Ask the Astronomer" session, and the opportunity to view through a professional research telescope. Beginning in the fall of 1996, POP will introduce the "Star Party," a weekly star-gazing session with emphasis on experiential learning about the sky. Star Party participants will examine the sky with the naked eye, binoculars, and the Visitor Center Telescope. Additional night program plans include scheduled group visits by schools, clubs, scouts, and members of the Tohono O'odham Nation. For daytime guests, the Visitor Center will offer daily observing of the sun through two new 8" Meade LX200 telescopes equipped with special solar filters. Whether day or night, POP promises a special treat for each of our visitors.

All of this is possible thanks to more than $30,000 worth of new equipment, donated by an outstanding assemblage of private corporations. In gratitude, an attractive plaque acknowledging each contributing corporation and its donation is being located at the Kitt Peak Visitor Center Telescope where 100,000 visitors may read it annually. Congratulations and appreciation go to the following corporations for their support of NOAO's Public Observing Program:

- **Adirondack Video Astronomy:** *Astrovid 7000 Video Camera*
- **Ash Manufacturing Company, Inc.:** *Previous donation of an Ash-Dome*
- **IPC Technologies:** *Pentium 120 multimedia PC*
- **Lumicon:** *OIII, H-Beta, UHC filters, 2" focuser*
- **M3 Engineering & Technology Inc.:** *Consultation on dome structural upgrade*
- **Meade Instruments Corporation:** *8", 10", & 16" LX200 Telescopes*
- **Murnaghan Instruments:** *1.25" Universal Flip Mirror*

- **Orion Telescope Center:** *Eyepieces, filters, and accessories*
- **Santa Barbara Instrument Group:** *ST-7 CCD and Color Filter Wheel*
- **Software Bisque:** *TheSky & SkyPro Software*

Additionally, many NOAO/Kitt Peak staff members have given unselfishly of their time and effort to establish the Visitor Center Telescope. We thank the following individuals: Khairy Abdel-Gawad, Tony Abraham, Bob Barnes, Jeff Barr, John Dunlop, Jim Hutchinson, Steve Lane, Larry Reddell, William Schoening, John Scott, Sidney Wolff, and the mountain facilities staff.

Please look for updates and announcements about the Public Observing Program in future issues of the NOAO Newsletter. For more information on POP please call (520) 319-8250 or contact me by e-mail, ridolfi@noao.edu.

Frankie Ridolfi,
Public Program Coordinator

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NOAO Educational Outreach

This is a time of high activity in the Educational Outreach office as we lay groundwork for future programs and continue to develop materials and methods considered effective by our network of teachers. A major effort has been developing "The Use of Astronomy in Research Based Science Education," a proposal for submission to the NSF Teacher Enhancement Program. Updated WWW pages describing the activities of this office are found at URL http://www.noao.edu/education/noaoeo.html.

Excerpts from the preliminary proposal mentioned above are on-line, as is a new classroom activity using Comet Hyakutake data taken with the CWRU Burrell-Schmidt telescope on Kitt Peak. Suzanne Maly, NOAO Outreach Advisory Board member, wrote an exercise that has students measure the motion of the comet relative to the background stars over a series of exposures. Suzanne used the NIH Image software in this lesson and presented the exercise at a recent "Image Processing for Teaching" conference in Orlando, Florida.

Michael Belton's NOAO-based Galileo Imaging Team's IDEA Grant involves "Integrating Space Exploration with Interdisciplinary Curricula at a Tohono O'odham Middle School." Coordinated by Elizabeth Alvarez del Castillo, this group has posted two draft modules at URL http://www.jpl.nasa.gov/galileo/sepo/sepo.html#education as part of the Galileo Solid State Imaging (SSI) team's education and public outreach WWW page. "Planets and Satellites" and "Navigating the Solar System" target math classes; additional modules will be appropriate for science, English, and social sciences classes. The teachers at the Tohono O'odham middle school will present this material as an integrated interdisciplinary program during the upcoming academic year.

The IDEA grant coordinated by Suzanne Jacoby supports the development of classroom materials based on "Hot Topics in Astronomy," with the initial focus being comets. The team has met to discuss the desired learning outcomes of this effort, the product content and format, and a timetable for development, evaluation, and distribution of the materials. We have planned for one semester of evaluation by local classrooms before distributing the materials next spring--we'll be ready for Hale-Bopp!

Stop by the NOAO Educational Outreach Office (room 159) on your next visit to Tucson, for sample materials and inspiring conversation. The NOAO EO WWW pages are updated frequently and contain more information on all topics mentioned here.

Suzanne Jacoby , NOAO Education Officer

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NOAO Preprint Series

The following preprints were submitted during the period 1 May 1996 to 31 July 1996. Please direct all requests for copies of preprints to the NOAO author marked with an asterisk.

709 *Sartoretti, P., Belton, M.J.S., McGrath, M.A. "SO2 Distributions on Io"

710 *Jacoby, G.H., Pierce, M.J. "Response to Schaefer's Comments on Pierce and Jacoby (1995) Regarding the Type Ia Supernova 1937C"

711 *Pilachowski, C.A., Sneden, C., Kraft, R.P., Langer, G.E. "Proton Capture Chains in Globular Cluster Stars. I. Evidence for Deep Mixing Based on Sodium and Magnesium Abundances in M 13 Giants"

712 *Corbin, M.R., Boroson, T.A. "Combined Ultraviolet and Optical Spectra of 48 Low-Redshift QSOs and the Relation of the Continuum and Emission Line Properties"

713 *Penn, M.J., Jones, H.P. "Limb Observations of He I 1083 nm"

714 *D'Silva, S., Duvall, T.L., Jefferies, S.M., Harvey, J.W. "Helioseismic Tomography"

715 *D'Silva, S. "Theoretical Foundations of Time-Distance Helioseismology"

716 Graham, J.R., *Dey, A. "The Redshift of an Extremely Red Object and the Nature of the Very Red Galaxy Population"

717 *Massey, P., "Numbers and Distribution of Wolf-Rayet Stars in Local Group Galaxies: Clues to Massive Star Evolution"

718 Grillmair, C.J., *Lauer, T.R., Worthey, G., Faber, S.M., Freedman, W.L., Madore, B.F., Ajhar, E.A., Baum, W.A., Holtzman, J.A., Lynds, C.R. "Hubble Space Telescope Observations of M32: The Color-Magnitude Diagram"

719 *Sarajedini, A., Geisler, D. "Deep Photometry of the Outer Halo Globular Cluster in Pyxis"

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Other NOAO Papers

Preprints that were not included in the NOAO preprint series but are available from staff members are listed below. Please direct all requests for copies of these preprints to the NOAO author marked with an asterisk.

*Beckers, J. "Techniques for High Angular Resolution Astronomical Imaging"

Bianchi, L., Clayton, G.C., Bohlin, R.C., Hutchings, J.B., *Massey, P. "UV Extinction by Interstellar Dust in External Galaxies: M31"

*Eggen, O.J. "Young Pulsating Stars in the B"hm-Vitense Decrement"

*Eggen, O.J. "Star Streams and Galactic Structure"

Gray, D.F., and *Livingston, W.C. "Monitoring the Solar Temperature: Calibration of C 5280 Using Stars"

Gray, D.F., and *Livingston, W.C. "Monitoring the Solar Temperature: Spectroscopic Temperature Variations of the Sun"

*Hamuy, M., Phillips, M., Schommer, R., Suntzeff, N., Maza, J., Avils, R. "The Absolute Luminosities of the Cal n/Tololo Type Ia Supernovae"

Hardy, E., Beauchamp, D., *Suntzeff, N. "Two Dwarf Galaxies of the Local Group: Fornax and the SMC. Implications for Stellar and Chemical Evolution"

*Heathcote, S., Morse, J., Hartigan, P., Reipurth, B., Schwartz, R., Bally, J., Stone, J. "Hubble Space Telescope Observations of the HH47 Jet: Narrow Band Images"

Hunter, D.A., Baum, W.A., *O'Neill, Jr., E.J., Lynds, R. "The Intermediate Stellar Mass Population in the M31 OB Association NGC 206"

*Jannuzi, B.T., Hartig, G.F., Kirhakos, S., Sargent, W.L.W., Turnshek, D.A., Weymann, R.J., Bahcall, J.N., Bergeron, J., Boksenberg, A., Savage, B.D., Schneider, D.P., Wolfe, A.M. "The HST Quasar Absorption Line Key Project XII. The Unusual Absorption Line System in the Spectrum of PG2302+029-Ejected or Intervening?"

*Keil, S.L., Altrock, R.C., Kahler, S.W., Jackson, B.V., Buffington, A., Hick, P.L., Simnett, G., Eyles, C., Webb, D.F., and Anderson, P., "The Solar Mass Ejection Imager (SMEI)"

Kinman, T., *Suntzeff, N., Kraft, R. "The Structure of the Galactic Halo Outside the Solar Circle as Traced by the Blue Horizontal Branch Stars"

Kraft, R.P., Sneden, C., Smith, G.H., Shetrone, M.E., Langer, G.E., *Pilachowski, C.A. "Proton Capture Chains in Globular Cluster Stars. II. Oxygen, Sodium, Magnesium, and Aluminum Abundances in M13 Giants Brighter Than the Horizontal Branch"

*Kuhn, J.R., Smith, H.A., Hawley, S.L., "Tidal Disruption and Tails from the Carina Dwarf Spheroidal Galaxy"

McNamara, B.R., *Jannuzi, B.T., Elston, R., Sarazin, C.L., Wise, M. "U-Band Polarimetry of the Radio- Aligned Optical Continuum in the Abell 1795 Cluster Central Galaxy"

*Neidig, D.F., Svestka, Z., Cliver, E.W., Airapetian, V., and Henry, T.W. "Observations of Faint, Outlying Loop Systems in Large Flares"

Olszewski, E., *Suntzeff, N., Mateo, M. "Old and Intermediate-Age Populations of Star Clusters and Field Stars in the Magellanic Clouds"

*Penn, M.J., Jones, H.P. "Limb Observations of He I 1083 nm"

Stenflo J.O., *Keller C.U., "The Second Solar Spectrum"

*Suntzeff, N. "Observations of Type Ia Supernovae"

*Walker, A. "CCD Photometry of Galactic Globular Clusters. III. IC 4499"

Wallace, L., *Livingston, W.C., and Hall, D.N. "Twenty-Five Year Record of Hydrogen Chloride in the Stratosphere"

Wallace, L., *Livingston, W.C., Hinkle, K., and Bernath, P.F. "Infrared Spectral Atlases of the Sun from NOAO"

Wells, L., *Suntzeff, N. "Reddening Correction and the Bolometric Light Curve of SN 1987B"

West, S.C., Nagel, R.H., Harvey, D., Brar, A., Phillips, B., Ray, J., Trebisky, T.J. Cromwell, R., Woolf, N.J., Corbally, C., Boyle, R., *Blanco, D., Otten, L. "Progress at the Vatican Advanced Technology Telescope"

Ann Barringer, John Cornett, Elaine Mac-Auliffe,
Jane Marsalla, Shirley Phipps, Cathy Van Atta

New Telescope Projects at CTIO

A number of projects are underway that will place a variety of new telescopes on Tololo and Pachon, covering a wide range of apertures and capabilities. Here is a quick survey of what's in the works now.

2MASS on Cerro Tololo

2MASS is a project to carry out an all-sky infrared survey with 2.0" pixels to 10 σ limiting magnitudes of J = 15.8, H = 15.1, and K = 14.3. The sole existing large area survey in the near infrared, the Two Micron Sky Survey, reaches only to 3rd magnitude, covers just over half the sky, and contains 5600 objects. With the 25,000 fold sensitivity improvement of 2MASS, it is expected to catalog 100 million point sources and hundreds of thousands of galaxies and other extended objects. Near term scientific objectives include the study of Galactic structure via IR luminous stars visible throughout the Galaxy, galaxies in the local universe (imaged at wavelengths that characterize their underlying mass distribution), and searches for rare objects such as brown dwarfs. Since the most exciting applications of the 2MASS database will probably be unforeseen ones, the Project has a strong commitment to making the completed Survey data available to the community without a lengthy proprietary period.

Two telescopes of 1.3-m aperture are being constructed to carry out the survey. One will be installed on Mount Hopkins, the other on Cerro Tololo. The project is being managed by a group at the University of Massachusetts, with the data product to be produced by the Infrared Processing and Analysis Center at CalTech. CTIO is acting as a contractor for construction on the Tololo site, and will play some contract role in operations as well.

On 14 May CTIO scientific, engineering and administrative staff members met with the UMass Project Manager to decide the most desirable site location for the southern 2MASS Telescope, explore practical construction solutions, and discuss the future operation of this telescope on CTIO. These meetings were later complemented with a visit to the designated telescope construction site. A month later, on 14 June, CTIO presented two proposals for the construction of the enclosure and the control room (designs prepared by CTIO and 3M Engineering.) UMASS opted for the CTIO version, which uses reinforced concrete for the enclosure and brickwork for the control room. We are currently working on the civil engineering design detail and statement of work concepts, and plan to commence the construction phase on the first of October.

SOAR 4-m Telescope

This is a project to build a 4-m alt-az optical/IR telescope with active primary and tip-tilt secondary on Cerro Pachon. It is a partnership between the University of North Carolina, Michigan State University, the nation of Brazil (through an internal collaboration of several funding agencies) and the NOAO. Partners will share time in proportion to their investment. The first full meeting of the partnership to finalize the conceptual design of the telescope, define the funding arrangements, and set up an initial project plan is due to be held in Chapel Hill, NC, in late August.

Gemini on Cerro Pachon

After months of work on the foundations, invisible to our scientific visitors, the concrete telescope pier has risen above the Pachon ridge as seen from Tololo, and the steel structure of the dome and building is surrounding it rapidly. A small telescope set up near the 0.9-m enables Tololo observers to watch the construction on a daily basis. Those not fortunate enough to be observing here may visit the Gemini Web site, http://www.gemini.edu/ to see images of the excellent progress of construction on Pachon.

Malcolm Smith (msmith@noao.edu)

Scientific Personnel Changes at CTIO

Ron Probst, from the IR group in Tucson, is just completing a sabbatical year with us at CTIO. He and his family have enjoyed their extended visit to Chile so much that they will be staying with us for another three years before transferring back to Tucson. This internal NOAO transfer mirrors the transfer of Jay Elias from CTIO to the USGPO earlier this year as Project Scientist for the Gemini IR spectrometer. Ron will initially have special responsibility for the transfer of the Cryogenic Optical Bench (with new 512 x 512 array and Wildfire controller) to Chile and its operation with the new f/14 tip-tilt secondary on the Blanco 4-m.

Richard Elston will be leaving us at the end of the year to join the new infrared group at the University of Florida. He has played a major role in driving several aspects of CTIO's instrumentation program as well as helping CTIO return to an international level in IR astronomy. He has also proved to be a stimulating research scientist. Partly as a result of Richard's imminent departure and the desire to prepare for an increase in the level of IR activity at CTIO over the next few years, we are advertising for two new tenure-track positions at CTIO (see following announcement).

Rene Mendez, a Chilean astronomer who obtained his PhD from Yale and is currently working as a postdoc at the European Southern Observatory in Garching, will be joining us for four years (beginning next March) as the first "CTIO/Chile Fellow." Rene's research interests are in the kinematical and dynamical description of stellar populations in the Galaxy, and how this constrains theories of Galactic formation.

Malcolm Smith, Mark Phillips (msmith@noao.edu, mphillips@noao.edu)

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Vacancies for IR Astronomers at CTIO

The following advertisement for two tenure-track positions at CTIO is being posted widely. Please do not hesitate to contact us or Revell Rayne if you are interested in this exciting opportunity and require further information. Please draw this notice to the attention of colleagues who may be interested.

Infrared Astronomers at CTIO

CTIO is seeking to hire two scientists to join the infrared group in Chile and help in the support of CTIO's IR instrumentation program. These are tenure-track positions, and will be filled at the rank of Assistant or Associate Astronomer (a suitably qualified candidate may be considered for appointment with tenure--subject to approval by the AURA board). The starting date for the positions is flexible, but would preferably be in late 1996 or early 1997.

As members of the CTIO scientific staff, the persons in these positions will each be expected to engage in a vigorous program of astronomical research using the CTIO facilities. An equal responsibility of these positions will be to collaborate with other scientific staff members in development and support of the CTIO infrared program; this is expected to include participation in development of plans for the new 4-m SOAR telescope, its active optics and its IR instruments and participation in instrument development in La Serena and Tucson. Alongside SOAR on Cerro Pachon will be the 8m Gemini South telescope; this telescope is currently under construction, with first light expected in 2000. It is expected that some instruments will be shared between Gemini and CTIO; the successful candidates will be expected to participate in the process of ensuring that this sharing is taken from a conceptual stage, to one of operational success. This will involve a high level of scientific leadership and productivity.

Candidates must have prior experience at least in the use and elementary maintenance of infrared instrumentation. In addition, it is desirable that candidates have at least two or more years' experience after receipt of their doctorate. For an appointment at the Associate Astronomer level, considerably more experience will be required, along with a clear ability and desire to provide scientific leadership and direction for the IR program at CTIO.

The instrument development activities of the Observatory are located at CTIO's headquarters in the coastal city of La Serena, Chile (pop. 120,000), while the existing telescopes are located on Cerro Tololo, 1hr 30min inland at 2200m altitude. Cerro Pachon is at 2700m, 30 minutes from Cerro Tololo. The new staff members will work primarily in La Serena with frequent visits to the mountain. The working language is English. Staff members have excellent benefits and living conditions, including US-style rental housing on the headquarters compound in La Serena, an overseas allowance, and annual travel to the point of origin.

By 15 October 1996, applicants should submit a vita, statement of current research and instrumentation interests plus letters from three professional references to:

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Revell Rayne, Human Resources Manager
National Optical Astronomy Observatories
PO Box 26732
Tucson, AZ 85726
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We are an equal opportunity/affirmative action employer.

Malcolm Smith (msmith@noao.edu)

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BTC Available for General Use at CTIO

The BTC (Big Throughput Camera), formerly known as LACCD, is a CCD mosaic imager built by Tony Tyson (Lucent Technologies) and Gary Bernstein (Michigan). The BTC system includes a dewar with four thinned SITe 2048 CCDs plus all readout electronics, and a Sparc 10 computer with fast disk and tape (DLT) storage. It was successfully used at the CTIO 4-m prime focus during May 1996, and is scheduled to be used again in December. In combination with the 4-m telescope, BTC is the highest- throughput mosaic imager anywhere, and the only one to use thinned, high QE CCDs. A single exposure covers 0.25 square degrees. Visit the WWW site to see some of the results from the May observing run: http://www.astro.lsa.umich.edu/btc/btc.html.

BTC will be available to visitors as a supported instrument for semesters I and II 1997, and possibly longer. It will be scheduled in two or three block runs per semester at the 4-m prime focus. We will continue to schedule the CTIO prime focus imager, which contains a single SITe 2048 CCD, for programs that do not need the large field or which require special filters. The information below should help you decide whether or not the BTC will be advantageous for your 4-m imaging program. Please contact the author if you have further questions.

The BTC mounts at the 4-m prime focus, behind the usual Atmospheric Dispersion Compensator (ADC), and it uses the standard PFCCD CCDTV guide camera. There is a four-position computer-controlled filter bolt holding 6-inch square filters, followed by a "near-focal-plane" shutter. The CCDs live in a large dewar behind lenses that correct for their curvature. Since the CCDs are mounted in standard packages, they are not butted together, and there is a cross shaped band approximately 16 mm wide between CCDs. Normal operation is to take many exposures in a shift-and-stare mode, to produce a large panoramic picture with no gaps. However, this is not essential. The pixel scale is 0.43"/pixel, and the ADC produces images better than 0.5" over the whole field. Work to minimize PSF variation (due to the non-flat CCDs) is on-going. The CCDs themselves have good (but not perfect) cosmetics, and eventually will be replaced by flatter devices, each with two working amplifiers.

There is only a limited selection of filters. BTC comes with 6 x 6 inch Bj, R and I (see ApJS, 99, 281, 1995). Anything significantly smaller will vignette. R and I are similar to the CTIO 4 x 4 R and I filters, although the BTC I filter has a long wavelength tail, which is not present in the CTIO I response. We will also provide UBV filters.

The data acquisition computer and electronics read the array (32 Mbytes per composite frame) to disk in approximately two minutes. There is a simple-to-use user interface, which may even be a GUI by 1997. Each mosaic image is written as four individual IRAF image files, one per CCD. Initial processing of the data (trimming, flat-fielding etc.) is straightforward, using the standard IRAF routines. Software for combining mosaic frames (distortion corrections, etc.) is still in its infancy, although some will be available by next year. In general, we believe that data handling issues are under control and do not severely affect observing efficiency. It IS recommended however, that there be two observers, one to concentrate on data acquisition and the second to handle image verification and processing.

The data storage system consists of 18 GB of disk storage and a DLT tape drive. Each DLT tape drive cartridge holds 15 GB uncompressed. For those without facilities to read DLT cartridges, it will be necessary to copy to exabytes or DATs. We will provide a DLT drive in La Serena, so that this copying can be done after an observing run. Observers should plan to spend 1-2 days in La Serena after their run, if much data copying is contemplated. Of course DLT tapes may be verified on the mountain, and we may have save-the-bits archiving backup for the BTC as well.

Alistair Walker (awalker@noao.edu)

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CTIO CCD News: Using STIS at the Schmidt

The STIS CCD (a front-illuminated Tek 2048) has been successfully used at the Schmidt telescope for more than a year. Recently it was reported that there was a long "hair-like" feature on the surface of the CCD. Investigation shows this to be a defect in the metachrome coating, which is used to give the CCD some UV sensitivity. The coating appears to have partially delaminated and the feature is interpreted as being the boundary between a stable area and one that has slightly shifted.

There are no focus changes across the defect and flat-fielding still works well. We are avoiding cycling the dewar temperature as much as possible, and there has not been any further deterioration in the coating. Removal and possible replacement of the coating is an option, but will only be done as a last resort as it is a risky procedure.

Another feature of this CCD is that there are a number of bright columns. These slowly leak charge in the serial direction. This leakage is not readily noticeable for most broad-band direct imaging programs, since it is swamped by the sky background. In situations where this is not the case, it is a good idea to take some dark frames with the same exposure as your object frames, since the behavior of the dark leakage current is nonlinear.

Full details of the STIS CCD, and procedures for observing with it at the Schmidt telescope, are discussed in the WWW manual written by Chris Smith (Michigan), found at:

http://www.astro.lsa.umich.edu:80/obs/schmidt/

This page is also accessible via the CTIO home page, http://www.ctio.noao.edu/ctio.html.

Alistair Walker (awalker@noao.edu)

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CTIO IR News: New Capabilities for 1997

There is currently a great deal of IR instrumentation activity at CTIO. The new f/14 tip-tilt secondary is nearly complete and should be installed in the 4-m by September. Following several months of optical polishing and testing in Tucson, the secondary mirror appears to be of excellent optical quality, well matched to the excellent figure of the Blanco telescope primary mirror. Our plan is to carry out the initial on-telescope optical testing of the f/14 secondary in September. The guider box and fast CCD TV camera for the tip-tilt system should be completed in October and initial tip-tilt testing with the Cryogenic Optical Bench will begin in late November. This will be followed by further tip-tilt engineering runs in December and January.

We plan to offer the tip-tilt system to visitors on a shared risk basis during the first semester of 1997. We expect the system to be working reasonably efficiently, although its performance will not be fully characterized and the user interface may not yet be as friendly as a typical NOAO facility instrument. Given that the system has yet to be tested and its actual performance is unknown, a conservative approach is warranted for science proposals. Prospective users should propose projects with bright guide stars ($V < 16.5$) within a 3' radius of the target object that will produce useful results with modest tip-tilt performance (i.e. 0.4" FWHM images). The experience we gain during the next semester will allow us to better quantify the performance of the tip-tilt system.

The NOAO Cryogenic Optical Bench (COB) is currently being fitted with a 512 x 512 ALADDIN array by the Instrumentation Project Group in Tucson. A mountain-based CTIO electronics technician is spending several weeks in

Tucson for familiarization with the instrument. With its new ALADDIN array, COB will provide 0.1" pixels and will become the primary infrared imager at CTIO for high spatial resolution work with the tip-tilt system. The COB will be tested with its new array on the KPNO 2.1-m telescope in late September and will be delivered to CTIO in October. It will have its first engineering runs at CTIO in November and December and its first visitor use in January. COB should be regularly available on the Blanco 4-m during the first semester of 1997.

The CTIO HgCdTe IR imager CIRIM will continue to be available for wide field imaging use on the 4-m (0.4" per pixel, 100" FOV at f/7.5) and on the 1.5-m at f/7.5 and f/13. The image quality in the corners of the f/7.5 field has recently been improved by using Hartmann test results and an optical design program to guide a careful realignment of the optics. The CIRIM user manual and CIRIM performance numbers are available both by anonymous ftp from CTIO and on the .

As reported in past Newsletters, we had planned to convert the CTIO Infrared Spectrometer (IRS) to accept the f/14 beam from the tip-tilt secondary and to add a more efficient pupil stop to improve rejection of stray background radiation. This was scheduled for October and November of 1996. But due to a shortage of engineering and mechanical shop resources we have been forced to postpone this upgrade until March and April of 1997. Thus, the IRS will be available in its current f/30 configuration for use at the Blanco 4-m telescope through February 1997. It will then be unavailable for use during March, April and May of 1997. The IRS will be available for visitor use in the f/14 configuration, with tip-tilt secondary, during June and July of 1997. Using the f/14 tip-tilt secondary should result in lower slit losses and a wider field for guide star acquisition. However, the internal f/ratio (after the slit) remains the same. So for proposal planning purposes the basic performance specifications (slit widths, resolutions, and throughput) will show little change. The IRS user manual and performance specifications are available both by anonymous ftp from CTIO and on the CTIO home page.

Finally, preparations are well underway for receipt and operation of COB, SQIID, and other large, complex IR instruments that may visit CTIO, such as Phoenix. This includes cabling and cryocooler installation, and construction of a modest clean room facility in La Serena to support future maintenance and upgrades on site.

Richard Elston, Brooke Gregory, Ron Probst (relston, bgregory , rprobst@noao.edu)

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More Ways to Pay for Your Stay

Through an arrangement with Merchant's Bank, which manages NOAO business in Tucson, CTIO is now able to offer our visitors the welcome choice of paying their bills for services with a Master Card or a Visa credit card, in addition to the current options for paying in cash (dollars or pesos), traveller's checks or personal checks. Charges will be handled in US currency, and will be processed in Tucson. We have sought to provide the means to maintain a reasonable degree of security in our transactions for the protection of our users.

Hernan Bustos (hbustos@noao.edu)

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Spending Extra Nights on Tololo

One of the more visible consequences of the CTIO's ever-shrinking budget has been the personnel reductions (17%) in the Telescope Operations division that have occurred over the past three years. This inevitably has led to increased pressure on the remaining staff, particularly on the Observer Support personnel, who are the ones who interface directly with visiting astronomers to insure that their observing programs are carried out successfully. We have adopted several measures to try to lessen this problem, for example a return to relatively strict block scheduling on the

1.5-m telescope (NOAO Newsletter No. 43, page 29).

At the request of the Observer Support staff, we are also trying to control more closely the number of nights that astronomers spend on the mountain. For several years we have included the following phrase in the material that the visiting astronomers are sent when they receive telescope time at CTIO:

"Observers are expected to arrive on the mountain on the day their run begins, and should return to La Serena the day immediately following the night of their run. Exceptions to this rule must be authorized by the CTIO Director's office (emacauliffe@noao.edu)."

We have found that many visiting astronomers seem unaware of this policy, and arrive a day or more early on the mountain or expect to be able to stay on the mountain the night after their run has ended. On the face of it, this wouldn't seem like such a big deal, especially since we now charge visiting astronomers (except thesis students) for room and board while on the mountain. However, our Observer Support staff tells us that the simple presence of telescope-less astronomers on the mountain can often translate into extra work. For example, most astronomers want access to a workstation to read their e- mail, prepare for their run, work on a paper, etc. While public workstations are available in La Serena, none are currently available on the mountain (due to budget problems!). Hence, visiting astronomers end up requesting to use workstations associated with the telescopes, or ones that are assigned to Observer Support. Even when such requests can be facilitated, the visiting astronomers often need assistance from Observer Support personnel.

We therefore request that future observers restrict their stay on Tololo to the minimum number of nights necessary. If you have a legitimate reason for wanting to go to the mountain a night early (e.g., to observe how to operate a complicated instrument, or to acclimate to the altitude if this causes you problems, or if you are observing in the winter and are concerned that you won't have time to prepare for your first night), we are likely to approve the request. However, you should be aware that we cannot offer you a workstation to use, and that the Observer Support personnel probably won't have time to answer any questions you might have. Regarding staying a night after your run ends, we unfortunately must request that all observers leave the mountain the day after their last night on the telescope. Also, if you are scheduled for two observing runs separated by more than one night, we ask that you go down to La Serena for the time between the two runs. Thank you very much for your cooperation and understanding.

Mark Phillips (mphillips@noao.edu)

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CTIO Telescope/Instrument Combinations*

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4-m Telescope:
        ARGUS Fiber-Fed Spectrograph + Blue Air Schmidt Camera+Loral 3K [40,41,42,45 ]
        ARGUS Echelle FF. Spect.     + Blue Air Schmidt Camera+Loral 3K [40,41,42,45 ] R-C
        Spectrograph                 + Blue Air Schmidt Camera+Loral 3K[40,41,42 ]
        Echelle Spectrograph         + Blue Air Schmidt Camera+Loral 3K[40,41,42 ]
                "                    + Folded Schmidt+Tek 1K CCD [22,23,25,26 ]
                "                    + Long Cameras+Tek 2K CCD [23,25,26,39,45 ]
        Prime Focus Camera           + Tek 2K CCD [36,39 ]
                "                    + Photographic Plates [23,38,41 ] (User must supply plates)
        Cass Direct                  + Tek 2K CCD [39]
        Rutgers Imaging Fabry-Perot  + Tek 1K CCD [25,26,42 ]
        Cryogenic Optical Bench      + 512^2 InSb [45]
        CTIO IR Imager               + 256^2 HgCdTe [40,41 ]
        CTIO IR Spectrometer         + 256^2 InSb [37,39,41,45 ]

ESO 3.6-m (12 nights/semester available): [45] ADONIS [45]
                                               TIMMI [45]
                                               EFOSC1 [45]

1.5-m Telescope: Cass Spectrograph               + Loral 1200x800 CCD [43][45]
                 Bench-Mounted Echelle Spectrograph   + BME Camera+Tek 2K CCD [22,23,39,42 ]
                 Cass Direct                     + Tek 1K CCD, Tek 2K CCD [39]
                 Rutgers Imaging Fabry-Perot     + Tek 1K CCD [25,26,42 ]
                 ASCAP Photometer [24,25,28,43 ]
                 CTIO IR Imager                  + 256^2 HgCdTe [40,41]

1-m Telescope:  Closed [46]
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0.9-m Telescope: Cass Direct     + Tek 2K CCD [39]
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Curtis Schmidt: STIS 2K CCD (Direct or Prism)[42]
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* Numbers in boldface following an instrument indicate the most recent Newsletter(s) containing relevant articles. If there is no number, the 1990 edition of the Facilities Manual is fully up to date. The most recent general summary of CCD characteristics is in 45; see also 33, 26 and 28. Information on telescope control guiders is in 21, 22, 24, 32.

Mark Phillips (mphillips@noao.edu)

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Requests for CTIO Telescope Time- August 1996-January 1997

Telescope		Nights Req.	Nights Sched.	Requested/ Scheduled	Visitor Nights	%Visitor Nights	Staff Nights	%Staff Nights	Eng.& Maint.
4-m	Dark	270	66	4.1	58	87	8	12	26
	Bright	201	59	3.4	46	77	13	22	31
1.5-m	Dark	128	89	1.4	74	83	15	16	3
	Bright	142	68	2.1	57	83	11	16	18
1-m	Dark	101	90	1.1	90	100	--	--	--
	Bright	184	59	3.1	59	100	--	--	--
0.9-m	Dark	156	122	1.3	109	89	13	11	--
	Bright	65	59	1.1	58	98	1	2	15
Schmidt		156	122	1.3	109	89	13	11	
ESO 3.6-m		9	8	1.1	5	63	3	38	--

Ximena Herreros (xherreros@noao.edu)

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Instrument and Telescope Availability at Kitt Peak

The deadline for observing proposals for the spring semester (1 February-31 July) is 30 September. A summary of the key changes in instrument and telescope availability follows. Details concerning performance of, and how to apply for, specific instruments can be found elsewhere in the Kitt Peak section of the Newsletter.

New Instruments

CCD Mosaic Imager: We are beginning the commissioning of an 8K x 8K mosaic of CCDs for optical imaging at the prime focus of the 4-m telescope and at the 0.9-m telescope. We want to make this instrument available to the community as soon as possible, but many steps remain before it is usable for science. In a later article in this Newsletter, we summarize the status and general capabilities of the instrument and describe how to apply for it. The goal of the procedure is to make this powerful new instrument available during the spring semester if at all possible, while minimizing the work required to submit an application, since we cannot guarantee that the imager will be usable by then. Updates on the CCD Mosaic performance and availability will be posted to the Mosaic Web page at http://www.noao.edu/kpno/mosaic/mosaic.html.

Phoenix High Resolution IR Spectrometer: Phoenix will be offered at the 2.1-m telescope during the spring semester. Since the instrument has just recently achieved first light, many questions remain to be answered about its performance characteristics, the software still must be made user friendly, and the degree of reliability is undetermined. Potential users should submit proposals for shared risk observing to the TAC following the standard procedure. Updates on performance characteristics as we obtain them during the fall semester will be posted on the Phoenix Web page, which can be accessed from the KPNO page.

OSU IR Imager/Spectrometer: With the shipment of COB to CTIO, KPNO no longer has a state-of-the- art near-infrared imager available. We are in the process of concluding arrangements to borrow an imager/spectrometer from Ohio State University and the MDM Observatory; this imager will be equipped with one of the new Aladdin arrays under development at NOAO. The instrument will be offered for shared-risk observing at the 2.1-m or 4-m telescope during at least two bright runs each semester.

Optical Imaging and Spectroscopy

Optical imaging is offered at five of the KPNO telescopes (the Mayall, WIYN, 2.1-m, 0.9-m, and Burrell Schmidt). Similarly, we offer a variety of spectroscopic options at various telescopes. To make it easier to determine which setup is right for a specific program, we have summarized the capabilities on the world-wide web. These summaries can be accessed through the KPNO Web page or reached directly at http://www.noao.edu/kpno/instruments.html.

Operational Simplifications

We have identified a number of simplifications in operations that will help to lower costs with what we believe will be minimal impact on the user community. First, we would like to minimize configuration changes, that is changes in instrument setups that normally require support from downtown, during observing runs. Observers requesting such changes during observing runs should flag their requirements in the observing proposal and should be prepared to do much of the work themselves; we will provide the necessary training, but observers must allow time for that training when planning for their arrival on the mountain. Support staff will work out schedules with observers.

0.9-m Secondary: People wishing to use the f/13.5 secondary at the 0.9-m telescope should offer strong justification for why it, rather than the f/7.5 secondary, is required. The f/13.5 configuration has limited application and produces somewhat poorer images than the f/7.5 secondary. Thus, we strongly encourage observers to use the f/7.5 secondary except in cases where the improved scale is crucial to the proposed observations. If you feel that you need the f/13.5 secondary, please make your case in the technical section of your telescope proposal.

Cutoff of observing applications: The TAC will be asked to indicate for each telescope those proposals that do not merit support even if observing time is available. Any open time will be left unscheduled, except for targets of opportunity (a supernova of magnitude -5 or events of comparable significance) or other time critical observations that could not have been planned in advance. We have in the past solicited applications for time that was left unscheduled by the TAC, but such applications do not receive the careful scientific scrutiny provided by the allocation committee; supporting these last minute programs involves more effort than is required for observing runs scheduled through the normal TAC process.

Telescope Availability

All of the telescopes now operated at KPNO (the 4-m, WIYN, 2.1-m, CoudÃ© Feed, 0.9-m, and Burrell Schmidt) will remain in service during the spring semester unless the budget for NOAO is reduced below the level that currently appears likely. It remains the case that we do not have sufficient funds to support the steady state operation of these six telescopes, where steady-state includes not only day-to-day operations but also improvements, major repairs and upgrades, and new instruments. However, closing these telescopes at the present time would eliminate certain scientific capabilities--high resolution spectroscopy at the Feed, wide-field imaging at the 0.9-m, and objective prism spectroscopy at the Burrell Schmidt. We will do everything we can to avoid closing these telescopes until the same capability is offered elsewhere.

We believe that when the mosaic CCD imager becomes available, it will offer better capabilities for wide-field imaging than does the Burrell Schmidt. We suggest that new and ongoing imaging programs at the Schmidt should be designed so that the observations can be obtained at the 4-m or the 0.9-m in subsequent semesters, or else the proposals should justify why the program requires the Schmidt and define how long it will take to complete the program. We are continuing to assess what to do with programs that make use of the objective prisms at the Schmidt since that capability is unavailable elsewhere.

Instruments to be Phased Out

We have identified a few instruments that we believe can be phased out either because equivalent or better capability is offered elsewhere at KPNO or because the level of use is incommensurate with the required support effort.

NICMASS: Phoenix offers spectral coverage and performance that is substantially better than that provided by NICMASS. In the spring semester, we will restrict the use of NICMASS to continuing programs for which uniformity of the data set is critical. We encourage users of NICMASS to request enough time to complete such ongoing programs as soon as possible.

CCDPhot at 0.9-m: The demand for CCDPhot is low, and our limited resources are not adequate to maintain operation at the level necessary to provide first-rate data. On-going programs will be supported, but no new programs will be accepted beyond the Spring of 1997. Applications for CCDPhot for the spring semester should indicate what observations will be required to complete the proposed program. There will be several meetings this fall as part of an AURA effort to understand how to maintain access to small telescopes in the northern hemisphere. We will explore the feasibility of making CCDPhot available elsewhere. People interested in having access to this capability should describe the scientific programs they would like to pursue in an e-mail to swolff@noao.edu so that we can be sure to present the case for CCDPhot at the upcoming meetings.

Goddard Fabry-Perot: The Goddard Fabry-Perot has been available as a shared-risk user instrument through special arrangement with Goddard scientists, who have provided the necessary support. Because of funding and personnel changes, this support is no longer available. People who wish to use the Goddard Fabry-Perot should contact Bruce Woodgate or his Goddard colleagues directly to determine whether a collaborative program is feasible.

Sidney Wolff

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Long-Term Observing Prospects

After the Web postings of this spring, you may wonder why you should even bother to apply for observing time. How can you be sure you can finish a program before a telescope is closed? And if you cannot finish a program, why should you even bother to start it?

I wish I could guarantee that all telescopes will remain available as long as there are high quality programs proposed for them. Unfortunately, I cannot. The basic decision is for the NSF to make, and it appears unlikely that the NSF will continue to support a program of the current scope. And I do not see that the quality of the science program has been much of a factor in the decision-making process; budgets are simply so tight that scientific productivity is but one--and perhaps a minor--factor in the priority- setting process.

Even in the absence of budget problems, it would still be necessary to confront the issue that the telescopes and instruments that are available to the community through NOAO are changing rapidly, and these rapid changes must be managed properly if scientific programs are to be completed successfully. We expect to provide a significant new instrument every 12-18 months at either CTIO or KPNO; Gemini will commission new instruments at the rate of about one per year; and there will be at least five facility class instruments available at the converted MMT and the Hobby-Eberly telescope. It will be a challenge to make this powerful new suite of capabilities truly accessible to the community and to ensure that the instruments are documented well enough that the time is used as efficiently as possible. We plan to pay closer attention to providing the types of information that will be required to determine what instrument/telescope combination is optimum for a particular program and to helping observers use the instruments effectively.

A second type of rapid change is a consequence of the fact that NOAO is now building instruments that can be used at multiple sites. There is a strong scientific case, for example, for using Phoenix at KPNO, Gemini North, CTIO, and Gemini South. And there will be only one Phoenix. How long should it remain in residence at each site? And how do we schedule time on Phoenix to make sure that programs can be completed before it moves on? Another example is COB (the Cryogenic Optical Bench), which was used for conventional imaging at KPNO for about a year, then converted for the DLIRIM (diffraction-limited infrared imaging) experiment, which lasted for two semesters, and is scheduled to be transferred to CTIO in the fall. These short time scales are inconsistent with the completion of most observing programs if we continue to schedule in the way that we have in the past.

What I can say is that NOAO is committed to supporting scientific programs. To me, this means that once a program has been initiated, we will do whatever we can, consistent with peer review recommendations, to see to it that the program can be completed--as we already do with thesis research. It means that we will try to avoid closing telescopes that provide unique capabilities; if the number of operating telescopes must be reduced for budgetary reasons, as appears likely, then we will try to transfer unique capabilities to the remaining telescopes. Before closing a telescope or taking an instrument out of service, we will ask those who have been using those telescopes and instruments to define what is required to complete their ongoing programs, and we will try to schedule enough observing time to obtain the specified data. We will try to signal at least a year (two observing semesters) in advance how long we expect an instrument to be in residence at a given site, just as the VLA announces its configurations in advance, so that people can plan programs that are feasible in the time available. One advantage of migrating instruments is that once an observer is familiar with that instrument, he or she can use it, with no additional learning curve, in both hemispheres and, in the case of most of our new instruments, on the Gemini as well as the NOAO telescopes. We will also consult with the Users' Committee concerning our plans for moving instruments from site to site.

In short, the quality, diversity, complexity, and throughput of the observing capabilities that will be available through the national observatories will increase sharply during the next five years. In the tradition of the half-empty/half-full glass, it is time to look forward to what we will be able to do rather than backward at what we can no longer do.

Sidney Wolff

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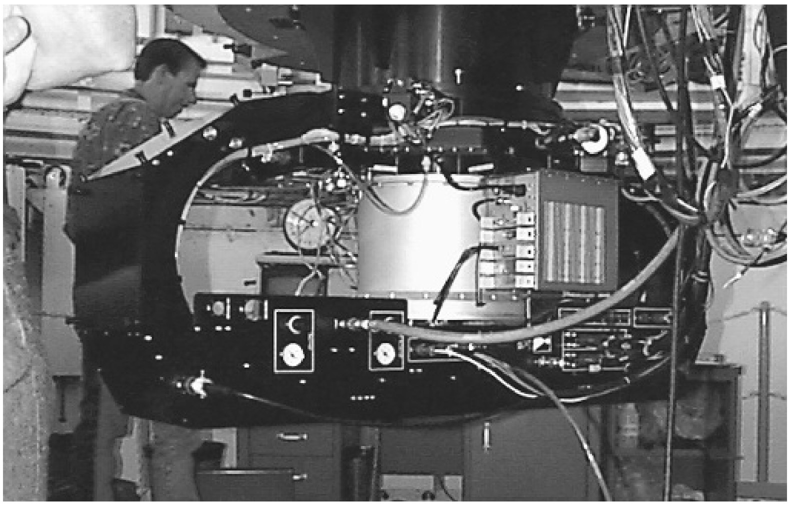
CCD Mosaic Imager Status

Since the last Newsletter, the CCD Mosaic Imager has been tested twice at the 0.9-m telescope. Because we are still developing the controllers and the associated software, only half of the full array of eight 2K x 4K CCDs was read out during these runs. Nevertheless, we were able to complete numerous on- telescope tests, and we summarize the principal accomplishments of the 0.9-m tests and subsequent work below.



Caption: The CCD Mosaic Imager and its corrector, mounted on the 0.9-m telescope for the June engineering run.

1. The new 0.9-m corrector for the Mosaic is performing as expected over the field that we could image (half the detector), including the TV guide fields at the edge of the CCD Mosaic. We saw no evidence for a tilt across the large field.
2. The dual TV guide systems work extremely well, seeing down to about 17th magnitude in nearly full moon. Each TV views about 5.3' x 4.9' on the sky at the 0.9-m and the image quality is more than adequate to achieve excellent guiding.
3. The 14 position filter track worked flawlessly and repositioned as required to minimize "dust donut" residuals.
4. We have constructed a temporary R-band filter (5.8 inches square) in-house and we should have a commercially purchased set of BVR filters by the time you read this. We tested filter inserts that allow use of our 4 inch square filters, although these illuminate only 6K x 6K of the Mosaic at the 0.9-m (and probably 5K x 5K at the 4-m).
5. During the first run, the large focal plane shutter exhibited an offset of 0.07s from the commanded time. This was traced to a pinched air line (the shutter is pneumatically powered). The defective line has been replaced and modified to avoid another occurrence, but we have not had another on-telescope opportunity to verify that the problem was eliminated. Lab tests, though, show the timing errors to be negligible now.
6. Software control and interaction between the data acquisition system and the telescope has been verified. That is, filters, focus, and short telescope offsets can be commanded from the acquisition computer, and proper telescope information is being collected for use in the CCD headers.
7. Dewar hold time is acceptable at 17 hours.

In addition, work has progressed on the new 4-m corrector and its atmospheric dispersion compensator. The four large fused silica elements of the corrector have been fabricated in-house and multi-layer coated by Continental Optical. The coatings have been verified to perform very well across the entire optical band. From below 3500 Ã… to longward of 9500 Ã… , the combined losses on all four elements (eight surfaces) is never worse than 8%, and is typically about 6%. By comparison, a single-layer magnesium fluoride coating optimized for 5000 Ã… (a good compromise wavelength) would suffer losses of 15-20% over this range. Uncoated optics would approach 25% losses.

The 4-m Atmospheric Dispersion Compensator is expected to yield similar performance over its four surfaces (that is, an additional 3-4% loss). Fabrication of these elements and their coatings should be completed by the time you read this.

To assist prospective proposers in writing observing proposals, we present below the expected performance characteristics of the CCD Mosaic Imager. The Mosaic can be mounted at either the 4-m prime focus or the 0.9-m f/7.5 Cassegrain focus. Pixel scales and fields of view are compared with the current CCDs in use at the two foci:

	4-m PF		0.9-m f/7.5	
	Mosaic	T2KB	Mosaic	T2KA
Pixel scale (arcsec/pixel)	0.26	0.47	0.43	0.68
Field of View (arcmin on edge)	36	16	59	23

The format of the Mosaic is 8192 x 8192 with 15 μm pixels. It is constructed of eight separate CCDs, each 2048 x 4096. Gaps between CCDs are less than 1 mm (67 pixels). Multiple shifted exposures will be required to fill these in.

The filter track holds 14 filters, each 5.8 inches square. By next spring we expect to have standard B, V, R, and I broad-band filters and two narrow-band filters, probably Ha and redshifted Hα, each with a 70 Ã… bandpass. We have not yet finalized parameters for the two narrow-band filters. Filters will all be 12 mm thick to preserve the focus. TV guide fields are located north and south of the science field and are viewed through separate broad-band filters.

Each CCD is read out through a single amplifier. All the data streams are multiplexed back to the control computer where they are assembled into a single image. The entire mosaic can be read out in approximately 100 s. On-chip binning of pixels is supported; this will speed up readout accordingly.

Although the CCDs have not yet been fully characterized, we expect that the typical read noise will be about 8 ϵ^-. However, several of the CCDs show peculiar charge injection problems that raise the effective noise over parts of the chip to levels as high as 30 ϵ^-. In addition, small areas (< 15%) of two of the chips are compromised by significant traps. There are several bright or dark columns on each CCD; we expect that normal data processing will eliminate the effects of these. Because of a processing error in the CCD fabrication that results in poor charge transfer efficiency when the chips are very cold, they are operated at the unusually high temperature of -60C. This results in a dark signal of around 100-150 ϵ^- pixel^{-1} hour^{-1}.

The chips are thick and front-illuminated. They are not coated with any kind of fluorescent coating, so the quantum efficiency should be typical of front-illuminated devices, peaking at 50% at about 7000 Ã… and falling to less than 10% below 4500 Ã… and above 9000 Ã…. We have not yet measured system throughputs; users might expect the count rates at V, R, and I to be half of those measured with the thinned Tek chips typically used at these two telescopes, and significantly worse than that in the blue. Consequently, the current system is not recommended for use below 4500 . Although these CCDs will be in use during the spring 1997 semester, NOAO is working to replace these devices with thinned science-grade CCDs.

At both the 4-m and 0.9-m, new correctors have been designed and constructed to support the field of view and image quality requirements of the Mosaic imager, as mentioned above. The new 4-m corrector includes an atmospheric dispersion compensator, and it will be used with all CCD imaging at that focus. The 0.9-m corrector will be used with only the Mosaic, as it is incompatible with the gold guider. Image quality is expected to be excellent with both systems.

We will offer the Mosaic to users as soon as the system has been tested and characterized. At this writing, there are sufficient uncertainties in the Mosaic progress, that we cannot guarantee that we will offer the instrument during the spring 1997 semester. The primary subsystems undergoing major work are: the CCD controllers, CCD optimization, the 4-m corrector and its atmospheric dispersion corrector, and the user software. At this point, it seems unlikely that the Mosaic will be ready for users by February 1997, but use in May or June appears plausible. Check our Mosaic Web page at http://www.noao.edu/kpno/mosaic/mosaic.html for recent updates and revised status reports.

We have come up with the following plan for users interested in using the Mosaic during the spring semester. We divide potential Mosaic users into two classes: those whose science can be done with the current CCDs at the 4-m and 0.9-m, but who would achieve further benefit from use of the Mosaic; and those who would not be able to achieve their science goals without Mosaic. Proposers should consider both the areal and sampling advantages provided by Mosaic, in contrast to the lower quantum efficiency (particularly in the blue), poorer cosmetics, and higher readout noise and dark current of the Mosaic CCDs compared to the T2KA and T2KB CCDs. Users can refer to the expected Mosaic performance given above; any of the undersigned are available for phone or e-mail consultation. With the current Mosaic CCDs, it is likely that only projects requiring large areal coverage and not using blue filters will benefit from using Mosaic instead of T2KA/B.

For the first group of proposers, those able to do their science with T2KA at the 0.9-m or T2KB at the 4- m but desiring an "upgrade" to Mosaic, the standard proposal form should be filled out. For instrument, specify T2KA or T2KB followed by "(Mosaic if available)." It would be beneficial to include some discussion in the technical justification section of the proposal on how the Mosaic would help achieve the project's goals. We will block together the runs that would benefit from Mosaic. The schedule will show T2KA or T2KB for these runs. If it becomes evident before a scheduled block that Mosaic can be used, we will contact the users and convert the block to Mosaic on the schedule.

For the second group of proposers, those wanting time only if Mosaic is available, we will use a methodology similar to that being employed for the Phoenix IR spectrograph. To save the effort of writing a full proposal before it is known whether Mosaic will be available, we request simply an expression of interest by the proposal deadline of 30 September. This will be done by e-mail to *kpno@noao.edu*. The subject line should read " *Mosaic expression of* *interest*." The message should include the name(s) and e-mail address(es) of the investigators, a brief program title, the telescope (4-m and/or 0.9-m), the desired number of nights, and the desired lunar phase. Based on these expressions of interest, we will set aside a number of nights on the 4-m and 0.9-m late in the spring semester. Later, we will request more detailed proposals from those who have expressed interest. The timing of the proposal request will be determined by progress on Mosaic commissioning coupled with a desire to give proposers adequate notice. The proposals will then be reviewed and the nights assigned.

We trust that users will agree that the capabilities of Mosaic are sufficiently interesting to justify this extra effort in the proposal process, in order to make the instrument available for science observing as soon as possible.

Taft Armandroff, Todd Boroson, George Jacoby, Rich Reed (for the Mosaic Team)

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Direct CCD Imaging Options at KPNO

A new Web page has been set up to help proposers select the best telescope for their CCD imaging needs. The page provides a table summarizing the characteristics of the five imaging sites, and will be updated as capabilities change at KPNO (for example, when the CCD Mosaic Imager becomes generally available). The summary table is reproduced below and is available at http://www.noao.edu/kpno/imaging/imaging.html.

We also have included a link to a prototype form-based assistant to help you select a telescope for your particular observing situation. Enter the parameters of your observing proposal (e.g., limiting magnitude, field of view) and a telescope recommendation will be posted for you. Note that the telescope best suited for your application isn't always the best choice to propose for. For less challenging problems, a smaller telescope with a lower subscription rate may be the wiser choice and the form considers this aspect of proposing in its recommendation.

Telescope + CCD	Field (arcmin)	Scale "/pix	Limiting Magnitude U	B	V	R	I	Seeing
4-m +T2KB f/2.7	16.0 x 16.0	0.470	24.9	26.1	25.8	25.4	24.6	1.1
WIYN +S2KB f/6.5	6.7 x 6.7	0.197	24.9	26.2	25.9	25.5	24.7	0.8
2.1-m +T1KA f/7.5	5.2 x 5.2	0.305	23.8	25.1	25.0	24.7	23.8	1.1
0.9-m +T2KA f/7.5	23.2 x 23.2	0.680	22.7	24.1	23.8	23.4	22.6	1.4
0.9-m +T2KA f/13.5	13.1 x 13.1	0.384	22.7	24.1	23.8	23.4	22.6	1.4
Schmidt +S2KA f/3.5	69.0 x 69.0	2.028	21.6	22.3	22.3	22.0	21.5	2.2

Note: Limiting magnitude is defined as the magnitude for which S/N = 10 is achieved in 1 hour under dark sky (new moon) conditions, and for typical seeing (FWHM) as given in the last column. Under different conditions, estimates can be calculated using the IRAF routine CCDTIME.

George Jacoby, Phil Massey

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New CCD A-to-D Converters: More Dynamic Range and Faster Readout

The Kitt Peak CCD controllers have had 15-bit A-to-D converters for many years, yielding digital saturation at 32,767. This digital saturation requires some compromises between using all of the linearity range of the CCD and the sampling of the readout noise. For example, with T2KB, 0.1% linearity deviations occur around 220,000 e^-, and the readout noise is 4 e^-. Currently, if one wanted to use as much of the linearity range as possible, one would select a gain of 5.4 e^-/ADU (gain index 3). However, this samples the readout noise poorly. Consequently, if readout noise was a key concern, one would choose a finer gain, but use less of the CCD's linearity range. Compromises of this sort are common. With a higher digitization limit, one would be able to achieve a better compromise, yielding a larger dynamic range with a better sampling of the readout noise.

This summer, we are installing new 16-bit A-to-D converters in all the Kitt Peak CCD controllers. (This does not include the controllers at WIYN, which are based on the ArCon technology and already use 16- bit A-to-Ds.) This conversion will be complete by the start of the fall semester. The 16-bit A-to-Ds double the digitization limit, allowing either twice the linearity range in electrons at constant sampling or two times better sampling at constant range. Users should consider the effects of the new digitization limit in selecting the best gain for their program. An added benefit, from the faster speed of the new converters, will be faster CCD readout. We conservatively estimate that 16 seconds will be trimmed from every 2048 x 2048 readout. From analysis of the Save the Bits archive, one of us estimates that the faster readout time will save 10 days per year of readout time!

In a previous Newsletter article, we described the effects of saturated stars on the CCD electronics and the resulting data. This overshooting phenomenon yields low-level trails to the right of saturated stars (see NOAO Newsletter No. 44, p. 33). Consequently, the video circuitry in the CCD electronics was adjusted to minimize the effects of overshooting for each of our direct imaging CCDs for a particular gain value (i.e., number of electrons/ADU). This optimal gain value for each CCD (the ICE default), was chosen based on the digitization limit of 32,767, the linearity limit of the CCD, and the readout noise. Since we are changing the limit, it makes sense to modify our overshooting-optimized gain values. The table lists the new optimal gains for each CCD used for direct imaging.

CCD	Optimized Gain (electron/ADU)	electrons @65KADU	0.1%linearity (electrons)	1%linearity (electrons)
S2KA	2.5	162,500	145,000	160,000
T2KA	3.2	208,000	180,000	190,000
T2KB	3.2	208,000	220,000	250,000
T1KA	2.7	175,500	250,000	250,000

We recommend that all users concerned with the effects of saturated stars on their imaging data use the optimal gains (which minimize the effects of overshooting; the overshooting will be significantly worse for other gain values). The ICE software has been updated to reflect these newly optimized gains. The default gains in ICE for these CCDs are the optimized gains. After an *obsinit*, even if one does not edit the "detpars" parameter set, one will by default be using the optimized gain.

We are updating the Direct Imaging Manual and the ICE manual to reflect the changes described above. Finally, we note that there is some effect on IRAF taping since the data are now 16-bit unsigned integers. If one simply uses the default *wfits* parameters, one will be safe.

Taft Armandroff, Rich Reed, Rob Seaman, Phil Massey

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Revised Integration Times for CoudÃ© Feed--It's Better Than We Thought!

Recent measurements of signal-to-noise values on some coudÃ© spectra have shown some of the integration times in the coudÃ© spectrograph manual to be very conservative. For example, the manual lists 300s to achieve a S/N ratio of 100 for V = 6 using grating A in second order. At V = 10, this would imply an exposure of 12,000s for the same S/N. However, recent spectra indicate an integration time of about 1500s to reach a S/N of 100 at V = 10. We are updating the on-line manual as we acquire data for different camera and grating combinations. The undersigned may be contacted for more information on a particular combination. We urge users to send us their estimates for integration times taken under good conditions.

Daryl Willmarth, Sam Barden

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Summer Shutdown Activities on Kitt Peak

As tradition has it, monsoons in Arizona run from the Fourth of July to Labor Day. While the weather only roughly keeps to the calendar, the KPNO Telescope Schedule marks this time as Summer Shutdown. This is when we close the domes for large scale engineering and maintenance work that cannot be done while we are in nightly operation. Major improvement projects and important maintenance work are outlined below.

Mayall 4-m: Almost all our effort this summer is focused at the 4-m, where we are aluminizing the primary mirror, refurbishing the primary support mechanism and installing a new prime focus mechanism (aka pedestal) for the Mosaic CCD Imager (described elsewhere in this Newsletter). We plan to open shortly after Labor Day for Cassegrain instruments only. Mosaic will be installed and tested during bright time in September. Prime focus will be available in early October, although PF CCD is not scheduled until dark time in November.

2.1-m: A few nagging maintenance headaches will be resolved, specifically to stop the dome from occasionally running away and to repair the cables for the ICCD camera.

CoudÃ© Feed: Beyond the usual "summer cleaning" of the coudÃ© room, the high dispersion setup with camera 6 and the echelle-grism will be re-aligned to achieve uniformly good focus over the field of F3KB CCD.

0.9-m: More lingering nagging maintenance items will be resolved: repair the pulse mixer, refurbish the console cards, repair the high voltage cable, remount the CCD temperature readout, etc. Most of these are of an ongoing nature of dealing with the decades-old Telescope Control System and are intended to restore reliability to this telescope which is operated by observers, who are often frustrated by these niggling little problems.

CCD Dewars: All dewars will be sent to town to be cleaned and evacuated. The CCDs will be flooded to improve ultraviolet sensitivity and the overall quantum efficiency will be evaluated. The analog-to-digital converters will be upgraded to 16 bits (described elsewhere in this Newsletter) and default detector gains will be set to optimize performance over a given range of astronomical requirements.

Guiders: All guiders and filter wheels will be stripped, cleaned, lubricated, and adjusted. This is the time when we track down those frustrating problems that never get enough time to solve during the observing season.

Computers: The operating systems on the Sun computers used for data acquisition and reduction will be brought up to the latest release. IRAF will be updated to v2.10.4 (patch 2) and microcode appropriate to the 16-bit ADCs will be installed in ICE for the CCD controllers.

Bruce Bohannan (for the many in Kitt Peak Operations who do the work)

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Electronic Proposal Submission

As usual, we are encouraging all observing proposals for the upcoming semester to be submitted electronically, although we are not actually requiring this. Last semester nearly all of our proposals arrived via e-mail, and most users seemed to find this fun and convenient. On this end, we've encountered few problems, with the largest time-waster being fixing the handful of proposals that were apparently never run through LaTeX and printed at the user's end. (We do not guarantee to do this in the future, so make sure the proposal looks the way you want the TAC to see it before submitting it!)

We've made a few changes to the form this time around to facilitate the automatic transferring of data from the electronic versions into the database used for the TAC and scheduling process. It would thus help us if you use the most recent copy of the form.

To submit an observing proposal here's what you do:

1. Obtain the proposal package by e-mailing *kpnoprop-request@noao.edu*. You will have to fill out the LaTeX proposal template. Alternatively, these forms are available via anonymous ftp to ftp.noao.edu in the subdirectory kpno/kpnoforms. You can similarly obtain the files via the World Wide Web. (The NOAO home page is http://www.noao.edu/).

2. Fill out the LaTeX proposal template with a scientifically exciting, well-reasoned, and clear program. Include whatever figures are needed to make your case in the form of Encapsulated PostScript files. (See the example provided with the package.)

3. If you are applying for WIYN time you will also need to fill out the queue-observing form that specifies all the parameters necessary to carry out the observations (analogous to HST's Phase II proposal).

4. Submit the observing form to *kpnoprop-submit@noao.edu*. You should immediately receive an acknowledgement message telling you what your proposal ID is. (If you don't, send e-mail to *kpnoprop-help@noao.edu* or give Judy Prosser a call at (520)318-8279.) Included will be instructions for submitting the figures and queue observing form.

5. Submit the figures and/or WIYN queue form following the instructions received in the acknowledgement. You should also receive acknowledgements for each of these.

6. In the case of thesis students, the advisor should send the "thesis letter" via e-mail (also to *kpnoprop-submit@noao.edu*) explaining how the present proposal fits into the overall scheme of the thesis, what other observing time might be required, and so on. It would help if the proposal number given in the acknowledgement message above were mentioned.

Electronic submission of proposals has made our lives easier as well as making it easier for observers to submit their requests--we encourage everyone to submit their proposals this way. Questions or suggestions for improving the process can be directed to kpnoprop-help@noao.edu or the undersigned.

Phil Massey, Jeannette Barnes, David Bell, Pat Patterson, Judy Prosser

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Applying for NOAO WIYN Observing Program: Reminders

Since the spring 1995 semester, the NOAO WIYN Observing Program has been scheduling proposals in two modes: queue and classical. Most accepted programs are scheduled as queue programs and executed by KPNO staff. The reminder are assigned specific nights and PIs are expected to be at the telescope to carry out their program. For further discussion of the philosophy of this program, see the March 1996 and June 1996 NOAO Newsletters, or the NOAO WIYN Observing Program Web page http://www.noao.edu/wiyn/obsprog/.

The application procedure for spring 1997 WIYN observing time will be essentially the same as for the fall 1996 procedure. Please remember to include instrumental setup overheads in your requested observing time. These overheads are available from our Web site. Information about applying for WIYN time may be found in all the same places as the normal KPNO observing proposal information, as well as on the Web page given above. A summary of the spring 1996 observing program and a look forward to fall 1996 may be found elsewhere in this Newsletter.

Dave Silva

New Near-IR Observing Capability for KPNO

A near-IR imager with low-dispersion spectroscopic capability is likely to be available on a shared-risk basis to KPNO users starting spring semester. Subject to successful operation on the 2.1-m telescope this fall, it will be offered there for the full spring semester, and probably on the 4-m later in the semester. The instrument was developed by Ohio State University for use on the MDM Observatory telescopes. NOAO is providing a two-quadrant ALADDIN InSb array for the instrument, and by mutual agreement among MDM Observatory, OSU Astronomy, and NOAO, the instrument will be made available to KPNO users. The early use of an array from the ALADDIN development program was graciously agreed to by our partner in that program, the US Naval Observatory Flagstaff Station.

The active array format is 1024 x 512 pixels. There is a choice of two image scales through cold interchangeable cameras: 0.35" and 0.18"/pixel at the 2.1-m, and 0.18" and 0.09"/pixel at the 4-m. J,H, and K filters are provided; user-supplied filters in 38 mm square format can be accommodated on request. The read noise is anticipated to be ~55 e^- /pixel for a single read, with multiple low-noise reads possible to reduce the noise. Performance of this array under lab conditions has yielded a dark rate of < 0.1 $e^- s^{-1}$; performance in the instrument will be demonstrated in September. The anticipated system throughput for direct imaging should be significantly greater than 30%. In addition to the filters, a grism can be inserted into the beam, giving a spectral resolution of ~1400 for 2 pixels FWHM. The slit width is 0.7" on the 2.1-m, and 0.35" on the 4-m; the slit length covers the full format. Spectroscopy is performed in one band at a time by using the appropriate combination of grism and filter.

OSU is currently retrofitting the instrument with a larger chip mount and associated cryo-cooler, and modifying their controller electronics for the ALADDIN array. It is scheduled for Test and Engineering time on the 2.1-m on 18-22 September, and again on 18-21 November. The results of those runs relative to the potential scheduling of the instrument in the spring 1997 semester will be available through the NOAO Web page.

We are optimistic about the performance and schedule of the OSU/MDM instrument, but it will have completed its first telescope run in this new configuration immediately prior to the deadline for spring semester proposals. Proposals will therefore be accepted on a shared risk basis. Because the instrument is shared with the MDM Observatory, it will not be available at every lunation. The minimum guaranteed availability to KPNO would allow scheduling during only two lunations. More time may be provided depending on semester-by-semester arrangements with the MDM Observatory. IRIM and CRSP will therefore still be scheduled to meet the total demand for time. Successful operation at the 4-m will depend on at least one engineering run, which has not been scheduled yet, to verify the interfaces. It is likely that any scheduled time on the 4-m will be late in the spring 1997 semester. For these reasons, please specify on your observing form the advantages of the larger instrumental format for your program, and the level of acceptability of IRIM or CRSP as backup. For the 2.1-m, you can assume that the instrument will be available any time during the semester, but specify as broad a range of acceptable dates as possible. For the 4-m, available dates will be limited to the period of May-July 1997; again, it will be advantageous to specify the broadest possible choice of runs. The name of the instrument is MOSAIC (MDM-Ohio State Active Infrared Camera), but we fear potential confusion with the new large-format CCD imager. For the purposes of your NOAO proposal, please designate the instrument as OSU-IRIS (IR Imager + Spectrograph). Proposals for projects that can be accomplished only with the new instrument will be scheduled after the instrument has been proven in successful operation during the fall T&E time.

Ian Gatley, Darren DePoy, Rick Pogge, Richard Green

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NICMASS Update

For approximately two years, we have offered the University of Massachusetts NICMASS HgCdTe imager for use at the Camera 5 location at the coudÃ© spectrograph on a shared-risk basis. A number of observers have successfully used this configuration for spectroscopy in the 1.0-1.7 μm region at resolutions of 7000 and 44000. This rather informal setup on the very stable spectrograph regularly yields radial velocities to better than 1 km s^{-1} on bright objects.

As readers will note elsewhere in this Newsletter, the high-resolution spectrograph Phoenix is being commissioned for use at the 2.1-m telescope. The 512 x 1024 array in Phoenix yields twice the spectral coverage at twice the resolution as the NICMASS system at the CoudÃ© Feed, provides higher quantum efficiency and lower read noise, is cosmetically cleaner, and provides coverage of the entire 0.9-5.5 μm response range of InSb. For these reasons, beginning with the spring 1997 semester we will be restricting the use of NICMASS at the CoudÃ© Feed to continuing programs for which uniformity of the data set is critical, or to programs for which the extended spectral coverage afforded by the R = 7000 configuration is crucial to the scientific goals of the program.

Dick Joyce, Ken Hinkle

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New, Improved 4-inch Washington Filters Now Available

A new set of 4-inch Washington C and M filters are available at both KPNO and CTIO. These filters follow the recent prescription of Geisler (1996 AJ, 111, 480) designed to improve their characteristics. They are all Schott glass filters and are thus not only cheap (you can buy a set for about $1K) but have guaranteed optical quality, unlike the Corning filters used previously. In addition, the C filter is about 20% more efficient and is also a closer match to the standard filter, thus resulting in significantly smaller color terms. This filter does have a small red leak (peak of 0.15%) between 6700 Ã… and 7700 Ã… but this should not cause significant errors (<< 1%) except for M stars or very reddened objects. The M filter response is very similar to that of previous M filters and has a comfortably small color term and negligible red leak. Observations taken with both the CTIO and KPNO C filters indicate that images are very good and that the color term has indeed been improved. For example, during good seeing conditions at the KPNO 4-m, C images actually had smaller FWHM and aperture corrections than R_{KC} images taken contiguously and showed a radial variation no greater than those in R. In addition, the C color term was found to be ~0.1 with the CTIO Tek 2K #4 CCD, which generally gave values up to twice as large as this with the previous C filter.

Everyone interested in obtaining Washington photometry should use these new filters. They are designated as C and M 4 x 4 "set 2" at CTIO and as KPNO filters 1580 (C) and 1581 (M). As noted in Geisler (1996), the R and I (Kron-Cousins) filters are excellent substitutes for the Washington T_1 and T_2 filters.

Doug Geisler, Ed Carder

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Instruments Available on Kitt Peak Telescopes: Spring 1997

The instruments listed below will be available for visitor use on KPNO telescopes during the February - July 1997 observing semester. Proposals for this period are due 30 September 1996. Visitor instrumentation is welcome at KPNO and can be scheduled if the instrument: a) is unique; b) is required for a project of very high scientific merit; c) conforms to block scheduling; and d) has small impact on KPNO operational and engineering resources.

The list of instruments is available as an external table.

Sidney Wolff

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Graduate Students at KPNO

This year KPNO has initiated a program to host graduate students at Kitt Peak while the students become involved in supporting visiting astronomers. At the suggestion of John Stocke, we assigned a week of observing time this spring on the 0.9-m telescope for calibrating observations that had already been obtained but not put on an absolute scale because the weather at the time of the original run was non- photometric. The opportunity to obtain such calibration data was advertised to the community, and the observations were made by a student-in-residence from the University of Colorado. The program is described below in a letter from Ralph Shuping, who made the observations.

If other students wish to gain this observing experience, KPNO will provide support for plane fare and for room and board on the mountain. We can offer this opportunity only a few times each year--if you are interested, submit an application to me indicating how far along you are with your graduate program, how much observing experience you have had, and what instrumentation you would most like to learn about. Please also have your advisor send me a letter supporting your application.

Sidney C. Wolff

The letter from Ralph Shuping follows:

This letter is a summary of the photometric recalibration program done in service mode April 1 through April 7, 1996, on the 0.9 meter telescope at Kitt Peak National Observatory (KPNO). The intent of this program was to provide photometric data to observers who had recently obtained non-photometric images from any of the KPNO telescopes. The observers could then do photometry on their non- photometric fields by "boot strapping" from the photometric 0.9 meter service fields, thus saving valuable images that would have otherwise been useless and discarded. It was my job to obtain these photometric images, under the advisement of C. Claver, imaging scientist, NOAO.

[The next part of the letter summarizes in detail the observing program that was carried out. Requests were received from six groups, and at least some data were obtained for all of them.]

I was able to undertake these observations as part of the "Opportunities for Graduate Students" program, which provided me room, board, and travel costs. My stay on Kitt Peak was very smooth: The room provided was spacious, the food excellent, and the computer and library facilities made it easier to undertake the service observations as well as my own research. With the shuttles provided, I was able to get downtown to speak with colleagues and sit in on a few talks: A welcome break from life on the mountain.

These recalibration service observations provided me with a unique experience. Living on the mountain for 2 months, I had many opportunities to see most of the telescopes in action, and learned much from C. Claver, G. Jacoby, and P. Massey, each of whom graciously let me sit in whenever they were working at the telescopes. Since this was a photometric program, I learned a lot about doing photometry correctly from local NOAO experts and hands-on experience. I also gained experience in organizing, planning, and executing a reasonably large project, with some help from C. Claver at each stage. Finally, the most important experience of all was with the 0.9 meter itself. Throughout my stay, I learned much from the 0.9 meter design and operation. During my 7 night run, I worked on becoming as efficient as possible in collecting the necessary data. This is a skill that only comes with experience and guidance (thanks again to C. Claver!). I feel prepared now to undertake future observations with greater confidence.

Based on my positive experience here, I would recommend that future service observations be undertaken by grad students through the "Opportunities for Graduate Students" program. A clearly defined project such as the one I was given, can easily be handled by a second or third year student (or higher) in a couple months time. It seems to be a cheap and easy way for NOAO to accomplish some of its goals (an important point in these times of budget crisis), and the student can reap a wealth of experiences that might not otherwise be available (especially students at Universities that do not have their own observatory). The program is great for those perhaps still searching for a thesis topic (it's something positive to do in a time of confusion), or for students wishing to "get away" from the university environment for awhile.

In conclusion, I would like to acknowledge a few people who went out of their way for me during my stay. Despite a busy schedule, Chuck Claver volunteered to advise me during my visit and was incredibly helpful when I was confused, which was often. I thought that we worked very well together, and I learned a lot from him. When it came time for me to take over the 0.9 meter on my own, his confidence in my ability (despite some mistakes) was reassuring and kept me relaxed and efficient at the telescope for the rest of the week. Chuck deserves a great share of the credit for the success of this project, and I thank him for his guidance and help. Many thanks also to George Jacoby who was instrumental in getting the service observing underway and completed. I would also like to acknowledge John Stocke back at C.U. Boulder for first presenting me with the service program idea and for helping to make it happen.

Next, I would like to thank B. Bohannan and the entire mountain staff. Special thanks go to the operators and TAs who welcomed a total stranger into their lives with the simple phrase: "Heh, you wanna watch the news with us?" The kitchen staff also deserves a great round of thank yous for excellent food and great company. Joanne and Pat were instrumental in getting me settled on the mountain and looked after many details - Thanks to both of them for their efforts.

Back in Boulder, I thank D.E. Schutz for his understanding while I was away; and finally, I thank J.M. Harder for unending support and for making it possible for me to stay at Kitt Peak by looking after my four legged, tail wagging responsibility back home.

Once again, I would like to thank all of NOAO for a wonderful chance to do some important work and gain valuable experience at Kitt Peak. I look forward to my next visit!

Sincerely,

R. Young Shuping
Center for Astrophysics and Space Astronomy
University of Colorado, Boulder

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WIYN Queue Observing Experiment: Spring 1996 Summary and a Look Forward to Fall 1996

Not surprisingly, the WIYN Queue Observing Experiment ran much more smoothly during the spring 1996 semester. By now, all active programs have been closed out and all datasets have been shipped. If you expected to receive data and did not, please contact us at *wiynq@noao.edu*.

Note that all spring 1996 WIYN queue programs have been officially terminated. To continue your program, to start a new program, or to try to get your old program started, you MUST re-apply for observing time using the normal KPNO observing proposal submission procedures.

NOAO was assigned 52 nights during the spring 1996 semester by the WIYN Consortium. These nights were split between classical and queue nights as follows:

	Total	Dark	Bright
Classical Nights	24	18	6
Queue Nights	28	16	12
Total	52	34	18

Programs scheduled classically were typically on-going survey projects where it either seemed advantageous for the PI to be on-site or an optimal match between observing conditions and observing program was not critical. This scheduling strategy eliminated the "program runaway" problem experienced during fall 1995 where a few programs greatly exceeded their TAC allocated number of hours. On the other hand, the relatively high percentage of classically scheduled nights appeared to reduce both queue execution sequence flexibility and our ability to match optimally queue programs to delivered observing conditions. During fall 1996, only 16% of the available NOAO dark nights and none of the bright nights have been scheduled classically. This change in the queue/classical ratio will allow us to test whether or not queue efficiency is increased when the queue has a higher percentage of nights in a given semester.

Of the hours available to the queue, 60% of the time was used by specific programs assigned to the queue (as delineated on our Web site, http://www.noao.edu/wiyn/obsprog), 30% was lost to weather, and 10% was lost to a variety of technical difficulties. This amount of downtime due to technical difficulties is still rather high (the WIYN goal is 2%) but not unreasonable for only the second semester in full operation for a very complex facility. Nevertheless, we continue to work with the operations staff to try to reduce such downtime.

A main goal of the WIYN queue observing experiment is to test empirically the hypothesis that, in the face of a high oversubscription rate (about 3.5:1 at WIYN), the science throughput of WIYN can be maximized by executing the most highly ranked science programs first, completing datasets in a timely manner, allowing a larger range of program lengths, and matching the observing program to the observing conditions. The table shows how we did in spring 1996.

	Number of Programs				
	In	Complete	Partial	None	Deactivated
Long Programs: High Priority	7	2	3	0	2
Long Programs: HP, Synoptic	3	3	0	0	0
Long Programs: Best Effort	12	0	3	9	0
2Hr Queue: High Priority	9	4	1	2	2
2Hr Queue: Best Effort	4	0	0	4	0

We were clearly successful in executing the high scientific priority programs first, in executing a range of program lengths, and in facilitating synoptic observing in a way previously unavailable to KPNO users. We also successfully matched observing conditions to observing programs in an unexpected way. The queue program was only allocated 16 dark nights this semester, very few of which had sustained seeing better than 0.8 arcsec, although the median seeing for the entire semester (NOAO and University time combined) was 0.8". Thus, we never executed several highly ranked scientific programs that required sustained delivered image quality less than 0.8", but instead executed nearly as highly ranked proposals that did not require such stringent seeing conditions. Hopefully, we will have more nights of sustained sub-median seeing during fall 1996.

Two things prevented us from completing more high priority programs. First and foremost was the advent of Comet C/1996 B2 Hyakutake. This event ended up consuming about 9 hours of prime dark time in a critical period. When combined with the normal impact of bad weather, we ran into a significant scheduling conflict around 13 hours in right ascension. We regretfully elected to drop one high priority program to maximize the amount of data we could provide to other active high priority programs, reasoning that providing more data to few programs was better than providing a partial dataset to one more program. This is in keeping with our goal to provide scientifically useful partial datasets when 100% program completion is not possible. We continue to work closely with the PIs to assure we meet this goal. A second high priority program was dropped when the space mission it was supporting was not launched. For fall 1996, we have been careful to resolve right ascension conflicts before assigning programs to the high priority queue.

The 2hr queue program was not as productive as we had hoped: only 50% of the high priority programs were completed. Again, this arose from an overly optimistic scheduling plan with respect to celestial coordinates and likely weather. While we cannot control the weather, we have been more conservative about phasing 2hr queue programs with the long programs during fall 1996.

Our Web site (http://www.noao.edu/wiyn/obsprog) was a big success, and was clearly watched carefully by queue participants. How do we know? Whenever we made a mistake, we always got e-mail! We did not, however, update the Web site after every queue night as promised. During one period, we did not update the Web site for almost six weeks. Our goal during fall 1996 is to update the Web site after every queue night.

We also need to formalize our data distribution method. Right now, we are mostly shipping FITS files written on Exabyte tapes and associated observing logs. We plan on making this process somewhat more formal during fall 1996.

Please continue to send us feedback on any aspect of the WIYN queue experiment. Our e-mail address is wiynq@noao.edu. Your input is very important to guiding the evolution of this experiment. Our most important goal remains to produce the best quality data possible.

Dave Silva, for the WIYN Queue Team
(Di Harmer, Alex Macdonald, Paul Smith, Daryl Willmarth)

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Phoenix First Light!

The high resolution 1-5 μm infrared spectrograph Phoenix saw first light 19 June on the 2.1-m telescope. The overall performance of the optical, mechanical, and electronic/detector systems was excellent, with the instrument performing as modeled. A science grade Aladdin InSb array with a 512 x 1024 format was the detector. The 1024 pixels in the dispersion direction translates into 1500 km s^{-1} of spectral coverage. In the spatial direction 180 pixels are used for a slit length of 1' on the 2.1-m. The illuminated section of the array is cosmetically nearly perfect. Spectra and images, as well as further details on the instrument are available at the Phoenix Web site http://www.noao.edu/kpno/phoenix/phoenix.html or by contacting hinkle@noao.edu.

Due to time limitations, testing concentrated on the K band. Extrapolation from a set of slitless observations of a 2nd magnitude star indicates that S/N = 100 should be possible at K = +8 to +9 for a 1 hour exposure depending on slit width and observing conditions. The R = 100,000 2 pixel slit is only 0.74" wide and slit losses are expected. For limiting performance observations users should consider a 3 pixel (1.1", R = 66,000) or 4 pixel (1.5", R = 50,000) slit. Phoenix is expected to have relatively constant sensitivity through the 1-2.5 μm region. However, the sensitivity of the spectrograph decreases very rapidly with wavelength red of 2.5 μm as a result of the increasing thermal background. Only a few tests in the thermal infrared were undertaken and no sensitivity numbers are currently available. Modeling indicates a limit of 5th magnitude at 4.6 μm for high signal-to-noise. However, a quick integration on a star at M = +1 revealed the telluric spectrum but not the star. At this time we urge an extremely conservative approach to planning observations in the thermal infrared until more test observations are attempted. A second test run is scheduled for late August and, weather permitting, more information on sensitivity will be posted on the Web site in early September.

Availability

Phoenix will be available on the 2.1-m telescope starting in January 1997. Time in January is available on a shared risk basis by submitting a proposal with January specified. Shared risk proposals will be accepted up to the normal spring semester deadline of 30 September. Phoenix will be available as a facility instrument on the 2.1-m telescope starting in

February.

The 2.1-m telescope does place some restrictions on guiding, which must be done using the 1' field of view of the instrument; off-axis guide probes are not available with Phoenix on the 2.1-m. Phoenix has an internal dichroic allowing the simultaneous detection of visible and infrared light. In addition, there is a "slit viewing" mode in which an internal mirror inserts into the beam behind the slit wheel and images the field on the array. One may then acquire an object through the 1' diameter open aperture, move to the desired slit, and center up by imaging the object through the slit. Any object in the visible channel field may then be used for telescope guiding. Tests show that flexure between the visual and infrared images is not measurable at the one pixel level.

Ken Hinkle, Dick Joyce

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Welcome Paul Smith

We extend a warm welcome to Paul Smith who joined the KPNO scientific staff in July. Paul was awarded his PhD by the University of New Mexico in 1986, after which he joined the FOS Instrument Team at Steward Observatory led by Roger Angel. While working with that group, he specialized in spectropolarimetry observations with FOS. Paul's main research interests revolve around the characterization of the geometry and structure of the inner regions of AGN using spectropolarimetry and the size of their broad-line regions via the analysis of long period emission line variability. His primary service responsibility at KPNO will be to augment the WIYN queue experiment team as a WIYN Queue Scientist. Although he will do some of the queue observing, his primary duties will be to carry out data quality assurance, to maintain the WIYN queue Web site, to assist in technical liaison activities with queue users, and to assist in scheduling the queue. Welcome Paul!

Dave Silva

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Requests for KPNO Telescope Time - August 1996-January 1997

Telescope		Available to TAC	Long-term Commitment	Available Long-term	Nights Requested	Ratio
4-m	Dark	72		72	153	2.1
	Bright	67		67	117	1.75
WIYN	Dark	32		32	57.5	1.8
	Bright	27		27	21.5	0.8
2.1-m	Dark	76		76	70	0.95
	Bright	75	8	67	81	1.21
					*95	*1.42
Coude	Feed	149	10	139	122	0.88
0.9-m	Dark	76	16	60	78.5	1.3
	Bright	78	8	70	53	0.76
Schmidt	156	79 (39 Dark)		39 Dark	72.5	1.9

**KPNO received 218 proposals from visitors and staff combined, of which 23 were two-hour requests for WIYN. Of these, 20 were long-term proposals; two were granted long-term status. In addition, five proposals which had previously been granted long-term status were also scheduled. The second line for 2.1-m B requests includes 14 nights allocated to shared-risk observing with Phoenix, but does not include 9 nights scheduled for T&E with the Ohio State "Mosaic" instrument, even though that might include some shared-risk observing. Of the 23 WIYN two-hour proposals, seven were awarded "high-priority" status, while eight were to be carried out if time is available.*

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From the NSO Director's Office

The NSO Users' Committee met on 10 June at the AAS meeting in Madison. We were fortunate to have the participation of Hugh Van Horn, Director of the NSF Division of Astronomical Sciences, and Ken Schatten, Director of the NSF Solar Terrestrial Research Program. A report from the Users' Committee Chair, David Rust, appears below.

The annual NSO/Sac Peak summer workshop was held during the week of 17 June. This year, NSO hosted the workshop for SOLERS22 (Solar Electromagnetic Radiation Study for Solar Cycle 22). With nearly 100 attendees, it was the largest summer workshop yet and featured wide-ranging discussions of the variability of the solar output and its effect on the terrestrial environment. Look for a full report in the next Newsletter.

On 8 and 9 July, both NSO sites were visited by representatives of a panel convened by the NSF to evaluate AURA's proposal to continue its operation of NOAO under a cooperative agreement. The same panel reviewed the omnibus "Renewing NOAO" proposal that includes the SOLIS (Synoptic Optical Long-term Investigations of the Sun) suite of instruments. Despite a hectic schedule, the panel focused effectively and constructively on key issues. The report of the panel should be available some time this fall.

Doug Rabin

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Report of the NSO Users' Committee

The committee met on the evening of 10 June 1996, during the AAS convocation in Madison, Wisconsin. Attending were committee members Bruce Lites, David Rust (Chair), Tuck Stebbins, and Dick White; Steve Keil sat in for member Rita Sagalyn. Jacques Beckers and Doug Rabin represented the NSO. Kenneth Schatten and Hugh Van Horn represented the National Science Foundation. The focus of the meeting was the SOLIS (Synoptic Optical Long-term Investigations of the Sun) proposal and the adaptive optics program. SOLIS is currently under review at the NSF. The Users' Committee strongly endorses SOLIS, and letters to that effect have been written to the NSF program directors involved. Considering the importance of synoptic full-disk observations for research on the solar cycle, the committee feels that SOLIS should be the first-priority new instrumentation project at NSO. SOLIS can be operational in time to play a major role in the Solar Magnetism Initiative that is now being assembled at the NCAR High Altitude Observatory. The committee discussed the need for HAO to participate in a material way in bringing SOLIS on line. In order to keep the US at the forefront of solar cycle/solar magnetism research, we should start SOLIS in the next fiscal year, and immediate HAO participation, both scientifically and in some areas of instrumentation, should be sought by the NSO management.

Jacques Beckers gave us an update on the CLEAR project. Good progress is being made in the engineering studies, especially in understanding the various cost vs. capability trade-offs. However, the committee feels that a Web page should be established to give the solar research community an opportunity to review the CLEAR project and, through an open discussion format similar to the one now being used on the NOAO Web page, to discuss the merits and needs of the project. The committee felt that the NSO Users Web page should be established somewhere other than NOAO, and David Rust agreed to set one up under the guidance of the Users' Committee. The planned Web site was seen by the committee in the broader sense, namely, as a way for NSO users to communicate better with NSO management and the Users' Committee.

An important issue for discussion on the Web site is the future of adaptive optics at NSO. Rabin announced that work on the image reconstructor has been suspended, pending successful development of other elements in the image improvement program at the Sacramento Peak Vacuum Tower Telescope. In view of the recent retirement of the lead mechanical engineer on the project and the shortage of funding, the committee concurred with Rabin's decision. The adaptive optics project now aims to improve VTT image quality with a fast correlation tracker (with tilt-tip mirror) and continued gradual improvements in the main optics, as well as experiments to verify a scheme for wavefront sensing. Community advice will be important in determining how much of NSO's resources should be devoted to the adaptive optics program in the next five years.

Finally, the committee wishes to commend Jack Harvey, Christoph Keller and the other members of the NSO scientific staff who acted so quickly to assemble the excellent SOLIS proposal, when an opportunity for new funding became clear. The committee also commends Doug Rabin for so effectively handling NSO affairs as the acting director during the year of Jacques Beckers' devotion to the CLEAR project.

David Rust, Chair (Johns Hopkins University Applied Physics Lab.)

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The NSO Summer Students: What They're Up To

Kester Allen, Amherst: Kester is working with Matt Penn studying the temporal behavior of the Helium 1083-nm line. They are examining variations in Doppler shift, equivalent width, and line strength associated with p-modes. They are also collaborating with Karen Harvey in a study of velocity perturbations and line asymmetries associated with X-ray bright points seen in Yohkoh images.

Eric Bell, Glasgow: Eric is working with Frank Hill on the GONG project. He is studying Modulation Transfer Functions (MTFs) caused by the optical effects of atmospheric turbulence on the GONG observations. He is designing software to characterize the MTFs over the broad range of seeing conditions encountered by the GONG instruments.

David H. Berger, Colgate: David is working with John Varsik on measurements of dust both in the air and on mirror surfaces as part of the CLEAR Engineering Study. Scattered light from dust would have a significant effect on the performance of the CLEAR telescope. In addition to monitoring the data from an airborne particle counter and looking for relationships between airborne particles and local weather conditions, he has also been preparing an experiment to study the distribution of dust particles on mirror surfaces. Software David has written allows these distributions to be measured automatically from digitized video images. David will also participate in nighttime observations at the Evans Solar Facility. These observations will measure the point-spread function of the coronagraph and measure the effectiveness of a coronagraphic telescope on nighttime objects.

Mark Fagan, Western Washington: Mark is working with Charlie Lindsey and Jack Harvey on NSO's program in local helioseismology. He is writing software to map GONG and SOHO images onto a flexible format that can portray them from any desired perspective in space. This flexibility in perspective is needed for the procedure that is used for computing acoustic power maps and Doppler acoustic maps of waves visible on the solar surface. Mark's software creates a mosaic of such images that allows computations of Doppler acoustic signatures covering a large fraction of the visible side of the solar disk.

Kathleen Ford, Rensselaer Polytechnic Institute: Kathleen (Saavik) is working with Stephen Keil and K.S. Balasubramaniam on two projects this summer. The first is to look at the twist (shear) in emerging magnetic fields, using data taken at the Vacuum Tower Telescope with the Advanced Stokes Polarimeter. Saavik is reducing the data, making movies of the vector field, and looking for evidence that the field is emerging in a twisted state. Saavik is also participating in a program to make vector field measurements using a near-IR camera and two IR etalons. She has looked at data from tests of the filter made in an iron line near 1.56 μm and near He 1083 nm. After the July observations she will analyze fields measured in the 1.56 μm line.

Inese I. Ivans, Toronto: Inese is working with Jeff Kuhn to use observations of the infrared corona to construct models of the density and temperature of the corona. She is using high spectral resolution data obtained during the eclipse in 1994 and IR photometry from the 1990 eclipse. From the IR Fe XIII emission lines and the Thomson-scattered IR continuum she hopes to develop an accurate understanding of physical conditions in the corona from the limb of the Sun out to about 2.5 solar radii.

Sean P. Matt, Arizona: Sean is working with George Simon analyzing full-disk Dopplergrams from the GONG network, in an effort to study the evolution of supergranules. In addition, he is comparing GONG and SOHO/SOI/MDI Dopplergrams and analyzing correlations among Dopplergrams, magnetograms, flow maps, and cork movies obtained by MDI on 7-8 March 1996 when the instrument was pointed at the south solar pole. Both full-disc (2" pixels) and high-resolution (0.6" pixels) MDI images are being studied.

Sarah O'Brien, University Of Arizona: Sarah is working with Mark Giampapa on the analysis of the timeseries of high resolution, Hα spectra of several classical and so-called weak T Tauri stars as obtained with the McMath-Pierce solar-stellar spectrograph. She is studying the line profiles to assess the nature and time scale of variability, including the determination of whether any periodic variability is present.

Abigail Paske, Pomona College: Abby is working with Bill Livingston on two diverse projects. She is analyzing observations of the high-excitation CI line at 538 nm in integrated sunlight for variations in Doppler velocity over the solar cycle. She has also obtained some high-quality images of the solar granulation at the McMath-Pierce Telescope on film and is analyzing these to measure the optimum resolution attainable by the telescope under good seeing conditions.

Ann D. Schiff, Harvard: Ann is working with Haoshing Lin using the precision full-disk photometric data from the PSPT (Precision Solar Photometric Telescope) prototype in Rome to study the problem of the active region energy balance. The project seeks to provide accurate, repeatable full-disk irradiance images. She is looking at the differences in center-to-limb luminosity variations in measurements that are being taken of Ca II K emission and blue continuum spectrum emission. Ultimately, she plans to use these results to help determine the physics of solar flux tube emergence and geometry.

Jeremy Tinker, Kansas: Jeremy is working with Thomas Rimmele and Louis Strous on a project to study the excitation of solar p-mode oscillations. Jeremy is analyzing narrow-band filtergram data taken at the Vacuum Tower Telescope with the Universal Birefringent Filter. He is studying acoustic events, which are observed in the high-resolution velocity data derived from these data. Acoustic events provide the acoustic energy needed to power the p-mode oscillations and are generated by granular convection. Jeremy's goal is to gain a more detailed understanding of the mechanisms that cause the events.

Wayne Winters, University Of Missouri-Columbia: Wayne, working with Harry Jones, is developing software to replace the current real-time reduction code for the Helium 1083-nm line at the NSO/NASA Spectromagnetograph. The new code will routinely compute Doppler velocity and line depth as well as equivalent width and continuum intensity. Wayne is working on software to fit and remove nearby silicon and water-vapor lines that contaminate the wings of the helium line and is developing an algorithm to characterize its spectral asymmetry.

Steve Keil, Charlie Lindsey

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Kitt Peak Vacuum Telescope: New Data and New Web Page

The NSO Kitt Peak Vacuum Telescope, operated in collaboration with the NASA Goddard Space Flight Center and the NOAA Space Environment Center produces full-disk solar maps of various quantities of use to the solar research community every clear day. Starting in 1973, we have made maps of the line-of- sight component of the photospheric magnetic field. In 1974, the strength of the He I 1083-nm line was added to the daily products. In 1993, the old instrument was replaced and additional quantities such as Doppler shift and line depth have been regularly measured.

From time to time, the KPVT has been used to make magnetic field measurements using chromospheric spectrum lines such as Hα, the infrared Ca II triplet, and He I 1083 nm. Stimulated by the recent discovery of apparent outflow from polar coronal holes observed with He I 1083 nm (Dupree, Penn and Jones, ApJ in press), D. Branston and J. Harvey made a full-disk map using Ca II 854.2 nm. This chromospheric map showed a number of surprises. It reveals magnetic fields near the limb (and especially the poles) much more clearly than when using photospheric lines. Closer to disk center, it is less affected by the clutter of small-scale background fields and appears to show very large-scale patterns of fields better than when using photospheric lines. It is also sensitive to prominences above the limb. (A technical problem is currently suppressing off-disk measurements). There appear to be diffuse unipolar patches covering several supergranules visible occasionally at high latitudes (prominence fields projected against the disk?).

Because of these differences with photospheric measurements and also because of the beautiful results becoming available from instruments on the SOHO spacecraft, we have added the chromospheric full- disk observations as a regular daily data product. Experiments are underway using the 849.8-nm line instead of 854.2 nm to try to obtain simultaneous photosphere and chromosphere observations. The 849.8-nm line is also more sensitive to magnetic fields.

Although the KPVT data were among the earliest solar images available on the World Wide Web, our web pages were not effective in getting data to the community. J. Harvey has overhauled automated reduction scripts and prepared a new page to access the most current popular KPVT data more effectively. This page displays tiny images and allows the user to obtain larger gif versions as well as to ftp research-quality versions of the data. The page can be accessed through NSO's home page, http://www.nso.noao.edu. Access to older data is under development.

Jack Harvey

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A Brief Study of the KPVT Bibliography 1991-1996

We maintain a partial bibliography of papers that use data from the Kitt Peak Vacuum Telescope. From 1973 through mid-1996 it totals more than 650 research papers. 217 papers were published from 1991 through mid-1996. This is where these papers were published.

Conference Proceedings	68	(31.3%)
Solar Physics	59	(27.2%)
Astrophysical Journal	51	(23.5%)
Astronomy & Astrophysics	10	(4.6%)
J. Geophysical Research	10	(4.6%)
Adv. Space Research	9	(4.1%)
Doctoral Theses	4	(1.8%)
Space Science Research	4	(1.8%)
Science	1	(0.5%)
Monographs	1	(0.5%)

To determine the affiliation of the authors of the papers, we categorized the authors into three groups and gave each author an equal fraction of the authorship of a paper (sum for each paper = 1). The result is:

US institution authors	114	(52.5%)
Non-US institution authors	69	(31.8%)
On-site visitors and staff	34	(15.7%)

Over the 5.5 year period surveyed, no trends were obvious, with one exception. The number of non-US authors is increasing relative to US and on-site authors. This probably reflects growth of solar physics research outside the US and its shrinkage within the US.

Jack Harvey

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NSO Telescope/Instrument Combinations

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

Evans Solar Facility (SP):
        40-cm Coronagraphs (2) 30-cm Coelostat 40-cm Telescope Littrow
        Spectrograph Universal Spectrograph Spectroheliograph Coronal
        Photometer Dual Camera System

Hilltop Dome Facility (SP):
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        H-alpha Flare Monitor White-Light Telescope 20-cm Full-Limb
        Coronagraph White-Light Flare-Patrol Telescope (Mk II) Sunspot
        Telescope Fabry-Perot Etalon Vector Magnetograph
        Mirror-Objective Coronagraph (5 cm) Mirror-Objective
        Coronagraph (15 cm)

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

Vacuum Telescope (KP):
        Spectromagnetograph High-l Helioseismograph 1083-nm Video
        Filtergraph

Razdow (KP):
        H-alpha patrol instrument
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Global Oscillation Network Group

The Global Oscillation Network Group (GONG) Project is a community-based activity to operate a six- site helioseismic observing network, to do the basic data reduction, provide the data and software tools to the community, and to coordinate analysis of the rich data set that is resulting. GONG data is available to any qualified investigator whose proposal has been accepted; however, active membership in a GONG Scientific Team encourages early access to the data and the collaborative scientific analysis that the Teams are undertaking. The GONG Newsletter provides status reports on all aspects of the Project and related helioseismic science. Information on the status of the Project, the scientific investigations, as well as access to the data is available on our WWW server whose URL is www.gong.noao.edu.

Overview

The highlight of the last quarter was the publication of the first results from GONG in a special issue of the journal Science, dated 31 May. In addition to an introductory article and one describing the Project itself, five of the scientific teams presented their first looks at the GONG data, and the scientific implications. The results, extended by several additional months' data, were presented by the team leaders during a special session at the Madison AAS meeting. The scientific teams will be developing their analyses, using considerably more data than was available for these quick looks, for a series of more in depth papers to be submitted by the end of the Summer. Individual analyses of the data may be submitted after these papers are in the works. Following this initial round of publications, we will be settling down for the continuing accumulation of data and development of our analyses techniques.

The Annual GONG Meeting was held following the AAS Meeting in Madison, with a large turnout, and associated meetings of the Scientific Advisory Committee, the Site Representatives and the DMAC Users' Committee were held. It was an exhausting week! It was also an incredibly stimulating week, with real data living up to our expectations in providing the starting point for the world-wide scientific community's pursuit of the next phase of helioseismology.

At the beginning of July, the Instituto de Astrofisica de Canarias inaugurated an impressive collection of new facilities, in the presence of the King and Queen of Spain. We were honored to have the Director of the National Science Foundation, Neal Lane, present the GONG station. Helen Lane (no relation, honest!), the Scientific Counselor from the US Embassy in Madrid, joined Pere Palle and John Leibacher in representing GONG.

We've had the pleasure, here in Tucson, of extended visits from Irene Gonzales and Jesus Patron (Instituto de Astrofisica de Canarias), Sushant Tripathy (Udaipur Solar Observatory), and Philip Stark (University of California, Berkeley) to work intensively with the Project team.

The Project itself is moving along very smoothly. We have successfully completed nine months of full, six-site, network and data reduction operations! The network is performing very well, and the data reduction is keeping pace; which is not to say that we are not learning an enormous amount about how to operate the network, and how to improve our analysis of the data. There's nothing like have the real thing, on both sides of the house. At the same time that we are 'settling down' into operating the initial configuration, we are looking to the future. Instrumentally, more detailed plans are being developed for the study of the feasibility of installing a larger format camera in the existing network stations. At a low level this effort has already begun with the evaluation of a small number of commercially available cameras in the 512^2 - 1024^2 class. This effort will enlarge significantly, early in the new fiscal year, to include the examination of commercially available frame grabbers and data recording systems, either as strawman solutions or proxies for subsequent in-house designs.

The target is to put sufficient bounds on the problem by January 1997 to permit the preparation of a proposal that would include the extension of network operation for a full eleven-year cycle, and if indicated, the development of the new camera system. The study will continue throughout FY 1997 to provide further details and refinements for the NSF's review.

On the data management side of the house, efforts have been underway to facilitate the planned reprocessing of the first-year's network data, using improved reduction software and faster computing platforms. Of course, these new systems will be used for the ongoing processing of the newly acquired data as well. This escalation of throughput will also serve as an exercise to better clarify the data management implications of using a larger format camera in the instrument, and be folded into the continuation proposal.

Operations

The operation of the GONG network is proceeding without serious problems. We're still only losing about four images out of every thousand during sunlit hours due to instrumental problems of all kinds, and many of these losses are covered by other sites observing the Sun at the same time. It's probably tempting fate to mention that we have not yet had to mount a "crash team" trip to repair a recalcitrant instrument. So far problems have either been addressed by on-site staff, or have been minor enough to wait for the next maintenance group from Tucson to arrive.

The original project plan called for a scheduled preventive maintenance visit to each site every six months. Given that there are six sites in the network, this implies that we would have a trip to some site every month, each trip involving either two or three individuals from the operations group. We completed the first round of these trips last April with the visit to Udaipur, India. This prompted a review of procedures and a discussion of lessons learned. We are resolved that at least for the time being we can probably increase the period between visits to as much as nine months when there is no compelling reason to go sooner.

The first site on the list for the new round of trips was Cerro Tololo, visited out of order so that we could replace the last of the old conventional 0.5 nm prefilters with a superior element manufactured with the ion-assisted deposition process. Only three of these ion-assisted filters were available when the network was deployed, and they were placed into the three instruments destined to be part of the three-site "mini- network." The new filters have the virtue that they are at least an order of magnitude less sensitive to temperature changes, and show no measurable drift toward bluer wavelengths as they age. The Mauna Loa, Cerro Tololo, and Udaipur sites all suffered from a gradual reduction of efficiency caused by slow bandpass shifts before their conventional filters could be replaced.

Another analysis of service log entries was performed in early June in preparation for the Madison AAS meeting. There had been little overall change since the first analysis reported in the previous Newsletter. Issues relating to Exabyte tape drives had expanded slightly to account for about 25% of all traffic between operations personnel and the host sites. Of these, the most common problem was the automatic switching of the writing of data from the primary to the secondary tape banks. Every site has had this happen at least twice, and some as many as eight times since full network operations began last October. Bank switches can be caused by a variety of system-detected troubles ranging from media problems to drive servo failures. We have now had one "double bank" failure (failure of the secondary bank before the primary could be repaired) during daylight operations at Big Bear, costing us about two hours of data while local staff at BBSO and operations staff in Tucson scrambled to get things running again. All together, however, Exabyte failures have only cost us about 700 images. Actual bank failures only account for about half of the Exabyte-related service issues, however. The balance are associated with requests for resupply of tapes or mailing envelopes, and inquires about specific tapes that are slow to show up in the mail. We have yet to lose any data to the mailing daemons, although several tapes have been delayed long enough to prompt us to request a copy made from the on-site duplicate.

In March, the Udaipur Solar Observatory gained continuous access to the Internet, greatly improving communication and enhancing our ability to help with problem solving from Tucson. Prior to the operation of their VSAT link, we attempted to log into the USO site daily via modem to examine the instrument's status, and to check our local "mail box" for news of problems. The expense of such phone calls made this an anxious in-and-out event that we are pleased to replace with the more effective (and relaxed) remote login to the shelter's work station via Internet. In addition, we are now able to compress and electronically transfer a copy of the minute-by-minute instrument "telemetry" from the previous 24- hour period for automated analysis every morning in Tucson. Five of the six instruments are now operating in this mode, and Learmonth, Western Australia may be on the net as early as this January.

The operations group remains somewhat ambivalent about the best method for distributing software updates and bug fixes. Ideally we would like to perform upgrades simultaneously at all six sites after carefully "beta testing" the new release at the Tucson prototype station. Once all six stations are on the Internet this option becomes practical, though not without some risk. The thought of downloading and executing new software to an instrument half a planet away, though normal enough for people in the space business, is still somewhat nervous making for us. To date, our preferred approach has been to install the new code at the beginning of a maintenance trip, giving us about a week to ten days of confidence-building experience and reassurance that we haven't neglected some northern/southern hemisphere or other site-specific effect. (Some motors do counter rotate in the southern hemisphere, while others do not. It's left as an exercise to the student to determine which are which.) This conservative procedure does mean that we could be running as many as six different versions of the control software at any given time. For the time being, we are resolved to weigh the risks and benefits of the two methods on a case-by-case basis, and proceed accordingly. To date, our configuration control system has proved to be up to the task of keeping track of who is running what--if not why.

Data Management and Analysis Center

During the past quarter, month-long (36-day) time series and power spectra were produced for GONG months 8, 9, and 10 (ending April 30) with fill factors of 0.88, 0.93, and 0.90. Five-month, six-month, and seven-month (the concatenation of GONG months 4 through 10) time series and power spectra for l's less than or equal to 30 were produced. A gray-scale, hardcopy of the power spectra from the six-month- long time series was produced. This displayed the spectrum for each m-value and for the entire temporal frequency range. By summing over many frequency bins, we were able to reduce the length of the plot to 20 feet, which was the length of the longest unobstructed piece of hallway wall that we could find.

For month 10, the processing delay between data acquisition and completion of the month-long power spectra was about 13 weeks (as it was during the previous quarter). Because of vacations, attendance at the AAS and GONG meetings in Madison, and various software activities, we expect a longer process delay for month 11 followed by an acceleration back to 13 weeks as subsequent GONG months are processed.

Mode frequency tables were produced for GONG month 9; from the five-month- long power spectra (the concatenation of the time series from months 4 through 8); from the month-long average power spectra constructed by averaging the power spectra from months 4 through 8.

The Field Tape Reader (FTR) (the subsystem that receives the raw data cartridges from the observing sites) processed 96 cartridges containing 643 site-days from the seven instruments. 439 site-days were processed through the site-dependent data reduction stages. The difference of 104 site-days is attributed to bad weather at the network sites and data from the engineering test unit in Tucson. The later is reduced only when requested by the instrument team. Since there were no significant instrument problems, these statistics are similar to those from the previous quarter.

During the past quarter, the DSDS serviced 72 data distribution requests for 455,842 files totaling 189.6 Gigabytes of data. The average delay between receipt of a request and shipping the media containing the data products was about 1.5 days. The DSDS performed 2937 data cartridge transactions (library check- ins and check-outs) in response to requests from the data reduction pipeline and other internal operations. The data volume distributed doubled when compared to the previous quarter. The other statistics are similar to those from the previous quarter. The copying of new data product cartridges, the delivery of these copies to the off-site storage facility, and the testing of old media in both the DSDS library and in the off-site storage facility continued as expected.

A DMAC Users' Committee meeting followed the GONG meeting in Madison. Much of the meeting was devoted to a discussion of the analysis of the Project's algorithm that identifies mode frequencies that is currently underway by several members of the GONG community. In addition, recent and proposed changes to the pipeline and a reprocessing campaign were discussed. The next DUC meeting will take place in Boulder during August.

Recently, the Project introduced two changes that affect the low-l p modes. These include a more automated and robust technique for editing bad data samples from the low-l site-day time series and removing from the l = 0 time series observer motion as determined from ephemeris data.

Despite the low-sensitivity and high noise level of individual GONG magnetograms, the large volume of data available for averaging produces a Carrington map with surprisingly high quality. The Project will add synoptic maps to the menu of magnetogram data products.

The Project is testing an algorithm that determines the residual camera rotation angles by correlating contemporaneous images from contributing sites. This will provide more consistent and more accurate camera rotator corrections. Routine use of this approach will likely begin with GONG month 12.

During the next quarter several operational changes will be made to improve the efficiency of the data reduction pipeline. The Project will integrate into the calibration stage the functions that are now performed by the next reduction stage that refines the determination of the geometry of the solar disk and estimates the modulation transfer function (GEOMPIPE). This change is expected to save about 400 cartridges annually and will reduce by half the time spent performing GEOMPIPE functions.

Currently, concatenating month long time series into year long time series and producing the power spectra are separate data reduction stages. These are being merged into one, and the phase spectra (the principal part of the arctangent of the real and imaginary parts of the Fourier transform of the time series) is being discontinued. Previously, these phase spectra were included in the power spectra data product.

The data reduction stages that merge the site-day time series into network-day time series, that concatenate the site-day time series into month time series, and that produce the power spectra from the month time series will also be combined into one data reduction stage. These changes will eliminate additional, unnecessary cartridge operations and process delay.

The Project is considering a reprocessing campaign that will begin after September but before April. This will apply the software updates that occurred during the past year to all the acquired network data and will result in a more consistent and homogeneous data set.

John Leibacher

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NOAO Newsletter - US Gemini Program - September 1996 - Number 47

US Gemini Program

A New USGP Scientific Staff Member

We are pleased to welcome David Silva to the US Gemini Program as an Assistant Astronomer. Dave's previous position was NOAO Assistant Scientist with responsibility for the commissioning of the WIYN telescope. He has extensive experience with telescope operations and alternate observing modes. His major research interest is stellar populations in elliptical galaxies, which he has studied using many different techniques, including optical and IR spectroscopy, IR imaging, and theoretical modeling. Dave's expertise will be valuable as we gear up our program for the operations phase of Gemini.

A Workshop to Define US Instrumentation Priorities for Gemini

Planning is beginning for the instruments that will be designed and built for Gemini after the initial complement. Each of the Gemini partner countries has been asked to establish its interests and priorities for future instrumentation, and the lists will be compared and merged starting this fall. In the steady-state of Gemini operations, approximately $3.5 million per year will be available for instruments and facility upgrades; approximately one-half of that will be spent in the US.

In order to arrive at a community consensus about priorities for future Gemini instruments, the USGP has organized a small workshop in Tucson in early August. About 25 astronomers have been invited to discuss the science drivers for Gemini capabilities. An attempt is being made to place the Gemini program in the context of the many facilities available to US astronomers by including representatives of most of the other large telescopes and projects. Opinions and input have been solicited from the community at large through a discussion on the World-Wide Web. The conclusions of this upcoming workshop will be reported in the next Newsletter.

Science Drivers for the Gemini High-Resolution Optical Spectrograph

A meeting was held in early May in London to discuss the performance requirements and scientific motivations for the Gemini High Resolution Optical Spectrograph (HROS). This instrument will be one of the last delivered of the initial complement and will be installed at Gemini South. Its design and fabrication has been assigned to the UK, and the team working on it is based at University College London.

The goal of the meeting was to review the sorts of scientific problems that could be effectively attacked with a high resolution optical spectrograph in the southern hemisphere, and to ensure that the requirements that the team is designing to are consistent with that vision of the instrument's mission. Representing the US community at the meeting were David Meyer (Northwestern), Mario Mateo (Michigan), Mark Giampapa (NSO/NOAO), and Todd Boroson (USGP/NOAO).

The results of the meeting are best summed up by the performance requirements that were endorsed:

1. The baseline instrument will be mounted at the Cassegrain focus. The committee recognized that a bench mounted spectrograph fed with either a fiber bundle or a beam would address additional important problems, but this role might be better filled by a separate spectrograph.
2. HROS will have two resolutions, selectable by changing the camera. These resolutions (corresponding to 3 pixel sampling) are 50,000 and 135,000.
3. HROS will be usable over the range 300 to 1100 nm with complete coverage from 350 to 700 nm in a single exposure at the lower resolution.
4. The nominal slit widths will be 0.6" (low resolution) and 0.24" (high resolution). The slit width will be adjustable and a decker will provide a slit length up to 60". An image slicer will be available for the high resolution mode.
5. Fairly ambitious requirements are placed on throughput, image quality, scattered light, and flexure.
6. It is considered highly desirable to provide a multi-object capability. A number of very interesting problems could be addressed with even a small number of slits over a 30" x 60" field.
7. The ability to make spectropolarimetric measurements would be a desirable feature.
8. It was recognized that there is an important need for a stable spectrograph to measure radial velocities with a precision of 1 m/s between 400 and 1000 nm to search for planetary companions and for asterioseismology.
9. The scientific importance of spectroscopy at a resolution of order 1,000,000 in the spectral range 300 to 1000 nm

was recognized.

Design work for this spectrograph is beginning, with a conceptual design review (CoDR) scheduled for late this year.

Near Infrared Instruments

Last year, the International Gemini Project Office asked the USGP to manage the IR instruments program for Gemini, since all of the Gemini construction-phase IR instruments are being built in the US. Current NIR USGP projects include the Gemini Near Infrared Imager (NIRI) built by the University of Hawaii, the Gemini Near Infrared Spectrograph (GNIRS) built by NOAO, and the NOAO ALADDIN arrays and NIR array controllers for both of these instruments.

The NIRI completed its CoDR in March 1995 and held its Preliminary Design Review (PDR) at the end of June of this year. No major technical problems were uncovered at the PDR, and designs identified by the review committee as carrying technical risk are now being prototyped. NIRI is scheduled for delivery to Mauna Kea in September 1998 in time to serve as the commissioning instrument for the Gemini North Telescope.

The Institute for Astronomy has assigned an outstanding design team to this project: Klaus Hodapp (PI), Joseph Hora (Principal Astronomer and optics designer), Tony Young (lead mechanical engineer), Ev Irwin (electronics engineer), and Hubert Yamada (software engineer). USGP appreciates the hard work of these people and others in preparing and delivering the PDR. More on this instrument appears below.

NOAO began work on the GNIRS last October and held the CoDR in March. The review committee was extremely impressed with the quality and quantity of work performed, which exceeded what they expected for a CoDR and was almost at a PDR level. The PDR will be held 3-4 October in Tucson and will be led by the GNIRS Project Engineer Dan Vukobratovich and Project Scientist Jay Elias. NOAO was fortunate to recruit the level of quality for this project exemplified by these two individuals, who have succeeded in keeping the project on schedule and within its budget. The GNIRS team also includes Nick Roddier (leading both electrical engineering and software) and Woon-Yin Wong (mechanical engineering), with substantial contributions by Gemini's Myung Cho (mechanical engineering and FEA modeling) and NOAO senior designers Randy Cuberly and Andy Kovacs. Jay described the spectrograph's science drivers, capabilities, and upgrade paths in the June Newsletter. GNIRS promises to exploit the full potential of the Gemini telescopes and to produce exciting science throughout its lifetime.

Both NIRI and GNIRS will use NIR arrays developed under NOAO's ALADDIN program and an upgrade of NOAO's Wildfire controller. NOAO is managing the arrays foundry run, the controller upgrade, and the integration of arrays and controllers into a working unit suitable for inclusion into each instrument. The first controller with an engineering grade array will be delivered to the NIRI team 15 July of next year, with the controller for the spectrograph following about a year later. As science grade arrays are produced, characterized, and selected, these will be integrated with each team's controller delivered previously and adjusted to optimize performance.

Proposals were received in early June by groups interested in performing conceptual design studies of a mid-infrared (8-25 μm) imager for the Gemini telescope. A committee of qualified members from the community reviewed the proposals and made a recommendation for funding. The selected groups(s) will be announced in the next Newsletter. The next phase of the activity, the final design and hardware phase, is also an open competition. Proposals will be solicited from anyone in the US.

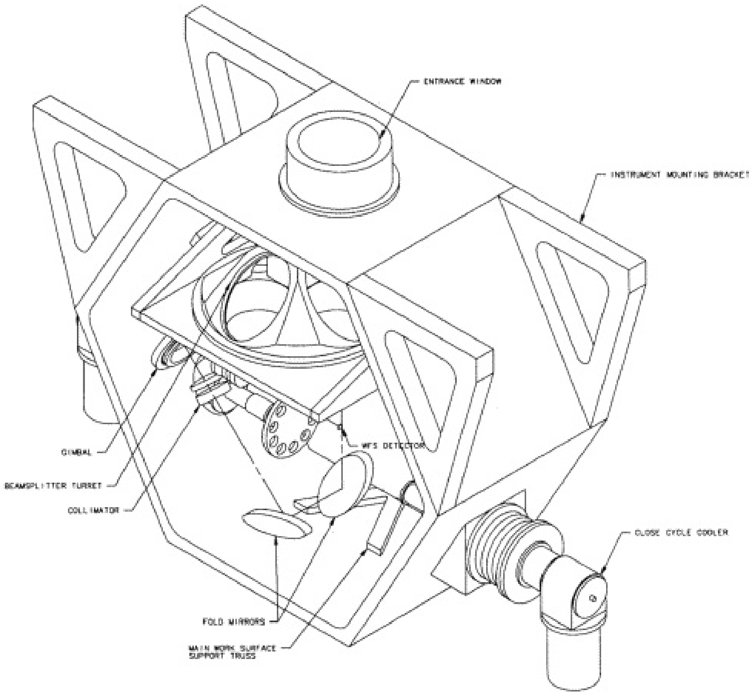
This initial conceptual design activity is useful to Gemini in gaining a better understanding of the cost and technical feasibility of obtaining an instrument which will meet the performance objectives.

Following the conceptual design work, the USGP will proceed with choosing a group for the complete design and fabrication of an instrument. Proposals for this work will be solicited from the entire US community. In order to propose, a group should have a design concept and analysis sufficient to address the types of performance questions listed in the Request for Proposals of the conceptual design study. Anyone wishing to receive this may request it from the USGP.

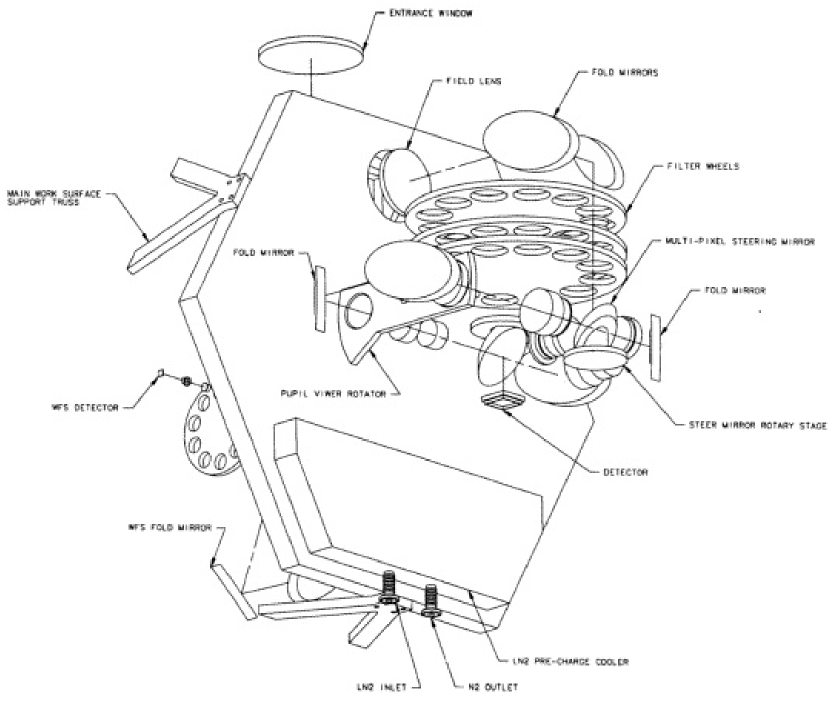
Gemini Near Infrared Imager

The Gemini Near Infrared Imager (NIRI) is being built by the University of Hawaii's Institute for Astronomy under contract to the International Gemini Project Office. This contract is being administered by IGPO contracts administrators, but the USGP acts as Technical Representative providing day-to-day oversight.

NIRI is designed to take advantage of Gemini's low IR emissivity, superb image quality produced by both active and adaptive optics (AO), large photon collecting area, and operating modes that can be adapted to observing conditions that vary rapidly over a wide dynamic range. The NIRI will operate as a camera with grism spectroscopy in the wavelength range 1.0 μm through 5.5 μm. The ALADDIN-style detector will have 27 μm pixels with scales of 0.02" (20" field), 0.05" (51" field), and 0.12" (123" field). The 0.02" scale will be used primarily with AO, while the 0.05" scale will be used most often with tip-tilt enabled but AO disabled (e.g., when low emissivity is preferred over spatial resolution). Matching focal plane masks will be provided in the focal plane mask wheel. Grisms provide low resolution spectroscopy in the 1.0-2.5 μm wavelength range using 120" slits. Extending low resolution grism spectroscopy to the 3 μm window would be a desirable future option.



As shown in the isometric projection in Figure 1, NIRI's optics will be mounted on an optical bench inside a hexagonal dewar, with the science optics on one side of the optical bench and the NIR On- Instrument Wavefront Sensor (OIWFS) on the other side. Pickoff mirrors mounted on a turret reflect the science beam in the middle of the field and pass the surrounding guide field to the OIWFS. The science- beam-side layout is shown in Figure 2. The IfA is providing the OIWFS detector, a 1K x 1K Rockwell HgCdTe array operating in the range 1.0-2.5 μm. Cryocooler heads and electrical connectors are all mounted on the central hexagon, for easy removal of the vacuum covers mounted on each side of the hexagon.



As with all true Gemini facility-class instruments, NIRI will be compatible with Gemini control systems, using the Experimental Physics and Industrial Control System (EPICS) software developed at US experimental high energy physics accelerators. This system provides a common framework for all Gemini enclosure, telescope, mount, and instrument control systems and guarantees they can all communicate with each other. Since the executable software is already debugged and operational (and has been for several years), all one does for a new system is populate a database specifying basic control algorithms and write a small amount of software to provide custom control features not found in EPICS. This speeds development and reduces overall software cost, but does require a substantial investment of a programmer's time to learn how to use effectively.

Watch this column for future articles on this critical Gemini instrument.

Todd Boroson, Mark Trueblood, Kathy Wood

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ADASS '96 Update

It's not too late to attend the world's premier meeting for astronomical software: ADASS '96! ADASS is an international conference which provides a forum for scientists and programmers concerned with algorithms, software, and software systems employed in the reduction and analysis of astronomical data. The previous ADASS meetings (1991--Tucson; 1992--Boston; 1993--Victoria, BC; 1994--Baltimore; and 1995--Tucson) have established ADASS as the leading world forum for scientists and software developers to discuss issues regarding algorithms and software systems for the acquisition, reduction, analysis, and archiving of astronomical data.

The Sixth Annual Conference on Astronomical Data Analysis Software and Systems (ADASS) will be held 22-25 September in Charlottesville, Virginia, at the Omni Charlottesville Hotel. The conference is hosted this year by the National Radio Astronomy Observatory. Additional sponsors include:

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Associated Universities, Inc.
Infrared Processing and Analysis
Center European Southern Observatory
Gemini 8-Meter Telescopes Project
National Aeronautics and Space Administration
National Center for Supercomputing Applications
National Optical Astronomy Observatories
National Radio Astronomy Observatory
National Research Council of Canada
National Science Foundation
Smithsonian Astrophysical Observatory
Space Telescope Science Institute
University of Virginia
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ADASS '96 is also fortunate to have received significant corporate sponsorship from Sun Microsystems, GE Fanuc, Inc., and US Sprint.

The Program Organizing Committee for ADASS '96 has the following members: Rudi Albrecht (ST- ECF/ESO), Roger Brissenden (SAO), Tim Cornwell (NRAO), Dennis Crabtree (DAO/CADC), Bob Hanisch - Chair (STScI), Gareth Hunt (NRAO), George Jacoby (NOAO), Barry Madore (IPAC), Jonathan McDowell (SAO), Jan Noordam (NFRA), Dick Shaw (STScI), Karen Strom (Massachusetts), and Doug Tody (NOAO). The Local Organizing Committee is chaired by Richard Simon (NRAO), and has participants from NRAO, the University of Virginia Department of Astronomy, and the University of Virginia Computer Science Department.

The invited speakers for ADASS '96 currently include:

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Paul Butler (San Francisco State)

Tim Cornwell (NRAO), "Design and Implementation of Radio-Astronomical
Calibration and Imaging in AIPS++"

Gary Ferland (Kentucky), "Cloudy: Modeling the Emission from
Astrophysical Nebulae"

Keith Horne (St. Andrews), "Astrotomography"

Harvey Liszt (NRAO), "A Home-Grown but Widely Distributed Data Analysis
System"

Michael Rosa (ST-ECF), "Physical Modeling of Scientific Instruments"
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The key topics for ADASS '96 are:

- Simulation and Numerical Modeling
- Algorithms and Applications
- Software Costs, Management, and Planning

Over 110 abstracts have been submitted to this year's ADASS meeting, and a number of Birds-of-a- Feather (BoF) special interest sessions have been scheduled as well. The final program for both submitted papers and BoF sessions will be available in early September via the conference homepage on the World Wide Web, (http://www.cv.nrao.edu/adass/). Late posters may still be considered; please contact the conference immediately at adass96@nrao.edu if you are interested.

We have also scheduled a half-day tutorial about JAVA, the programming language for network-based applications that has become so popular on the World Wide Web. There will be a nominal charge for this tutorial which is in addition to the regular registration fee. And again, this year, there will be an IRAF Developer's Workshop following the Conference.

The preliminary program for the Conference is available on-line from the Conference home page (http://www.cv.nrao.edu/adass/). The Program includes specifics about hotel reservations, registration, abstract submissions, demo requests, and travel assistance. Important dates include:

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21 Aug. 1996:          Deadline for hotel reservations

12 Sept. 1996:         Deadline for late registration

22-25 Sept. 1996:      ADASS '96, Charlottesville, Virginia
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For further information and to be placed on the mailing list for the conference, please send a request to either:

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adass96@nrao.edu or to:

ADASS '96
C. White
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA  22903  USA
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Mark your calendar now and plan to attend ADASS '96!

Richard Simon LOC Chair, NRAO

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IRAF Update

A major development for the IRAF project in this past quarter was the award of a three-year NASA ADP grant to IRAF to support the Open IRAF initiative. The Open IRAF initiative will evolve and enhance IRAF in many ways to allow better integration of IRAF with non-IRAF software and data formats, and improve the support for user software development. These enhancements will include improved facilities for host execution of IRAF tasks and scripts, multi-language support, support for host-callable IRAF libraries, and support for dynamically loadable modules. The multi-language support will give the developer a choice of any of several different programming languages including C, Fortran, and probably C++. The Open IRAF funding will also aid our efforts to develop IRAF support for distributed objects and messaging and object component technology. This project represents a collaboration of the IRAF group at NOAO and all the major IRAF development sites within NASA, including HST, AXAF, SAO, and CEA. In addition to allowing this critical work to proceed, this grant represents significant funding coming in from outside NOAO to help support and develop IRAF, something which we especially appreciate in these tight budget times.

The second patch to IRAF V2.10.4 (V2.10.4-p2) is now available for the SunOS, Solaris, Linux (Slackware), and DEC Alpha OSF/1 platforms. There were some minor bug fixes as well as enhancements to support specific outside projects, but from the viewpoint of most users the main reason for its release was platform support, i.e., to support changes to operating system software or compilers. For Solaris/IRAF the patch adds support for Solaris 2.5 and the SunSoft version 4 compilers. This same distribution also supports Solaris 2.3 and 2.4. For Linux/IRAF the patch includes support for ELF-based versions of Linux, but still uses the a.out format binaries (see the README for details on dealing with ELF). For OSF/1, patch 2 was simply a bug fix upgrade since we are still running an older OSF/1 V2.0 operating system on our Dec Alpha. The current OSF1/IRAF release should run fine under OSF/1 V3 but not the newly released Digital Unix 4.0; steps are being taken to upgrade later this year. For a more detailed list of the bug fixes and enhancements included in the patch see the announcement posted to *adass.iraf.announce*, or visit the URL http://iraf.noao.edu/iraf/web/new_stuff/patch2.html.

IRAF V2.10.4-p2 is also available now for SGI/IRIX (see the iraf/v210/IRIX directory on *iraf.noao.edu*). This was essentially a new port and is a major upgrade for this platform. The port was done under IRIX 5.3; we plan to upgrade to IRIX 6.x later this year and release a new version of IRIX/IRAF at that time. X11IRAF binaries were also released for this platform, including support for ximtool, xgterm, and xtapemon (see the directory pub/v2103-beta on *iraf.noao.edu*). We would like to thank Wisconsin and the WIYN Observatory for letting us use their SGI for IRAF support.

IRAF users should look for a new release of the X11IRAF package about the time this Newsletter comes out. This release will include an integral print capability and limited file load/save support for ximtool. The print capability will support output of greyscale and color PostScript to a printer or to an EPS file. The file load/save option will initially support Sun rasterfiles only, but look for extensions to a variety of PC formats plus FITS and IRAF image formats in the future. Beginning with this new release support for the X11IRAF package will be expanded to include all currently supported X11IRAF hosts.

Another current IRAF systems project is the transparency monitor, an automated camera that continually observes Polaris to monitor the transparency of the sky (or at least a portion of the sky). This is a high priority for KPNO and WIYN for monitoring observing conditions during photometric runs and to help manage queue observing. It is an important and interesting project for IRAF as well as it involves developing new capabilities which are important for the future evolution of IRAF, such as distributed objects and messaging, support for heterogeneous systems (integrating IRAF and non-IRAF components), and other elements of the Open IRAF initiative.

Meanwhile work continues on IRAF V2.11, currently running on all the IRAF development systems. V2.11 will add the FITS image kernel and the latest versions of all applications, and will upgrade all the remaining IRAF platforms not already supported by V2.10.4-p2. Support for some older platforms is being dropped while other new platforms are being added. HPUX remains a popular platform and is probably the most significant platform not supported by V2.10.4-p2. VAX/VMS is still supported and V2.11 will add support for OpenVMS. Support for Apple A/UX has been dropped, but MkLinux will be added in the future. VAX/Ultrix support is being dropped but the DECstation running Ultrix will be supported a while longer, assuming we can keep the platform running locally. We are considering dropping support for IBM/AIX as our local machine is no longer able to support newer releases of AIX and we currently do not have the capability in-house to support this platform. Platform support is based in large part on user demand, so please let us know if you are concerned about support for any of these platforms.

As mentioned in the last Newsletter, support for the NOAO Mosaic will be a major project for the IRAF group in the latter half of the year. The NOAO Mosaic is an 8K x 8K CCD mosaic generating 128 MB (64 megapixel) images. Work thus far has concentrated on keywords and the data dictionary, the Mosaic data format, and design of the messaging system and the real time display and mosaic viewer. Although the keyword and data structure definition is still in progress, a draft of the specification is available at http://iraf.noao.edu/projects/ccdmosaic/. Comments on the new keywords are welcome: please contact Frank Valdes (valdes@noao.edu) for further information or feedback. The real time display and mosaic viewer will provide near real time display and quick look analysis of single frame or mosaic data during readout. The facility will be highly extensible to support integration with local instrumentation, to support various messaging systems for data capture, custom data formats, permit on the fly calibration, and so on. Contact Doug Tody (tody@noao.edu) for further information on the Mosaic data system design or the Mosaic RTD/viewer.

As a guest of the Starlink group at RAL, Doug Tody visited the UK in April to give a talk at the annual National Astronomy Meeting in Liverpool on future IRAF developments and IRAF/Starlink collaboration. Similar talks and user discussions took place at Cambridge and Oxford as well. Doug also spent several days working with the Starlink folks at RAL on various projects including Adam/IRAF integration, the UK mirror for the IRAF FTP/Web services (this is now up and running), use of the Starlink SLALIB library in IRAF, plans for the new IRAF Astrometry package, and plans for Gemini data handling.

Lindsey Davis has continued work on the image matching package IMMATCH. Three new image astrometry tasks CCMAP, CCSETWCS, and CCTRAN have been added to the package. The main function of these tasks is to compute a plate solution for an image using a matched pixel and celestial coordinate list, convert the computed plate solution to an image world coordinate system, and store it in the image header where it can be accessed by other world coordinate system driven tasks. The new tasks can also be used to compute simple geometric parameters for images such as plate scale and orientation, and to do simple astrometry. The new tasks are currently available as part of the version of IMMATCH in the iraf ftp archives. Lindsey is also continuing to work on developing the IRAF ASTROMETRY package.

Frank Valdes is working on CCD reduction software for the NOAO CCD Mosaic. This involves defining the data format and upgrading the CCDRED package. He has also been collaborating on making an astronomer-developed package for infrared mosaicing available to the IRAF community. The package is called DIMSUM and was developed by a number of astronomers including Peter Eisenhardt and Mark Dickinson. In June Frank attended the second conference on Statistical Challenges in Modern Astronomy held at Pennsylvania State University.

Nelson Zarate, who has worked for the past few years in the STSDAS group at STScI, has joined the IRAF group and started work here in July. Nelson is a member of the systems group (along with Mike Fitzpatrick and Rob Seaman) and will be involved in IRAF systems development and support as well as technical/user support.

The IRAF group plans to attend the ADASS '96 Conference in Charlottesville in September. If you are able to come to this Conference please stop by our demo display and see what the future of IRAF has to offer or discuss your ideas about IRAF with any of the IRAF programmers. We hope we see some of you at this very stimulating Conference that fosters discussions among scientists and programmers about reduction and analysis of scientific data.

Many of you have registered with the IRAF project--the main reason for this is to receive the IRAF Newsletter. But over the last few years, due to limited resources, the IRAF Newsletter issues have appeared infrequently. Although we feel a bit guilty about this the infrequent newsletters are offset by the rich assortment of Internet-based IRAF information services that we have added in the past couple of years. These include the IRAF Web pages, the FAQ, the adass.iraf USENET newsgroups, the listserver, the IRAFINFO facility, and the IRAF HotLine. As a further step we have decided to augment the Newsletter by auto-subscribing all registered users for whom we have an e-mail address to the mailing list associated with the *adass.iraf.announce* newsgroup. This way you will immediately receive any important announcements about new releases of system or application software. The traffic on this mailing list is low and should not be a burden, but instructions will be included with each mailing so that anyone who wishes to unsubscribe, or subscribe to other IRAF newsgroups and their associated mailing lists, can easily do so. We hope you find this additional source of information about IRAF useful. We have not discarded the Newsletter--we expect one to come out with the release of V2.11.

For further information about the IRAF project please see the IRAF Web pages at http://iraf.noao.edu/ or send e-mail to iraf@noao.edu. The adass.iraf newsgroups on USENET provide timely information on IRAF developments and are available for the discussion of IRAF related issues.

Doug Tody, Jeannette Barnes

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NOAO FTP Archives

The various FTP archives for the National Optical Astronomy Observatories can be found in the following FTP directories. Please log in as "anonymous" and use your e-mail address as the password. Alternate addresses for the following archives are given in parentheses.

```
ftp ctios1.ctio.noao.edu (139.229.2.1), cd ctio CTIO archives--Argus
   and  1.5-m  BME  information, 4-m PF plate catalog, TEX template for
   e-mail proposals, filter library, instrument manuals, standard star
   fluxes.

ftp ftp.sunspot.noao.edu (146.5.2.1), cd pub Directory containing SP
   software and data products --coronal maps, active region lists, sunspot
   numbers, SP Workshop paper templates, information on international
   meetings, SP observing schedules, NSO observing proposal templates,
   Radiative Inputs of the Sun to the Earth (RISE) Newsletters and SP
   newsletters (The Sunspotter).

ftp ftp.noao.edu (140.252.1.24), cd to one of the following directories:

   aladdin (gemini.tuc.noao.edu)--Information on the Aladdin program which
   is a collaboration between NOAO and the US Naval Observatory to develop
   a 1024 x 1024 InSb infrared focal plane at the Santa Barbara Research
   Center.

   catalogs--Directory of astronomical catalogues: the Jacoby et al.
   catalog, "A Library of Stellar Spectra"; the "Catalogue of Principal
   Galaxies"; the "Hipparcos Input Catalogue"; the "Lick Northern Proper
   Motion Program: NPM1"; and the "Coud\'{e} Feed Spectral Library."

   fts (argo.tuc.noao.edu, cd pub/atlas)--Directory containing solar FTS
   high-resolution spectral atlases.

   gemini (ftp.gemini.edu, cd pub)--The FTP archives for the Gemini 8-m
   Telescopes Project.

   gong (helios.tuc.noao.edu, cd pub/gong)-- Directory containing GONG
   helioseismology software and data products--velocity, modulation and
   intensity maps, power spectra.

   iraf (iraf.noao.edu)--IRAF network archive containing the IRAF
   distributions, documentation, layered software, and other IRAF related
   files. It is best to login to iraf.noao.edu directly to download large
   amounts of data, such as an IRAF distribution.

   kpno (orion.tuc.noao.edu)--KPNO directory containing filter lists and
   transmission data, CCD and IR detector characteristics, hydra (WIYN)
   information, LaTeX observing form templates, instrument manuals, KPNO
   observing  and  monthly support schedules, 4-m PF platelogs, reference
   documents, and sqiid data reduction scripts.

   kpvt (argo.tuc.noao.edu)--Directory containing various KP VTT solar
   data products - magnetic field, He I 1083 nm equivalent width, Ca II
   K-line intensity.

   noao (gemini.tuc.noao.edu)--NOAO e-mail and phone lists, Royal
   Greenwich Observatory electronic mail address databases, list of
   areacodes and zipcodes for the US, various LaTeX tidbits, report from
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Gemini WG on the high resolution optical spectrograph, etc.

nso (orion.tuc.noao.edu)--Directory containing NSO observing forms.

sn1987a--An Optical Spectrophotometric Atlas of Supernova 1987A in the
LMC.

tex--LaTeX utilities for the AAS and ASP.

utils--Various utilities but only contains some PostScript tools at
this time.

weather (gemini.tuc.noao.edu)--weather satellite pictures.

wiyn (orion.tuc.noao.edu) - WIYN directory tree containing information
relating to the WIYN telescope including information relating to the
NOAO science operations on WIYN.
```

The following numbers are available for the machines mentioned above:

```
argo.tuc.noao.edu       = 140.252.1.21
ctios1.ctio.noao.edu    = 139.229.2.1
ftp.gemini.edu          = 140.252.15.71
ftp.noao.edu            = 140.252.1.24
ftp.sunspot.noao.edu    = 146.5.2.1
gemini.tuc.noao.edu     = 140.252.1.11
helios.tuc.noao.edu     = 140.252.8.105
iraf.noao.edu           = 140.252.1.1
orion.tuc.noao.edu      = 140.252.1.22
```

Questions or problems may be directed to the following: Steve Heathcote (sheathcote@noao.edu) for the CTIO archives, Frank Hill (fhill@noao.edu) for all solar archives, Steve Grandi or Jeannette Barnes (grandi@noao.edu or jbarnes@noao.edu) for all others (and they will direct your questions as needed).

For further information about the NOAO observatories and projects see the World Wide Web URL: http://www.noao.edu/.

Jeannette Barnes

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