**NOAO Newsletter - June 1997 - Number 50**

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## NOAO Highlights!



## Director's Office



## Cerro Tololo Inter-American Observatory



## Kitt Peak National Observatory



## National Solar Observatory



## Global Oscillation Network Group



## US Gemini Program



## Central Computer Services






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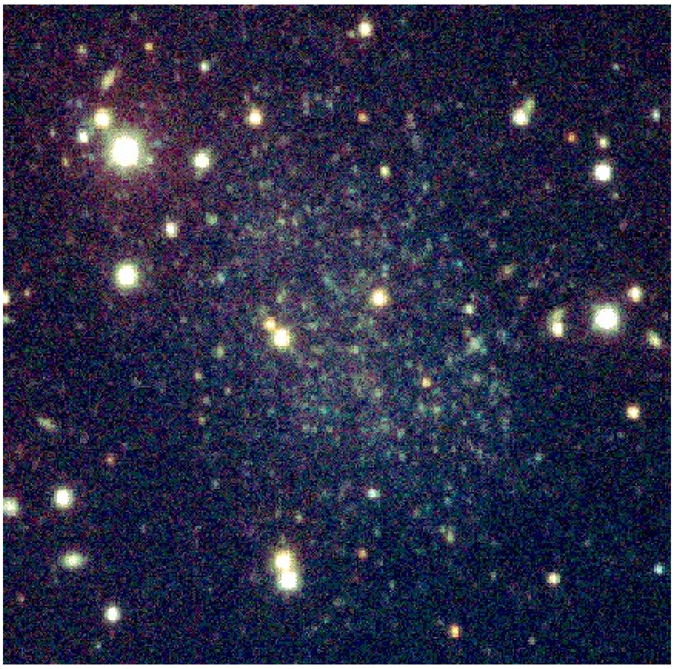
# A New Isolated Dwarf in the Local Group

A new dwarf member of the Local Group of galaxies has been identified by CCD images obtained at the CTIO 1.5-m telescope. The discovery was made by Alan Whiting, George Hau (both of Cambridge), and Mike Irwin (RGO), based on a candidate identified during visual inspection of the UK Schmidt southern sky survey plates. The newly discovered galaxy, in the constellation of Antlia, lies in a region of space previously thought to be devoid of nearby dwarf galaxies. The Antlia dwarf is of special interest as it is isolated in the Local Group, rather than being a satellite of the Milky Way or M31. It can thus be used as a probe of the dynamical evolution of the Local Group.

Visual inspection of 894 UK Schmidt Telescope photographic plates covering the entire southern sky had been used to discover many uncatalogued large, diffuse low surface brightness objects. Digitization of candidates on the RGO PDS microdensitometer confirmed their potentially interesting nature, and followup deep CCD imaging on the CTIO 1.5-m telescope showed that two such objects could be clearly resolved into stars. Red giants visible in the Antlia dwarf place it in the Local Group, while blue and red supergiants visible in the second candidate dwarf (in the constellation Argo) suggest that it lies beyond the Local Group.



**Caption:** The newly discovered Antlia dwarf galaxy, from an R band CCD image taken with the CTIO 1.5-m telescope. The brightest stars of Antlia are readily resolved, placing it within the Local Group.

On the sky survey plate Antlia looks like a fuzzy low surface brightness patch some 3' in diameter. This appearance is characteristic of potential new Local Group dwarf members and a host of interlopers such as old planetary nebulae, Galactic reflection nebulae, and distant low surface brightness galaxies. Whiting, Hau, and Irwin thus required followup CCD imaging at CTIO to classify their dwarf candidates.

The Antlia dwarf appears to be similar to other dwarf spheroidal galaxies. The brightest stars are easily resolved and the galaxy appears smooth and devoid of any obvious concentrations of stars or clusters. A deep H image reveals no obvious star forming regions and there are no young hot blue stars apparent in any of the deep CCD images taken. The color and luminosity distribution of Antlia stars is typical of the Milky Way satellite dwarf spheroidals; comparison with these and other nearby galaxies suggests that Antlia is roughly 1 Mpc distant. Antlia is most similar in appearance to the Tucana dwarf, the only other isolated Local Group dwarf spheroidal galaxy known. At a distance of 1 Mpc the apparent size of Antlia on the deep CCD images implies that it is only 1-2 kpc in diameter and probably only contains a million or so stars, placing it firmly at the faint end of the galaxy luminosity function.

Being far away from both the Milky Way and M31, Antlia will help to constrain the age and total mass of the Local Group via timing arguments. Members of the Local Group were born close together in space but with sizeable relative velocities. Knowing their present distances and velocities plus the masses of the larger members makes it possible to work backwards to derive an age of the Universe independent of $H_o$.

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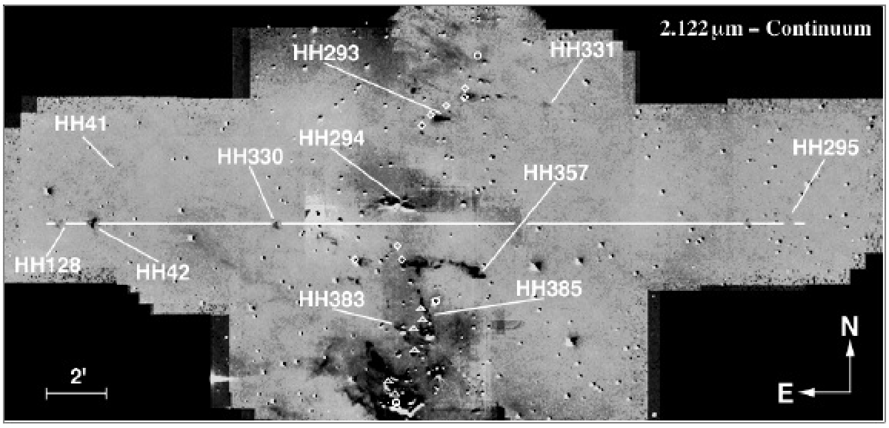
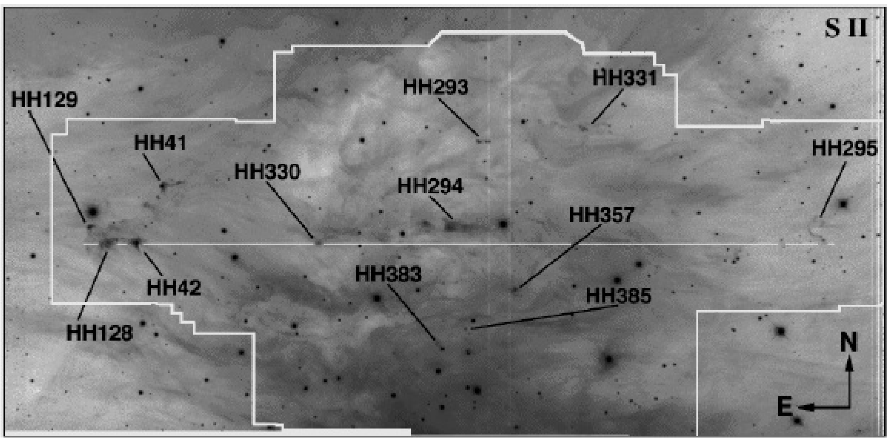
# Images of Shocks in the Orion Molecular Ridge

Ka Chun Yu, John Bally, David Devine (all at Colorado), and Bo Reipurth (ESO) used IR cameras on the KPNO 2.1-m and CTIO 1.5-m telescopes to map the Orion molecular cloud sources OMC-2 and OMC-3 in the 2.12 m line of shocked molecular Hydrogen ($H_2$). They find that the OMC-2/3 region is one of the most active sites of ongoing low to intermediate mass star formation known. The discovery of nearly a dozen collimated outflows from young stellar objects (YSOs) and more than 80 individual $H_2$ emitting shocks demonstrates that outflows from young stars are churning this molecular cloud.

OMC-2 and OMC-3 are two major star forming cloud cores that form a molecular ridge bounded by the Orion Nebula to the south and NGC 1977 to the north. Previous infrared investigations have shown that the majority of stars on the line of sight to OMC-2 are likely young members of the Orion OB association. Images of continuum emission by dust at 1.3 mm show a remarkable north-south chain of over a dozen class-0 protostars embedded in a thin dust filament extending from OMC-2 to OMC-3 (see Chini et al., 1997, ApJL, 474, L135).

The figures show a continuum-subtracted 2.12 m line image of a 24' 11' field in the OMC-2/3 region, and an optical narrowband S [II] image of the same region, taken with the CTIO 1.5-m. The locations of known IRAS (circles), far-infrared (triangles), and mm continuum (diamonds) sources are shown in the near-infrared difference image. Also identified are previously known HH objects to the east, the Haro 5a/6a reflection nebula (containing HH294), and a slew of new HH objects. The S [II] image also shows in a white outline the area covered in the difference mosaic.




The mm cores, the far-infrared sources, and the sources for all of the YSO outflows fall on a narrow molecular ridge that runs roughly N-S. The suspected YSOs are so deeply embedded that they are invisible in the S [II] image, where only a fraction of the shocks are visible as HH objects. In fact, the most well known set of visible shocks to the east (HH41, HH42, HH128, and HH129) are well away from the deepest extinction. Without imaging with an IR shock-excited tracer, it would be extremely difficult if not impossible to connect shocks with individual outflows and sources. Also seen are scores of individual $H_2$ knots, which show up as black in the difference image, which delineate flow axes. The flow morphologies include chains of $H_2$ knots, bright jets, bow shocks, and streamers, frequently coinciding with known HH objects or millimeter emission sources. Other structures, such as the faint fan-shaped filamentary structures to the far north in the center of the mosaic, may mark molecular gas excited by UV-induced fluorescence rather than shocks.

The longest suspected single outflow in the image is a remarkable E-W flow (highlighted by the horizontal line in the figures) that connects with HH128 to the east and HH295 to the west, for a length of 19', or at the distance to Orion, 2.6 pc. It is the first parsec-scale YSO outflow to be discovered in the infrared, although the suspected source is so deeply embedded that it is not seen at 2 m and is not associated with a mm or far-infrared core.

The total 2.12 m $H_2$ emission line luminosity within the field is ~ 0.5 $L_\odot$. For an excitation temperature of $T_e$ ~ 2000 K, the total luminosity for $H_2$ emission is 10 times that of the 2.12 m line alone. Assuming a 2.2 m extinction of 1 mag, the extinction-corrected $H_2$ luminosity is then ~ 12 $L_\odot$. This is a strong lower limit on the rate at which mechanical energy is injected into the molecular cloud since $H_2$ is but one of many important coolants that radiate away thermal energy in shocks.

The Orion Nebula has produced on the order of 500 to 1,000 young stars, including a number of high mass ones in the last million years. Although much less luminous, the OMC-2 and 3 cores and the dense ridge of molecular gas that extends north of the Orion Nebula appear to be an extremely active site of on-going star formation that contains over a dozen class-0 protostars, dozens of active outflows, and perhaps hundreds of more evolved young stars that have formed within the last few million years. The large number of active flows and sub-mm sources indicates that this region is continuing to form stars at a high rate. Assuming that the depth of this star forming ridge is about the same as its projected width, 4' or 0.5 pc, then the effective volume where most of the young stars are located is on the order of several cubic parsecs. If the duration of the phase during which an outflow is only observable by means of its $H_2$ or CO emission (as opposed to shocks visible as Herbig-Haro objects) is about 3 X $10^4$ years, comparable to the duration of the lifetime of class0 YSOs, then the formation rate must be about 30 to 40 per $10^5$ years. The cumulative effect of the jets and outflows from such sustained star formation must be an important source of dissociating shocks and turbulent motions, and must play a crucial role in the dynamics, chemistry, and evolution of star formation within the cloud.

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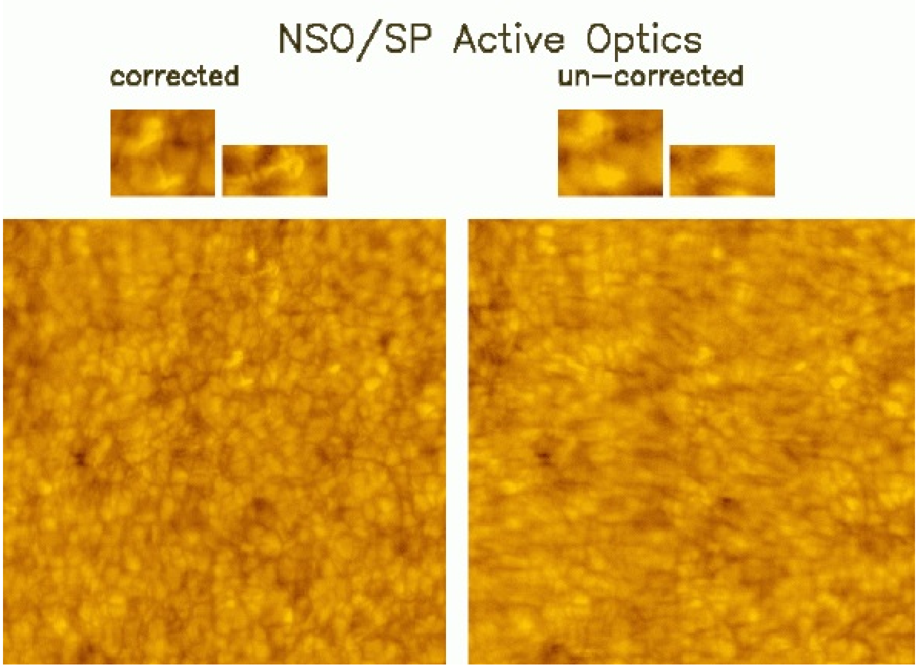
# Active Optics Control Loop Closed at the Sac Peak Vacuum Tower Telescope

In late 1995, the National Solar Observatory and the USAF Phillips Lab group at Sac Peak began the co-operative development of an active optics system for the Vacuum Tower Telescope. Although the immediate objective of this project is to provide a system for sensing and correcting the slowly varying aberrations in the optical system of the VTT, the system is also intended to provide a platform for further development of a full atmospheric compensation system for use in solar imaging. A correlating 69-subaperture Shack-Hartmann wavefront sensor, capable of using solar granulation as its target, and a 97-actuator deformable mirror, manufactured by Xinetics, Inc, are the key components of the new system. During March 1997, the control loop was closed for the first time at the VTT. The ability of the active optics system to improve the resolution performance of the VTT using both a small sunspot and granulation as the wavefront sensing target was successfully demonstrated. The illustration shows corrected and uncorrected G-band (430 nm) solar granulation images, obtained under comparable seeing conditions. The principal telescope aberrations in this test were introduced by the uncooled entrance window of the VTT. We believe that the corrected telescope was compensated to better than 1/10 wave by the active optics system during this test.




Thomas Rimmele, Richard Radick (USAF/PL)

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# NOAO Educational Outreach

With the recently awarded NSF grant, Educational Outreach at NOAO has reached a stable configuration, balancing our efforts between direct classroom involvement (Project ASTRO), teacher enhancement, and the development of instructional materials. More information can be found on the WWW at: http://www.noao.edu/education/noaoeo.html.

NOAO facilities will be used to support *The Use of Astronomy in Research Based Science Education*, a Teacher Enhancement Program funded through the NSF's Directorate for Education and Human Resources. Suzanne Jacoby, Jeff Lockwood (Sahuaro High School teacher), and Don McCarthy (Univ. of Arizona astronomer) are co-investigators on this four-year project, which offers a research experience to middle and high school teachers during summer workshops beginning in 1997. Participants will experience how science is practiced and develop strategies for paralleling those techniques in their classrooms. The research experience extends to the classroom during the academic year with datasets in preselected areas of astronomical research being provided over the Internet. We are recruiting Tucson teachers for this summer's pilot program and will select teachers from across the nation in subsequent years. This program will be a cornerstone of the NOAO Educational Outreach program, and our user community will be kept informed and involved as the project develops.

Matt Penn and Harry Jones (NSO scientists) received Educational Outreach Supplements to recently awarded science grants in NASA's Sun-Earth Connection program. Harry Jones will be overseeing a three year effort to develop a CD-ROM about the Sun's magnetic cycle to improve student and public understanding of this topic. The CD-ROM will include a day-by-day record of the 22-year solar activity cycle as recorded in magnetograms and He I 1083 nm spectroheliograms at the NSO Kitt Peak Vacuum Telescope. This project funds the return of Michael Gearen (Honolulu Punahou School science teacher); Mike completed a prototype video spanning two years of magnetogram data during his sabbatical last summer.

In collaboration with the UA Media Arts Department, Matt Penn will produce a video about dramatic, short time scale Solar events such as flares and solar oscillations. Observations from ground-based NSO telescopes and the SOHO satellite will be used to illustrate the awesome power and size of astronomical objects. The video product will appeal to a wide range of audiences including high school and undergraduate students, outreach programs for the general public, and public and cable television channels.

Matt has also worked with students from Salpointe High School in Tucson this spring on Blazing Sunspots: a project investigating connections of field lines between members of groups of sunspots with data from the KP/VT telescope. The team of three students won a Grand Award at the Southern Arizona Science and Engineering Fair, giving them full, four-year scholarships to the University of Arizona and a trip to complete in the Intel International Science and Engineering Fair in Kentucky in May of 1997. This project involves Richard Siegel (NOAO Outreach Advisory Board teacher) and is seen as an example of successfully bringing astronomical research into the classroom, the type of activity that will be facilitated through the NSF Teacher Enhancement grant.

*Visitors from Space - Comets!* a color brochure on the comets has been distributed to 300 classrooms in the Southwest and is featured on the NOAO Educational Outreach Web Page. Funded by a 1996 NASA IDEA Grant, the brochure brought timely and accurate information into the classroom to supplement newspaper and television headlines about Comet Hale-Bopp. The Southwestern Consortium of Observatories for Public Education (SCOPE) provided an effective distribution network for the brochures. This inter-observatory group was formed to promote public awareness of astronomy and support science education. SCOPE includes representatives from NSO/SP, Apache Point, McDonald, VLA/NRAO, Whipple, Lowell, and KPNO.

Suzanne Jacoby

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# NOAO Preprint Series

The following preprints were submitted during the period 1 February to 30 April 1997. Please direct all requests for copies of preprints to the NOAO author marked with an asterisk.

737 *Balasubramaniam, K.S., Keil, S.L., Tomczyk, S. "Stokes Profile Asymmetries in Solar Active Regions"

738 *Sarajedini, A. "A Review of Recent Advances in the Study of Blue Straggler Stars"

739 Spinrad, H., *Dey, A., Stern, D., Dunlop, J., Peacock, J., Jimenez, R., Windhorst, R. "LBDS 53W091: An Old, Red Galaxy at z = 1.552"

740 *Bower, G.A., Heckman, T.M., Wilson, A.S., Richstone, D.O. "The Nuclear Ionized Gas in the Radio Galaxy M84 (NGC 4374)"

741 *Wolff, S.C., Simon, T. "The Angular Momentum of Main Sequence Stars and its Relation to Stellar Activity"

742 *De Young, D. "Growth of Large Scale Structures in Two Dimensional Mixing Layers"

743 *Wallace, L., Hinkle, K. "Medium-Resolution Spectra of Normal Stars in the K Band"

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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.

Baum, W.A., Hammergren, M., Thomsen, B., Groth, E.J., Faber, S.M., Grillmair, C.J., *Ajhar, E.A., "Distance to the Coma Cluster and a Value for H_0 Inferred from Globular Clusters in IC 4051"

Devereux, N., Ford, H., *Jacoby, G., "Hubble Space Telescope Imaging of the Central 1 Kpc of M81"

*Eggen, O.J. "The Abundance of CN, Calcium and Heavy Elements in High Velocity Stars"

*Eggen, O.J. "Kinematics and Metallicity of Stars in the Solar Region"

Hall, P.B., Martin, P., DePoy, D.L., *Gatley, I. "The Optical/Near-IR Colors of Broad Absorption Line Quasars, Including the Candidate Radio-Loud BAL Quasar 1556+3517"

Kormendy, J., Bender, R., Magorrian, J., Tremaine, S., Gebhardt, K., Richstone, D., Dressler, A., Faber, S.M., Grillmair, C., *Lauer, T.R. "Spectroscopic Evidence for a Supermassive Black Hole in NGC 4486B"

John Cornett, Suzan Ecker,
Elaine Mac-Auliffe, Jane Marsalla,
Shirley Phipps, Cathy Van Atta

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# SN 1987A: Ten Years After

On 23 February 1987, SN 1987A appeared in the Large Magellanic Cloud, sparking an intensity of observational and theoretical activity rarely before experienced in astronomy. To celebrate the 10th anniversary of this event, a week-long workshop was held in La Serena on 22-28 February. This meeting marked the fifth in a series of scientific workshops begun in 1990 and jointly sponsored by CTIO and ESO. We were pleased to have the the Las Campanas Observatory join us in co-sponsoring the meeting, and look forward to continued collaboration between all three observatories for future workshops.

Although the idea behind the SN 1987A workshop was to celebrate the many discoveries that have come (and are still coming!) from the study of this important supernova, the meeting also highlighted what has been learned in general about core-collapse supernovae and explosive nucleosynthesis over the past 10 years. Among the topics discussed were: the pre-explosion evolution of Sk 202-69 as seen in the general framework of the stellar population and chemical evolution of the LMC; early and late time observations of SN 1987A including neutrinos, gamma-rays, X-rays, UV, optical, IR, and radio; modeling of the evolution of the SN; nucleosynthesis in SN 1987A and in other type II SNe; observations and modelling of the formation of dust in the SN debris; the circumstellar environment of Sk 202-69 and the interaction with the SN; SN 1987A in the context of observations and modeling of other type II SNe; the distance to the LMC as derived from observations of SN 1987A, and the general use of SNe II as distance indicators; and the future evolution of SN 1987A. The workshop was attended by approximately 90 astronomers from all over the world, many of whom had never visited Chile before.

The neutrino burst that announced the core collapse and resulting explosion of Sk 202-69 was detected at 7:35 UT on 1987 23 February. In keeping with the supernova theme, the Workshop began with a real bang---the "Ten Years After Party" on the night of Saturday, 22 February. Although the "official" party ended just after midnight, at the precise moment of the 10th anniversary of the neturino burst (4:35 a.m. local time), many true disciples could be found in the hotel swimming pool, which presumably served as a symbol of the giant detectors that intercepted the ~ 20 neutrinos from SN 1987A!

SN 1987A was discovered at Las Campanas Observatory independently by Ian Shelton and Oscar Duhalde around midnight on 23 February 1987. In honor of this historic event, the workshop participants took a Sunday afternoon "pilgrimage" to Las Campanas. The highlight of this tour was seeing the mighty 0.25-m Astrograph with which Shelton took his discovery plate, and a tour of the twin Magellan 6.5-m telescopes that are currently under construction. A side trip to La Silla was included, and later in the week workshop participants visited Cerros Tololo and Pachon.

Space limitations do not allow us to summarize all of the interesting papers presented at the workshop. Look for the workshop proceedings, which will be published in the ASP Conference Series later this year. By most accounts the workshop was a great success---all agreed to return to La Serena in 2007 to celebrate the 20th anniversary!

Mark Phillips, Nick Suntzeff (CTIO),
Patrice Bouchet (ESO), Pat Knezek (LCO)

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# CCD News: The Bad and the Ugly

The CCD news is almost all "bad" this time, and what's left is "ugly." The first piece of bad news is that our best large format CCD, Tek 2048 #4, suddenly died in December 1996 and attempts to revive it have not been successful. It does not see light, and all four amplifiers are inoperative. The CCD has been returned to SITe for a post-mortem. This CCD has mostly been used at the 4-m and 1.5-m telescopes for direct imaging and with the echelle spectrographs. We will continue to offer a Tek 2048 (either #3 or #5) for these applications. Tek 2048 #3 is mostly dedicated to direct imaging at the 0.9-m telescope, so it's likely that users on the larger telescopes will be scheduled with Tek 2048 #5. Although all four amplifiers of #5 function, one has higher than usual noise (~ $20e^-$ rms); thus it is normally read out through two amplifiers. For direct imaging at the 4-m prime focus with broad band filters Poisson noise from the sky often dominates instead, and some users have preferred to read the CCD in quad mode to gain efficiency from halving the readout time. Otherwise, Tek 2048#5 is an excellent quality CCD, the only obvious cosmetic defect being a single adjacent pair of blocked columns. In particular, it does not have the myriad of low-level (few $e^-$) traps that are an unfortunate characteristic of Tek 2048 #3, which although of little consequence for most direct imaging applications, degrades images with near-zero background. Therefore we will always try to schedule #5 for use with the echelle spectrographs.

Note that the BTC Mosaic Imager is also available for use at the 4-m prime focus, and is to be preferred for all programs except those for which the large area coverage is not important, or for programs requiring filters unavailable in 6 6 inch size.

The second CCD causing concern is the STIS 2048 CCD, which is dedicated to the Schmidt telescope. This CCD is front-illuminated, and has a coating of lumogen (Metachrome) that provides UV and blue sensitivity. For the past year this coating has been slowly delaminating, although no part as yet has become completely detached. Visually, on flat field exposures, the CCD appears to have several "cracks" and "bands" meandering over the surface. These are a few percent more sensitive than the majority of the CCD. These features are also wavelength dependent and are more prominent at shorter wavelengths. On closer examination under a microscope one can see a fine example of plate tectonics. The cracks are actually boundaries between two plates where material has piled up. It appears that as yet there are no regions on the CCD that are devoid of metachrome. Despite the bizarre appearance, standard flat-fielding techniques do a good job of producing flat object frames, and there are no discernible image profile variations when a star falls on a crack. However, the delamination is steadily progressing with time, and eventually it is likely that a large piece of the coating will separate from the CCD. If this happens, then one possibility is to remove the whole coating chemically. This is not without risk. Thus we have arranged that the identical CCD used on the Burrell Schmidt at KPNO will be sent to CTIO when that CCD is replaced by Case after it assumes responsibility for operations later this year.

Here is a brief list of our CCDs:

Tek 2048 #5: 4-m and 1.5-m direct imaging, echelles
Tek 2048 #3: 0.9-m direct imaging
STIS 2048: Schmidt direct imaging
Loral 3K: 4-m spectroscopy (R-C, Argus, Echelle)
Loral 1K: 1.5-m spectroscopy
Tek 1024 #2: Fabry-Perot, some direct imaging

All these CCDs are being operated by Arcon CCD controllers. See the CTIO WWW pages for more information on CCD characteristics and Arcon.

Alistair Walker

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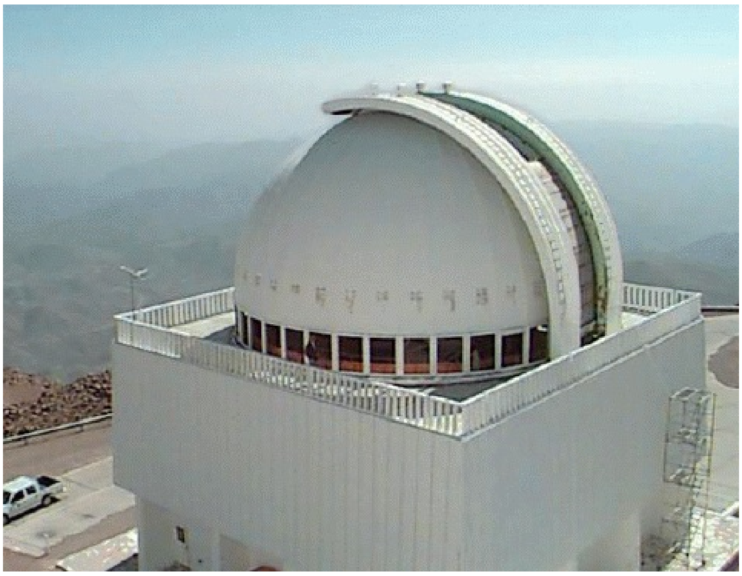
# 1.5-m Telescope Ventilation



**Caption:**The 1.5-m telescope with ventilation doors open. Installation of 32 doors, each 1.5 meters square, was completed in April. Controls allow independent opening by quadrants; partial opening of each octet is also possible.

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# The Return of the CTIO REU Program

The NSF Research Experiences for Undergraduates (REU) Program at CTIO has hosted a total of eight undergraduate student research assistants over its two years of existence, 1995 and 1996. Both the students and the CTIO staff have found the program highly rewarding. The CTIO REU program offers students the unique opportunity to gain observational experience studying objects in the rich Southern hemisphere (the Magellanic Clouds, the Galactic center, etc.), while also providing a chance to work alongside Chilean astronomy and engineering students who come to CTIO for summer projects.

After losing our excellent REU site director, Eileen Friel, the CTIO REU program suffered a disappointing hiatus this year, but plans are underway to bring the program back to life for January 1998! Pending NSF approval of funding, we anticipate offering four Undergraduate Research Assistant positions for a 10 week program starting in January 1998 under the direction of a new site director, Chris Smith. The deadline for applications is 26 September. For more information, visit our REU web page at: http://www.ctio.noao.edu/reu.html.

Chris Smith (Michigan),
Malcolm Smith, Mark Phillips

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# Large Filters for CCD Imaging

We are slowly but steadily increasing our complement of large filters for direct imaging. 4 4 inch filters can be used for imaging with large format, single CCD systems at the 0.9-m, 1.5-m and 4-m. This size will severely vignette mosaic imagers, however. The BTC Mosaic Imager can accommodate 6 6 inch filters, although purchases made by CTIO are slightly smaller to be compatible with the NOAO Mosaic Imager. Although these filters are expensive and we have a limited filter budget, suggestions for new filter purchases are always welcome. We hope to purchase some Ha and O[III] filters for the BTC later this year.

New large filters recently received are:

- Johnson-Cousins UBVRI set, 146 146 mm and 12 mm thick, for use with the 4-m prime focus BTC Mosaic Imager, and eventually with the NOAO Mosaic.

The BVR filters are identical to the filters used with the NOAO Mosaic at KPNO. The I band filter is an interference filter to the same specification as our 4 4 I filters. The U filter does not match Johnson U very well, and has a narrower passband rather similar to Sloan u. The throughput is rather disappointing, with a peak transmission of only 50%. Later this year we hope to replace this filter with one that more nearly matches Johnson U.

- Sloan Digital Sky Survey (SDSS) ugriz set, 4 4 inch format (see AJ, 111, 1748, 1996 for a description of the SDSS photometric system).

Nominal central wavelengths and FWHM in Angstroms are u (3513/628), g (4759/1430), r (6265/1483), i (7734/1500), and z (9100/1400). The long wavelength cut-off for the z filter is CCD dependent.

- Calcium II H and K filter, 4 4 inch.

This filter supplements our Stromgren set, and is intended to permit Caby photometry (see AJ, 101, 237, 1991). The filter has center wavelength and FWHM 3960/100, with peak transmission of 50%.

Alistair Walker

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# Bringing Visitor Equipment to CTIO: Helpful Hints for Import and Export

A growing number of our scientific visitors observe with their own specialized equipment, transported between diverse locations around the world for short term use, and often with tight time constraints for arrival at various destinations. This trend is likely to continue and expand to larger, more complex and costly instrumentation as the next generation of large telescopes comes on line. Often this equipment has high dollar value or is irreplaceable, with limited or no options for insurance. Even repairable damage can mean loss of an observing run while still paying all the associated costs. The complexity of import/export rules, especially pertaining to high technology items, can cause time consuming delays. In these circumstances, the speed and reliability of the transport logistics can be central to the success of an observing program. Therefore, if your observation program at CTIO is dependent on custom instrumentation that you must ship into and out of Chile separately from your own travel, read on!

In the US, Clark Enterline (centerline@noao.edu) and his staff in the CTIO Tucson Support Office will assist you with expert guidance and support on legal requirements and "red tape" when dealing with US export regulations. They can handle customs procedures, contracting with overseas shippers, buying insurance, return formalities and payment of freight bills. In Chile we also provide similar specialized help to secure the prompt and safe passage of your equipment through Customs until its final destination at CTIO. The bulk of this activity is handled by our Santiago office staff (hbustos@noao.edu), in coordination with Tucson, La Serena and Cerro Tololo. We would like to share with you some important aspects of an overseas shipping operation.

Essentially, international freight moves on documents. Precise, accurate, timely documentation is of paramount importance. The most common documents that are required for an export-import operation, are the Bill of Lading or Air Way Bill, which is issued by the transportation carrier; the insurance policy, when insurance coverage is bought; and an Invoice Pro-Forma or Packing List (which you provide), listing the exact amounts and description of the equipment being shipped and the commercial values that must be declared to the Customs involved in the operation. Furthermore, certain items including personal computers, electronics, and optical equipment must have prior approval by either the US Commerce or State Departments. Obtaining licenses is sometimes a lengthy business. You should contact Clark Enterline as early as possible---at least a month before the shipping date---so exportability can be determined and the proper approvals secured.

Chilean importation procedures also require full documentation, which we must present to the appropriate Ministry at least ten days before your arrival. With the import approvals in hand, we can meet your shipment at the airport, expedite it through Customs under the legal provisions applicable to AURA, and get it speedily on its way to La Serena. If the shipping documentation is late, incomplete, or inaccurate, or there are security mishaps or partial receipts, this procedure can take several days to complete.

Appropriate packaging is necessary to protect your valuable assets from the rigors of international freight, and to insure they will arrive intact and together. Mechanical shock is the most likely source of damage for most items. Pack securely with isolation, immobilization, or cushioning as appropriate. Double boxing is a sound precaution. For the outer carton, use new, plain, heavy duty cartons clearly labeled with the destination address. Customs officials are alert for dutiable items, so reusing the carton your workstation came in as an exterior shipping container might cause delay and the opening and handling of your equipment. The recipient should be identified as AURA, Inc. with the name of the principal investigator added in parentheses. It is good practice to put a copy of the packing list on every shipping box. The use of a few large, unwieldy cartons is better than many small, easily handled (or mislaid, or stolen) boxes to insure everything arrives together.

Once your shipment arrives in Santiago and passes through Customs, we will send it by truck to La Serena. An AURA vehicle makes this trip approximately biweekly; otherwise, we must contract for a commercial carrier. Delivery can be to the La Serena offices or directly to Cerro Tololo. It is important for us to know your schedule requirements and delivery preferences. Apart from checking for obvious external damage, we will simply hold equipment for unpacking by the investigator. Other arrangements should be made with your scientific contact person.

Use e-mail to keep the Tucson and Santiago offices, and your scientific contact in La Serena, informed about schedules, advance shipping information, changes or delays, or other information that contributes to the logistics. While we have concentrated on getting from the US to Cerro Tololo, the return trip can be equally complex. Be sure to clearly explain your return schedule requirements in advance so that we can get the logistics in place.

Sometimes equipment is sufficiently limited that investigators prefer to bring it as accompanied baggage. We have not discussed this, as it offers some special handling and Customs concerns, which are best addressed on a case by case basis.

Hernan Bustos (hbustos@noao.edu)
AURA, Inc. Santiago Business Office

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# Observing Request Statistics: August 1997 - January 1998

**4-m Telescope: 142 nights**

| Requests | | Nights Requested | | | | |
|---|---|---|---|---|---|---|
| Dark | Bright | Dark | Bright | Instrument | Nights | % |
| 10 | 6 | 42 | 21 | Argus | 63 | 12.7 |
| 0 | 4 | 0 | 9 | COB | 9 | 1.8 |
| 4 | 0 | 7 | 0 | CF/CCD | 7 | 1.4 |
| 26 | 8 | 88 | 35 | CS/CCD | 123 | 24.7 |
| 5 | 15 | 18 | 59 | Ech/CCD | 77 | 15.5 |
| 0 | 4 | 0 | 14 | CIRIM | 14 | 2.8 |
| 0 | 15 | 0 | 51 | IR/IRS | 51 | 10.3 |
| 13 | 2 | 37 | 4 | PF/CCD | 41 | 8.2 |
| 25 | 1 | 83 | 4 | BTC | 87 | 17.5 |
| 3 | 0 | 11 | 0 | RF-P | 11 | 2.2 |
| 0 | 4 | 0 | 14 | Visitor | 14 | 2.8 |
| -- | -- | --- | --- | | --- | ----- |
| 86 | 59 | 286 | 211 | | 497 | 100.0 |

| | Now | Last Semester | Semester Before Last |
|---|---|---|---|
| No. of requests | 145 | 131 | 133 |
| No. of nights requested | 497 | 433 | 471 |
| Oversubscription | 3.50 | 2.99 | 4.13 |
| Average request | 3.43 | 3.31 | 3.54 |

**1.5-m Telescope: 149 nights**

| Requests | | Nights Requested | | | | |
|---|---|---|---|---|---|---|
| Dark | Bright | Dark | Bright | Instrument | Nights | % |
| 3 | 2 | 24 | 12 | ASCAP | 36 | 11.8 |
| 23 | 5 | 115 | 19 | CF/CCD | 134 | 44.1 |
| 7 | 8 | 25 | 33 | CS/CCD | 58 | 19.1 |
| 1 | 3 | 10 | 25 | Ech/CCD | 35 | 11.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 11 | 0 | 34 | CIRIM | 34 | 11.2 |
| 1 | 1 | 5 | 2 | RF-P | 7 | 2.3 |
| 0 | 0 | 0 | 0 | Visitor | 0 | 0 |
| -- | -- | --- | --- | | --- | ----- |
| 35 | 30 | 179 | 125 | | 304 | 100.0 |

| | **Now** | **Last Semester** | **Semester Before Last** |
|---|---|---|---|
| No. of requests | 65 | 45 | 55 |
| No. of nights requested | 304 | 220 | 270 |
| Oversubscription | 2.04 | 1.39 | 1.66 |
| Average request | 4.68 | 4.89 | 4.91 |

**0.9-m Telescope: 171 nights**

| **Requests** | | **Nights Requested** | | | | |
|---|---|---|---|---|---|---|
| **Dark** | **Bright** | **Dark** | **Bright** | **Instrument** | **Nights** | **%** |
| 21 | 10 | 128 | 71 | CF/CCD | 199 | 100.0 |

| | **Now** | **Last Semester** | **Semester Before Last** |
|---|---|---|---|
| No. of requests | 31 | 31 | 27 |
| No. of nights requested | 199 | 259 | 221 |
| Oversubscription | 1.16 | 1.51 | 1.31 |
| Average request | 6.42 | 8.35 | 8.19 |

**Schmidt Telescope: 132 nights**

NF/CCD 15 requests for 167 nights 100.0%

| | **Now** | **Last Semester** | **Semester Before Last** |
|---|---|---|---|
| No. of requests | 15 | 16 | 17 |
| No. of nights requested | 167 | 142 | 156 |
| Oversubscription | 1.27 | 1.02 | 1.11 |
| Average request | 11.13 | 8.88 | 9.18 |

**ESO 3.6 m Telescope: 12 nights**

| | | | |
|---|---|---|---|
| ADONIS | 3 req. for | 10 nights | 58.8 |
| TIMMI | 1 req. for | 4 nights | 23.5 |
| EFOSC1 | 1 req. for | 3 nights | 17.6 |
| | - | -- | ----- |
| | 5 | 17 | 100.0 |

| | **Now** | **Last Semester** | **Semester Before Last** |
|---|---|---|---|
| No. of requests | 5 | 2 | 4 |
| No. of nights requested | 17 | 11 | 9 |
| Oversubscription | 1.42 | 0.92 | 0.75 |
| Average request | 3.40 | 5.50 | 2.25 |

Ximena Herreros
xherreros@noao.edu



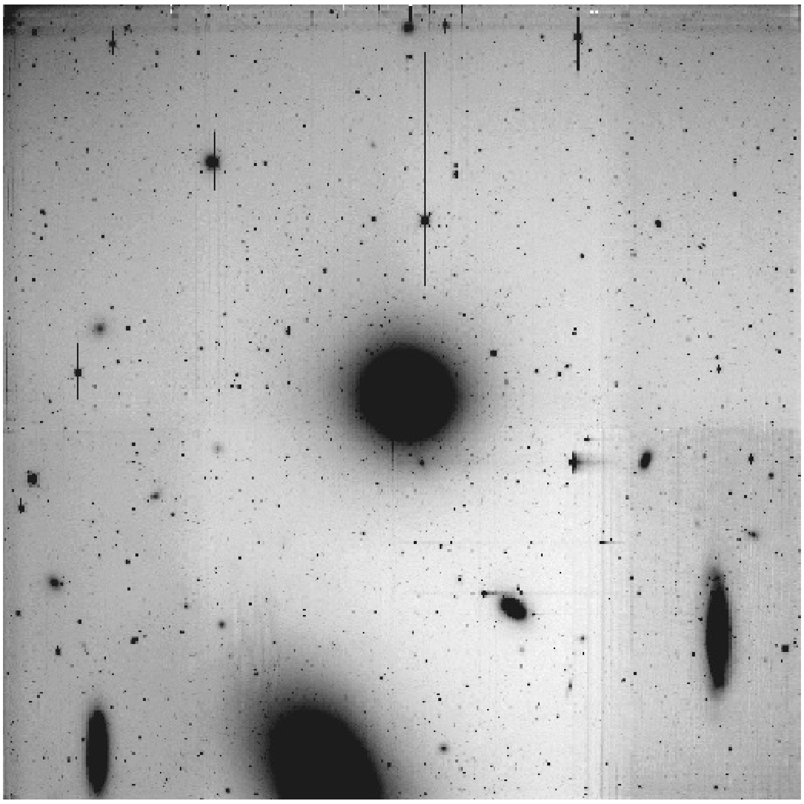




**NOAO Newsletter - Kitt Peak National Observatory - June 1997 - Number 50**

# CCD MOSAIC Imager Status

During the past report period, we have been proceeding with the commissioning of the 8K 8K CCD Mosaic Imager, concentrating on user level functionality. Engineering runs at the 4-m in February and April enhanced the end-user status of the instrument significantly.



**Caption:** R Band image of Virgo---300 seconds---five images astrometrically and photometrically corrected, and shifted to a common frame. Image reduction courtesy of Frank Valdes.

An example of an image taken during the April 4-m run is shown in the figure. The giant Virgo cluster galaxies M84 and M86, as well as many other smaller galaxies, are evident. (The full 155 Mbyte image can be downloaded via anonymous FTP from madrona.tuc.noao.edu, cd pub, get m84.fits.Z to get an idea what it's like to work with a full Mosaic frame. Also, the image may have scientific value; contact G. Jacoby or T. Armandroff for details about the image and an appropriate credit line if you find it scientifically useful to your work.)

The data acquisition and reduction software continues to develop and mature. We have added several new features, particularly in the use of the atmospheric dispersion compensator (ADC) and documentation of the images through new and more accurate header keywords. Most importantly, though, the software is far more robust and reliable than before, and is close to a final user configuration. Significant advances have been made to incorporate the IRAF message bus (see the IRAF section of this *Newsletter*) for data capture. Much of the software work has been directed toward reducing the readout time. Formerly, close to 6 minutes elapsed before the picture was written to disk. Now, with the picture descrambling and formatting occurring on a Sun UltraSparc, it takes only 2 minutes.

Considerable testing of the ADCs demonstrated that they offer a real image quality improvement. In 1" seeing, it is evident that the image quality is improved in the B-band when using the ADCs during observations at high zenith distances (greater than 40). We offer three user modes with the ADCs. TRACK mode is the simplest and most likely to yield good consistent images and will be the default. The two prisms rotate to the appropriate positions that minimize atmospheric dispersion as the telescope tracks. PRESET mode places the prisms at a position where the correction is optimized for the moment of mid-exposure. The prisms do not move during an exposure. This mode is offered for those who may be concerned about image motion or PSF changes during the exposure, but still want a good correction. (We have looked for but found no evidence that the images move or change in any way, but we will continue to offer this mode anyway). NULL mode can be selected to place the prisms in a non-correcting fixed configuration, although we have no reason to believe there is any advantage to this mode.

As reported in the previous *Newsletter*, we found evidence for a ghost image of the telescope pupil due to an internal reflection in the corrector. Formerly, the ghost image exhibited a maximum magnitude above sky of 3-5% with narrow-band filters. We have reduced that level by a factor of 4 to 5 by applying a carefully tuned Sol-gel AR coating to the offending surface. The coating minimizes reflections between 5000 and 7000. Furthermore, on-sky testing demonstrates that any residual ghost image is effectively eliminated by flatfielding with twilight or dark sky flats. See the article on the Prime Focus CCD System in this *Newsletter* for further details.

The relay optics for the guide TV system have been revised so that the image quality (and presumably guider stability) is much improved. We verified that we can guide on images fainter than V = 20.

With the CCD Mosaic, every exposure produces 128 Mbytes of raw data. After a good night, an observer may have 100 images, or 12.8 Gbytes of data. Writing this volume of bits consumes a great deal of time and tape, comparable to more than 10 hours and 3 Exabyte 8505 tapes. We have considered the market for a new direction in tape drives and have decided to experiment with the digital linear tape technology. A DLT-7000 tape drive is now on order, and a second drive will be purchased for use downtown for those needing to transfer tapes to other technologies. The DLT-7000 can write tapes about 5 times faster than the Exabyte 8505 and the tape cartridge holds 7 times the data volume in an uncompressed mode. While tape cartridges cost about $100, they can hold roughly three nights of data. As a backup, we will continue to offer two Exabyte 8505 drives with the Mosaic system as well.

As discussed in the last *Newsletter*, we are awaiting the science grade CCDs from SITe. The first shipment is expected by June.

We are pleased to report that we received 12 proposals requesting the CCD Mosaic for fall 1997. A user manual for the Mosaic is under construction and will be made available under the KPNO Mosaic web page (http://www.noao.edu/kpno/mosaic/mosaic.html ). We also have initiated an internal training program for system use and hardware installation in anticipation of visitor use of the Mosaic system.

George Jacoby, Taft Armandroff,
Todd Boroson, for the Mosaic Team

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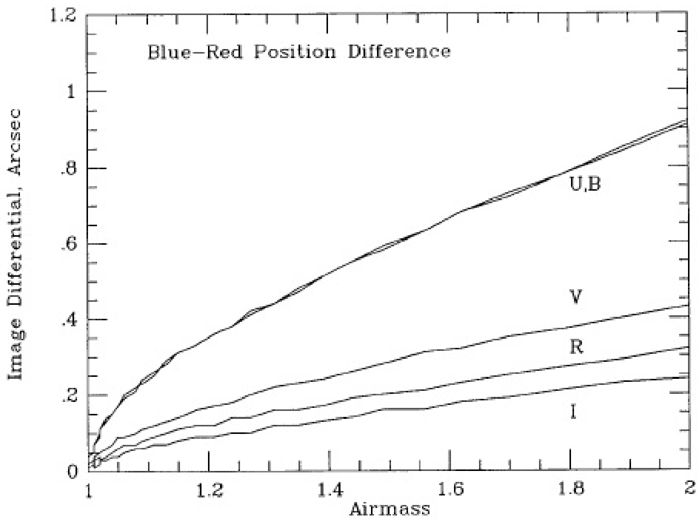
# New 4-m Corrector/ADC Commissioned and in Use with PFCCD

We expect that the standard PFCCD system will remain in demand at the 4-m until blue-sensitive CCDs with good cosmetic qualities become available for the new Mosaic camera. However, PFCCD users will immediately begin to benefit directly from the Mosaic project thanks to the commissioning of the new prime-focus 4-m corrector and atmospheric dispersion compensator (ADC). Details of the new corrector/ADC can be found in the June 1996 *NOAO Newsletter*; here we briefly summarize some of the changes that PFCCD users can expect.

The PFCCD corrector is a four-element design that replaces the small doublet corrector that has been in use with the PFCCD. Users of the old system have long been aware of the degradation of image quality as one approaches the edges of the chip; the new corrector produces excellent images over the entire CCD. During commissioning tests, we have obtained sub-arcsecond images over the entire field, and the point-spread function variations seem smaller than with the doublet.

In addition, the new corrector has a built-in ADC which further improves the image quality, particularly at U and B, for observations obtained away from the zenith. As the accompanying figure shows, without ADC there is a natural spread in a U or B image of about 0.5" at an airmass of 1.5, due simply to differential refraction over the widths of the bandpasses. The ADCs will remove this extra spread. The ADCs are run by the telescope operator, who must select the approximate bandpass ("U" through "I") to get the right amount of correction; the two prisms are then put in "track mode" and their positions corrected once a minute. If an observer chooses not to use them for some reason, they can be locked in a null position. Observers can also expect improved scattered light performance because of careful consideration given to coatings, metal blackenings, and spacing of elements.




**Caption:**Plot of the image spread in altitude resulting from differential atmospheric refraction at the blue and red ends of the filter bandpass for the U, B, V, R, and I filters, as a function of the airmass.

We found that twilight sky exposures obtained in bright twilight flattened dark-sky exposures to a fraction of a percent both in broadband and narrowband exposures, with dome flats adequate only at the 1-2% level. This is similar to what was the case with the old corrector. As described in the March 1997 *Newsletter*, there is a faint ghost of the telescope pupil visible in exposures. This reflection is typical of such correctors, but we have managed to greatly reduce its effect by using a special coating (Sol-gel) on the critical optical surface. In practice, the level of the ghost image in *raw* frames is < 3% for most interference filters and at "U"; for other broad-band filters the intensity is far below this. These ghost images flat-field out well (< 0.1-0.3%) using twilight flats, although we expect that observers may be disconcerted when examining raw frames with strong windowing around the sky level. Exposures through a narrow interference filter at 9500 shows a considerably larger effect (10%), although we expect this to also flat-field out as well. For applications requiring better than 0.1-0.3% flat-fielding, we recommend (as always) that flat fields be constructed from dark sky exposures.

The f-ratio with the new corrector is somewhat slower (f/3.1) than with the old corrector, providing improved sampling. The image scale is now 0.420"/pixel, and the field covered is 14.3' 14.3'. Although this is nominally smaller than the 16' 16' obtained with the old corrector, the useful field is probably about the same or somewhat larger, as superb image quality can be obtained over the entire field.

We were also able to obtain an improved measure for the count rates obtained with the PFCCD system. For a Johnson-Kron-Cousins U=B=V=R=I = 20th magnitude star, we expect the following count rates in $e^-$/s:

| U | B | V | R | I |
|---|---|---|---|---|
| 45 | 270 | 330 | 340 | 175 |

The "Direct Imaging Manual for Kitt Peak" (available either by anonymous ftp or via the documentation page on the Kitt Peak home page) has been updated to reflect all of these changes.

We are grateful to the many individuals who made the new corrector and ADC possible, including David Vaughnn, Ming Liang, Dick Sumner, Rich Reed, Gary Muller, David Mills, Shelby Gott, Bob Marshall, Dave Dryden and Bill Schoening.

Phil Massey, Taft Armandroff, George Jacoby

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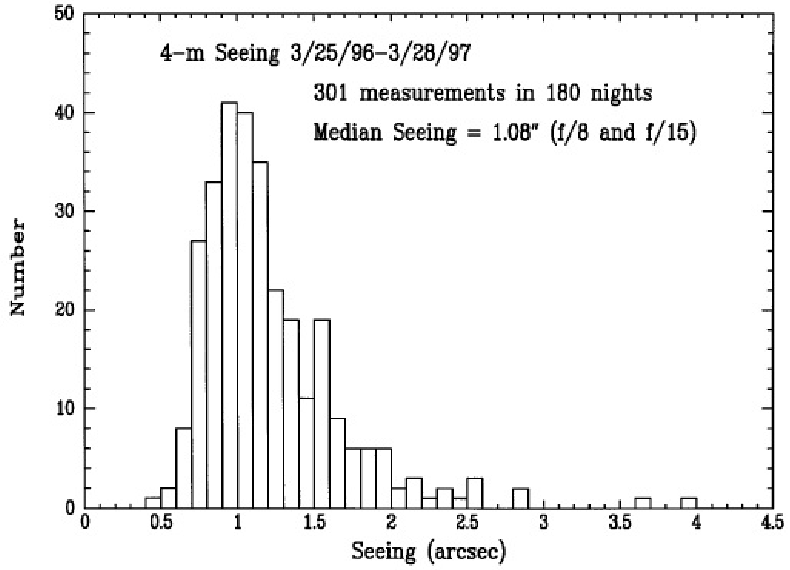
## Seeing at the 4-m

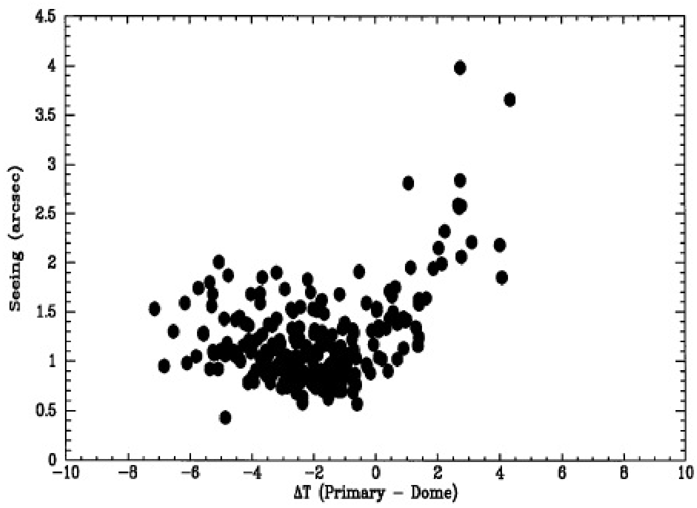
For the past year, we have been obtaining seeing measurements at the Mayall 4-m telescope with a camera mounted on the south port of the guider. Several times during a night, the telescope operators use this system to measure the "delivered image quality" (DIQ). In order to make comparisons to the nightly measurements at WIYN, we take these data through an "R" filter, and have demonstrated that the measured FWHM agrees with what one obtains with a 10s exposure with a direct CCD. Along with the seeing measurements, we automatically record the temperatures at various points around the dome.

During April 1996 to April 1997 we obtained 308 measurements on 180 nights; the median DIQ is 1.08", with no difference between the f/8 and f/15 secondaries. The results are shown in Figure 1. (Measurements at prime are somewhat *worse* due to degradation from the doublet corrector used with the CCD; as discussed elsewhere in this *Newsletter*, an improved corrector, along with an atmospheric dispersion compensator, has just replaced the old system.)

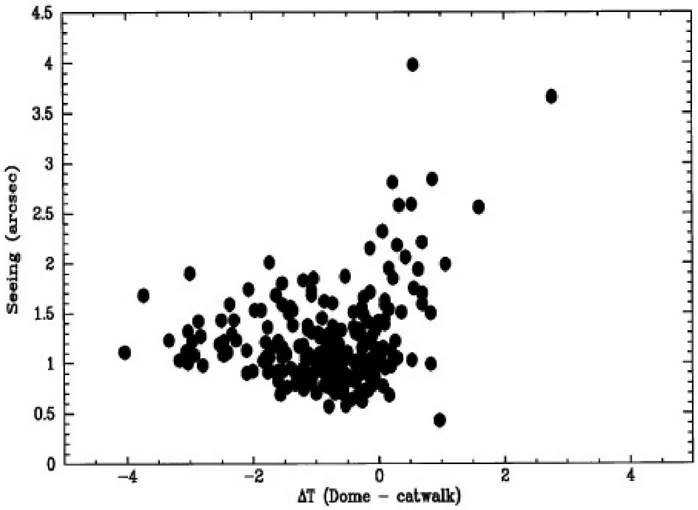



**Caption:** Figure 1. 4-m seeing from April 1996 to April 1997.

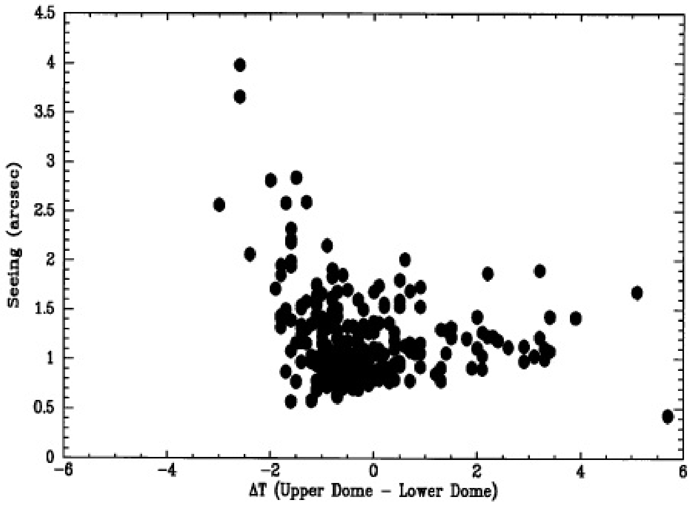
What causes our nights of poor seeing? Examination of the temperature data indicates that whenever the wrong things are warmer, the seeing is bad: physics happens! And, the converse is also true: that on nearly every night of poor seeing, the thermal environment is highly non-isothermal. As the three accompanying plots show, (a) whenever the primary mirror is warmer than the surrounding dome air, the delivered image quality degrades quickly---although a somewhat cooler mirror is OK (Figure 2). Presumably this is due to convection cells forming directly above the mirror. (b) If the dome air is warmer than the outside ambient air, then convection cells occur as warm air leaves the dome and cool air falls (Figure 3). This is even better demonstrated by the fact that (c) whenever the air temperature in the upper part of the dome is significantly cooler than in the lower part of the dome, the seeing is bad (Figure 4).




**Caption:** Figure 2. Seeing as a function of temperature differential between the primary and surrounding air.




**Caption:** Figure 3. Seeing as a function of temperature differential between air surrounding the primary and air outside the dome.




**Caption:** Figure 4. Seeing as a function of temperature differential between air in the upper and lower dome.

So, what can we do about this? We have taken the following steps: (1) If the primary is warmer than the previous night's low temperature, cold air is blown onto and around the primary during the day when the telescope is not being used and when the incoming air temperature is at least a couple degrees above the dew point. We are currently in the process of tweaking the system to improve the amount and duration of the cooling. (2) We have installed a powerful fan that runs during the day to mix the air in the dome. Since the floor is cooled, the effect is to take the cold air at the bottom of the dome and mix it throughout the structure. (3) We are designing large dome ventilation doors, the installation of which will start this summer and continue into the fall. The goal is to achieve 30-40 flushes of air per hour in modest (10mph) wind.

Phil Massey, Bruce Bohannan, Chuck Claver, George Jacoby, Richard Wolff

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# Weather Takes a Heavy Toll on the Spring 1997 WIYN Queue

Through the end of April 1997 the NOAO WIYN Queue has been able to obtain data only during 50% of the time allocated to the Queue. The weather has been particularly bad during April. For example, during the 29 March-3 April observing run only 8 hours were usable out of a possible 55 hours. The weather also plagued the "bright" April run with 32/52 usable hours, but much of this time was hampered by cirrus. All told, of the 29 Queue nights through the end of April, only 10 were unaffected by weather, four were totally lost (including the night of 3 April when it snowed on the mountain!), and observations could be made for only two hours or less on another six nights.

Progress in executing the "High Priority" Queue has been greatly slowed by the weather. As a result, it will be difficult to make substantial progress in the "Best Effort" Queue for the remainder of the semester (see our Web page http://www.noao.edu/wiyn/obsprog/queue/S97/QueSumS97.html for definitions of the various WIYN Queues and the current status of the spring 1997 Queue observing programs). Although 14 of 24 long programs have been activated so far this semester, few have been completed. Roughly 240 hours were allocated to high-priority long programs and only 82 hours have been executed so far. At the writing of this article there are approximately 170 hours left in the NOAO WIYN Queue allocation with about 30 hours falling within the traditional thunderstorm season (July-August). Most of this remaining time will need to be spent completing as many of the high-priority programs as possible.

On a brighter note, the performance of the telescope and associated hardware/ software has been much more reliable this semester than last. Outside of problems with the brake system of the telescope mount during cold weather at the beginning of the spring 1997 semester, little time has been lost to technical problems. The WIYN Queue Team thanks the technical staff headed by Dave Sawyer (WIYN Observatory Site Manager) for their efforts in improving the operation of the WIYN telescope.

We are eager to receive feedback from investigators who have received data from the WIYN Queue during the current semester and/or past semesters. In particular, we would like to know if the data delivered attain the quality requested in your proposal. Please email any comments, suggestions, or complaints to wiynq@noao.edu. We would also appreciate receiving preprints and/or reprints of any research that includes data obtained from the WIYN Queue Observing

Program. Please send relevant publications to:


```
WIYN Queue Experiment
c/o Paul Smith
National Optical Astronomy Observatories
P.O. Box 26732
Tucson, AZ 85726-6732
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Paul Smith, for the WIYN Queue Team
(Di Harmer, Alex Macdonald, Daryl Willmarth)

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# No More Plate Scanning

A brief article appeared in the December 1996 *NOAO Newsletter* with the rather bland title "Status of Laboratory Measuring Equipment to be Reviewed." In case you missed it, and especially since we received no responses, we would now like to emphasize that the PDS microdensitometer and the associated fast scanner ("Monet machine") will not be supported after this spring and will not be available for use in Tucson. It is no longer possible for us to support the current system without significant expenditures of staff time and money, which the lack of interest and rapid decline in usage do not justify. It is also true that alternative facilities with better support exist elsewhere.

If you have a need to scan photographic plate material here in Tucson to complete a project, please send a request and justification to the Director immediately with a request to be scheduled in the very near future.

Nigel Sharp, Jim DeVeny



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# More Filters

We have added two new filter sets to our inventory. We now have available the Sloan Digital Sky Survey Photometric System. This includes five color bands, u' g' r' i' and z'. We have also received on long-term loan from NASA, the Hale-Bopp Narrowband Comet set. Both are 4 inch sets. The filter data may be found in the anonymous ftp area in the sub-directory kpno/filters or in the Filter Information section of the KPNO Home Page.

J. DeVeny, E. Carder



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# Best Wishes for Pat Patterson

The next time you visit us, a familiar face will be missing. After 17+ years of providing administrative support to all our various committees, observers and NOAO staff in general, Pat Patterson has accepted a new position. She has taken up residency in Pasadena, California and is continuing her administrative career in astronomy. Pat is now working for Charles Beichman at the Caltech/JPL Infrared Processing and Analysis Center (IPAC). I know all of you join us in thanking Pat for a job well done and wish her the best for her future with IPAC.

Bob Barnes

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# From the NSO Director's Office

The AURA Observatory Visiting Committee (OVC) reviewed the programs of the National Solar Observatory from 8--11 December. The need to visit both NSO sites during these visits makes the effort for the OVC members particularly strenuous. Nonetheless, the visits provided an outstanding opportunity for the NSO staff and the OVC to interact extensively and closely. The hard work and sincere interest by the OVC members in assessing the quality and plans of NSO were very much appreciated by the NSO staff and myself. The OVC expressed appreciation for the service and research programs at both sites and strongly endorsed our vision for a renewed NSO centered around SOLIS and a large Optical/Infrared observing facility. The OVC report and the comments on it by the NOAO and NSO have been accepted by AURA and forwarded to NSF.

As a result of comments by the OVC, the efforts related to the preparation of a proposal for the large Optical/Infrared observing facility (or "Flagship Telescope" in the language of the report) are being expanded by increasing the participation of the NSO staff. With Christoph Keller as chair, a team of six NSO astronomers has prepared a proposal to realize this broader participation. Its first step is the formation of four task groups, to make recommendations about science goals, site choice, high-resolution techniques and coronagraphy techniques. Convenors for these task groups are Jack Zirker, John Leibacher, Rich Radick and Matt Penn respectively.

Other current activities relating to the future NSO program include: (1) the submission of a more complete proposal for SOLIS to NSF; (2) the preparation of a proposal for an enhancement of the GONG facility to allow higher resolution imaging; (3) an attempt to resolve issues surrounding the funding of the RISE/PSPT facility; and (4) an agreement with the USAF/PL for NSO/SP to construct the prototype of the USAF ISOON telescope/instrument package. The pressure on our staff of all these new initiatives together with our desire to maintain visitor observing support and provide enhanced observatory capabilities unfortunately starts eating into the research time available to the NSO scientific staff.

The scientific staff was strengthened by the recruitment of Haocheng Lin at NSO/SP. He takes the position vacated as the result of the retirement of Jack Zirker. Other personnel changes include the departure of Ann Barringer from the NSO Director's Office. Ann moved to a new position in Phoenix. Her replacement is Priscilla Piano (ppiano@noao.edu).

Jacques Beckers

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# KPVT Upgrade

The KPVT upgrade is gradually moving along. We have tried to focus on items of the KPVT upgrade that would transfer to SOLIS should it become a reality. Items such as the new hand paddle, the guider detector, motor drivers, driver electronics, and communications and control software are all aspects that are fundamental upgrades to the KPVT, but are also directly applicable to SOLIS.

Ed Stover, Carol Leiker and Dave Jaksha have made excellent progress in defining, constructing, and operating a prototype multi-function hand paddle. A set of liquid crystal graphics displays with integrated switches are packaged into what is basically a display/button array. The interface to the hand paddle is RS232 from a control computer, which loads the image data to display, and reads and interprets the switch closures from the hand paddle. The system control then is through the control computer. Ed has built a prototype unit and is currently working on its packaging. Dave has defined a (more or less) complete set of menus to define hand paddle functions for telescope, grating, and tank control. Carol has implemented the control computer code to load the image bitmaps, configure the displays for various hand paddle functions, and read the switch activity.

Work continues on the new guider detector. The new guider will consist of eight linear 256-element CCD arrays with associated A/D converters arranged around the limb of the guider solar image. Each element of the detector is digitized and fed to a Digital Signal Processor board with a limb detection algorithm to determine the limb position on each of the arrays. The eight detected limb positions are then processed to determine the disk position error. The error is then digitally filtered. High-frequency signals are sent to the #4 mirror control and low speed signals are sent to the #1 and #2 mirror control for tracking. The unique element of this design is the observing position weighting of the guider signals.

Lonnie Cole

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# USAF Near-IR Fabry-Perot Filters and InGaAs Camera

The USAF Phillips Laboratory, solar research group at NSO/Sacramento Peak has designed a narrow-band tunable near infrared filter that uses two tunable Fabry Perot (FP) etalons and works between 1200 and 1700 nm with appropriate blockers. The FP Etalons and their controllers have been purchased from Queensgate. The order-sorting, broad-band FP has a FWHM pass band of 0.19 nm and a free spectral range (FSR) of 4.09 nm at 1565 nm. The narrow FP has a FWHM pass band of 171 m and FSR about 0.548 nm, at 1565 nm. A high transmission prefilter is available for use between 1563 and 1566.5 nm. Initial tests of this filter system at the NSO/SP Vacuum Tower Telescope using a 128 128 InGaAs camera from Sensors Unlimited, the Michigan State 128 128 HgCdTe camera, and a specially constructed rotatable wave-plate and polarizer system, have demonstrated the capabilities of this system in making spectropolarimetric images in the spectral line FeI 1564.85 nm. Tests on the dual FP system at the VTT are in progress with the goal of evolving the system to a stand-alone vector magnetic field patrol instrument. The instrument and its components are available for use at the VTT on a shared risk basis. Additional information on this system can be obtained by contacting any of the following scientists.

Craig Gullixson, Steve Keil, K.S. Balasubramaniam

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**NOAO Newsletter - National Solar Observatory - June 1997 - Number 50**

# NSO Observing Proposals

The deadline for submitting observing proposals to the National Solar Observatory is 15 July 1997 for the fourth quarter of 1997. Forms, information and a Users' Manual are available from the NSO Telescope Allocation Committee at P.O. Box 62, Sunspot, NM 88349 for Sacramento Peak facilities (sp@sunspot.noao.edu) or P.O. Box 26732, Tucson, AZ 85726 for Kitt Peak facilities (nso@noao.edu). A TeX template and instruction sheet can be emailed at your request; obtained by anonymous ftp from ftp.sunspot.noao.edu (cd pub/observing_templates) or ftp.noao.edu (cd nso/nsoforms);

or downloaded from WWW at http://www.nso.noao.edu.

Dick Altrock

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# New NSO Users' Committee

The membership of the new National Solar Observatory Users' Committee has changed. New members are:

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Tom Ayres      (University of Colorado) (chair)
               e-mail: ayres@vulcan.colorado.edu
Tim Brown      (High Altitude Observatory)
Tom Duvall     (NASA/GSFC, stationed at
               Stanford University)
Phil Goode     (New Jersey Institute of Tech.,
               Big Bear Solar Observatory)
Ernie Hildner  (NOAA/SEC)
Don Jennings   (NASA/GSFC)
Kimberley Leka (High Altitude Observatory)
Dick Shine     (Lockheed Palo Alto Research Lab.)
```

and *ex-officio*:

Ben Snavely (NSF/AST)
Rita Sagalyn (USAF/PL)

Jacques Beckers

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# New Personnel and Changes at NSO/SP

As noted in the Director's report, Haosheng Lin has rejoined the staff at NSO/SP, effective 6 January 1997, vacating his current position as a research associate working with the RISE/PSPT project. Lin received his PhD from Michigan State University. He has also held a position at Caltech/BBSO as a research associate. Haosheng maintains a strong interest in problems related to precise solar photometry and infrared polarimetry and magnetometry. His instrumental interests in these research areas are an important component of the research focus at the National Solar Observatory.

In other personnel news, Louis Strous has accepted a research appointment with George Simon. Louis has been interested in problems related to the excitation of 5-min oscillations and will be working with Simon on these and other problems associated with photospheric convection studies.

A new Instrumental Programmer/Engineer will join the technical staff at NSO/SP. Christopher (Kit) Richards comes to Sac Peak from Tektronix, Inc. in Lakewood, Colorado. At NSO/SP, Kit will be involved in the design and development of instrumentation projects.

Rex Hunter, Jeff Kuhn

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# NSO Telescope/Instrument Combinations

**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):**
- Ha 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 patrol instrument

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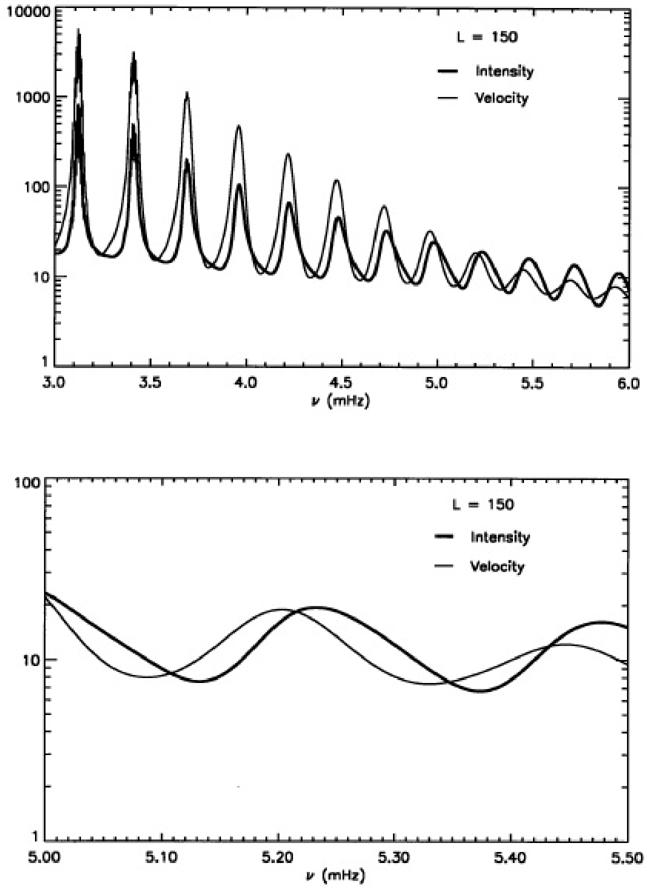
# Global Oscillation Network Group

The 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.

GONG data are available to any qualified investigator whose proposal has been accepted; however, membership in a GONG Scientific Team encourages early access to the data and the collaborative scientific analysis that the Teams are undertaking. Information on the Project and the scientific investigations, as well as access to the data, is available on our WWW at: www.gong.noao.edu.

## Operations

The GONG instrument continues to run with a high degree of reliability at all six sites around the world. Since the beginning of the calendar year we managed to collect all but about 1.5% of the possible images, and as usual, many of these potential gaps were filled by adjacent sites observing simultaneously.




**Caption:**Comparison of Intensity and Velocity Power Spectra, for l = 150, showing surprising differences. While asymmetry at lower frequencies had been noticed previously, it had not been seen in a single data set and was "suspect." The coincidence of the resonant peaks at lower peaks gives us confidence that the processing is similar for the two variables, but the increasing difference of the peaks of the intensity and velocity resonances with frequency was totally unanticipated. While there may be a small effect arising from the different distribution of the signals from the center of the solar disk to the limb, the principal differences probably result from the increasing transparency of the atmosphere to sound waves with increasing frequency, and the different dependence of temperature and velocity fluctuations on wave form. The spectra have been smoothed with a wavelet denoising technique.

Two thirds of the images lost this quarter resulted from a lightning storm at El Teide where the ensuing power-down and power-up resulted in the failure of a critical power supply. With the help of the excellent staff at the observatory the problem was diagnosed quickly, but shipping delays kept the instrument down longer than we might have liked. We are in the process of addressing this problem by supplying all of the sites with a full set of power supplies to be stored with the instrument.

The next most damaging source of down time this winter has been dew and frost on the turret optics. This has caused delayed startup of the instrument at Big Bear and El Teide on clear mornings following winter storms. Some experimentation during a dew event in the midst of the recent maintenance trip to the Canary site taught us that the optics can be cleared relatively quickly by diverting all or most of the available "clean air" from the optical table to the turret. (During normal operation the flow is split equally between these two demands.) We have also installed an experimental air-drying system in the air line at the Big Bear site. While the system worked well in Tucson during a few wet mornings earlier this winter, results at Big Bear have so far been disappointing.

Although costing little in the way of actual down time, tape-drive issues were a major source of frustration at several sites recently. The problems were eventually traced to a bad batch of head-cleaning tapes. The manufacturer admitted that oil-contaminated cleaning cartridges had been distributed, causing performance to degrade with each cleaning. In our case, several brand new drives were rendered useless in just one cleaning. Repeated cleaning with a "new-and-improved" type of cleaning cartridge brought the recalcitrant drives back to their duty. If you have had similar problems with Exabyte drives, call for details!

We have welcomed Humberto Villegas to the operations group this winter, replacing Sang Nguyen as an electronic technician. Sang, who constructed most of the electronic chassis in our instruments, has moved to NOAO's engineering and technical services group. Humberto is a fine addition to the group, and has already attended one preventive maintenance trip to Tenerife. Later this spring he will travel with the India team to look in on that instrument.

## Data Management and Analysis

During the past quarter, month-long (36-day) time series and power spectra were produced for GONG months 15 and 16 (ending 961202) with fill factors of 0.91 and 0.94. The fill factors for these two months were significantly higher than for the previous two months (0.73 and 0.76). The fill factors for GONG months 13 and 14 were unusually low because of global weather patterns (including monsoons at Udaipur and typhoons at Learmonth), preventive maintenance visits to several sites, and some instrument problems. These factors did not adversely affect GONG months 15 and 16. The month 16 fill factor (0.94) matches the previous high from GONG month 11.

As part of the preparation for a reprocessing campaign to regenerate p-mode power spectra from calibrated velocity images, the project temporarily halted the routine production of month-long p-mode power spectra and reprocessed GONG month 16 with the software and processing parameters that the project intends to use during the reprocessing campaign. The evaluation of the results and consultation with the project's scientific community through the DMAC Users' Committee is expected to be completed within in the next few weeks.

Resources that would normally have been used for routine p-mode reduction were redeployed to produce month-long time series and power spectra from the intensity and modulation images from GONG month 16. The intercomparison of these and the same products from the velocity images is underway.

## Data Algorithm Developments

The project has been implementing some substantial changes to the processing of the data upstream of the spectral fitting. The new reprocessing implements a new spatial map and apodization in the spherical harmonic decomposition; a temporally varying longitude zero point in the remapping to compensate for the changes in the synodic to sidereal correction caused by the Earth's elliptical orbit; the normalization of the site-day time series moduli to partially correct for different instrumental velocity scale factors; and the restriction of the gap filling to two-point gaps only. These changes are ready to go, and will be routinely used after approval by the GONG DMAC Users Committee.

In the area of spectral fitting, we have installed an iterative background removal, which has reduced the number of noise spikes identified as modes. An asymmetrical line profile model is also under development. The leakage matrix calculation is undergoing improvements, being ported from IDL to Fortran to improve its speed, incorporating pixel integration, and calculations for intensity and modulation. We are also about to begin work on an alternative peak finder tailored for low-degree only. A wavelet denoising and multi-taper package is up and running thanks to Rudi Komm and Yeming Gu, and is now being applied to month 16 *I-v* spectra.

With a bit of effort, we have merged together one day of GONG network data with one day of MDI/SOI data from SOHO. The resulting spectrum shows a noise level reduction greater than the square root of 2 factor expected from simple averaging, and substantially lower than either of the two individual spectra. This result is probably due to the power of combining coherent signals and suggests that it may be very profitable to routinely merge together GONG and SOI data.

We are extremely pleased to welcome Stuart Jefferies to the GONG/SOI data team. Stuart brings a wealth of experience in sophisticated spectral fitting techniques to the Project. On the down side, Yeming Gu has left the project to work on advanced image processing for supermarket scanners at NCR. We wish him the best of luck distinguishing apples from oranges. Long-term visitors are currently Frederic Baudin and David Freilly-Fraillon. Frederic is working on applying homomorphic deconvolution to GONG and SOI spectra, and studying the details of mode excitation. David is compiling statistics on mode amplitudes and lifetimes.

Recently, the project analyzed one month of GONG data using all three available observables---Doppler velocity (V), total intensity (I), and modulation (M, a proxy for equivalent width). The objective was to evaluate the scientific uses of M and I, and to discard the calibrated data products if they contained little information. While we expected to observe the well-known difference in line asymmetry, we were unprepared for the completely surprising and substantial frequency shift between V and I! As shown in the figure, there is a relative shift in the apparent peaks of tens of microHz between V and I in the region of 4.5-5.5 mHz. There is no apparent shift between V and M. Further comparison of the V, M, and I spectra showed the presence of the f and p1 peaks in V (but not in M or I); the expected asymmetry difference between V and I, and the similar asymmetry of the peaks observed in V and M.

We are striving to understand these effects. There are qualitative differences between the observation of V, M, and I. The velocity is a vector field that is primarily directed normal to the solar surface, and observed projected on the line of sight. The intensity and modulation are scalar fields, with rather different center-to-limb variations in magnitude. These differences affect the apparent amplitude of the modes, particularly the distribution of artifacts known as spatial leaks that arise from our inability to observe the entire solar surface. This differing spatial leak structure may play a role since the frequency range is precisely where the short mode lifetimes cause the spatial leaks to blend together. This effect is being modeled.

Alternatively, the physics of the wave propagation in the solar atmosphere suggests that the waves are evanescent, and implies a roughly $90^{o}$ phase difference between V and I. This, coupled with the location of the modes driving close to the solar atmosphere, the different effective heights of formation for V, M, and I, and an acoustic cutoff frequency around 5 mHz suggests that the comparison of the spectra in the three observables may yield new insights into mode physics. Finally, the fitting of the mode parameters may also be improved by considering all three observables simultaneously.

## Looking Forward

The project has received a three-year travel grant from the NSF International Division to support enhanced scientific collaboration between U.S. and Indian science team members.

GONG has just received the details of its FY 1997 operations budget. The good news is that we have the $2.0M requested. This was not unexpected, but it is always good to have it finally written down.

NOAO is committed to operating the GONG network for a full eleven-year solar cycle, with the usual caveats about the availability of future funding. The project is in the process of renewing three of the site MOU's that expire during the current year. Verbal agreements are in place for all three sites and much of the paperwork is well under way.

Design and planning efforts continue for the proposed larger-format camera for the GONG instrument, an acceptable version of which is currently in house. A conceptual design review is scheduled for June with participation by the GONG community. A proposal is being prepared for submission to the NSF for funding of the construction of these cameras.

John Leibacher

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# Support Capabilities Workshop

*For in-depth coverage of Gemini progress, see the Gemini Newsletter, which accompanies this issue of the NOAO Newsletter.*

The USGP is planning to hold a workshop this fall to identify and quantify the capabilities (telescopes, instruments, surveys, software, etc.) required to support the Gemini telescopes and other large telescopes available to the US community. The discussion will be science based, with teams of astronomers assembled to work through observational programs end-to-end to understand requirements for (1) surveys and other precursor observations to identify objects for detailed study, and (2) astrometric and photometric information to support acquisition of targets and reference stars.

The results of this US workshop will be used to support a subsequent workshop at the Gemini international level, which is planned for November of this year. More information on the international workshop is available on the Gemini homepage http://www.gemini.edu.

Kathy Wood

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# Science Advisory Committee

The USGP meets bi-annually with its community-based advisory council, the US Science Advisory Committee (US SAC), to discuss the US perspective on all matters that bear on the scientific quality and productivity of the Gemini Telescopes. This currently includes reviewing the implementation of the initial instrument the plans to support the US users' requirements for pre and post-observing. The current US SAC members are: Todd Boroson, Chair (NOAO), Suzanne Hawley (Michigan State), Buell Jannuzi (NOAO), Bob Joseph (Hawaii), Mario Mateo (Michigan), Gerry Neugebauer (Caltech), Larry Ramsey (Penn State), Steve Strom (Massachusetts), Charlie Telesco (Florida), Alistair Walker (NOAO), and Chick Woodward (Wyoming).

We appreciate the advice and support of this committee, and the sacrifice of their time. We also wish to thank past members Eric Becklin (UCLA), Pat Osmer (Ohio State), and Jay Gallagher (Wisconsin) who all made noteworthy contributions as members of the US SAC and also as members to the international Gemini Science Committee.

Kathy Wood

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# GMOS Passes its Critical Design Review

The Gemini Multi-Object Spectrograph (GMOS) underwent a critical design review in the UK in late February 1997. The review panel, headed by Richard Green, gave GMOS the go ahead to start fabrication after some relatively minor issues were investigated and resolved.

Two instruments will be fabricated, one for each Gemini telescope. GMOS is scheduled for delivery in 1999 to Gemini north and 2000 to Gemini south.

GMOS will work in the following modes:

- Multi-aperture spectroscopy via masks
- Long-slit spectroscopy via masks
- Integral field spectroscopy via lenslets and fiber arrays
- Direct imaging

A field of view of 5.5' 5.5' can be covered for both spectroscopic and imaging applications. Spectral resolutions of up to 10,000 are possible within the 0.36-1.1 m window. The CCD detector system will consist of three 2K 4K CCDs with just under 15 m per pixel.

Further information can be obtained by reading the article on GMOS in the December 1996, Gemini Newsletter (issue 13, page 8), by consulting the following URL: http://star-www.dur.ac.uk/~jra/gmos.html, or by contacting the undersigned.

Sam Barden

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# ADASS '97 Update

The Seventh Annual Conference on Astronomical Data Analysis Software and Systems (ADASS) will be held 14-17 September 1997 in Sonthofen, Bavaria, Germany. The ADASS Conference provides a forum for scientists and programmers concerned with algorithms, software, and software systems employed in the reduction of astronomical data. ADASS '97 is organized jointly by the Space Telescope European Coordinating Facility and the European Southern Observatory. This year's key topics will include, among others, Astrostatistics, Computing Infrastructure, Computational Astrophysics, Educational and Public Information Activities, Future Trends in Astronomical Computing, and Software Systems and Applications.

**Important Dates**

```
  7 July 1997: deadline for - early registration
                            - abstract submission
                            - demo requests
 15 August 1997             - hotel reservations
  4 September 1997          - late registration
 14-17 September 1997       - ADASS `97

Location: Allgau Stern Hotel
          Sonthofen, Bavaria
```

The ADASS '97 Program Organizing Committee is comprised of the following members: Rudi Albrecht (ST-ECF/ESO), Roger Brissenden (SAO), Tim Cornwell (NRAO), F. Rick Harnden - Chair (SAO), George Jacoby (NOAO), Jonathan McDowell (SAO), Jan Noordam (NFRA), Dick Shaw (STScI), Richard Simon (NRAO), Britt Sjberg (ST-ECF), Doug Tody

(NOAO), and Dave Van Buren (IPAC). The Local Organizing Committee is chaired by Rudi Albrecht.

The Conference program includes invited talks, contributed oral presentations, poster papers, and computer demos. Papers are invited in the areas of the special topics mentioned above and in the general area of astronomical software development. A number of Birds-of-a-Feather (BOF) special interest sessions will be scheduled as well. BOFs are organized by ADASS participants and are usually about one hour in duration. (Please contact Rick Harnden (frh@cfa.harvard.edu) if you are interested in organizing a BOF.)

The Converging Computing Methodologies in Astronomy (CCMA) Conference will be held in Sonthofen 17-19 September following ADASS '97. Information on this Conference can be found at: http://cfa-www.harvard.edu/~kurtz/CCMAFinalConf.html.

The ADASS Conference will be held in Sonthofen, Bavaria, about 100 km southwest of Munich near the Bavarian Alps. The Conference facilities at the Allgu Stern Hotel are first class, the setting in the alpine environment is spectacular, and the weather should be nice in mid-September.

Details pertaining to registration, hotel reservations, abstracts submissions and the meeting in general are available at the Web page address below.

```
Contacts: Britt Sjoberg
          ST-ECF/ESO
          Karl Schwarzschlid Str. 2
          Garching, Germany
          e-mail: adass@eso.org
          Phone: +49-89-320 06 291
          Fax: +49-89-320 06 480
          WWW: http://ecf.hq.eso.org/
```

Rudi Albrecht, Chair, Local Organizing Committee

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# IRAF Update

Much of the work this quarter has been split between two major projects: preparation for the upcoming release of IRAF V2.11, and ongoing work on the NOAO Mosaic data handling system.

Beta-testing of V2.11 began in March. We plan two beta releases before the public release, currently targeted for late May. The beta-1 release includes most user interface and science applications changes, and the major (i.e. risky) system bug fixes and other revisions. Beta-2 will include some isolated new features such as the FITS image kernel and related FITS and image support. After limited internal testing within the IRAF group the beta-1 release went to the major outside IRAF development sites in early April, and following extensive initial in-house testing was installed for staff testing on the major NOAO servers in late April. Beta testing has thus far gone very well.

The V2.11 release is being closely coordinated with the STSDAS group at STScI, which will be simultaneously releasing a new version of STSDAS to provide support for STIS and NICMOS pipeline reductions. V2.11 will be released first for SunOS and Solaris, as a single sharable distribution supporting both systems. Releases for all other supported IRAF platforms will follow throughout the summer, with the major platforms following as soon as possible after the initial release. We have done a lot of work over the last year updating all the IRAF platforms so that we can make V2.11 available on all platforms as soon as possible after the release cycle begins. A summary of the new features and enhancements in the V2.11 release can be found in an accompanying article in this section of the *Newsletter*.

The new version of X11IRAF announced in the last IRAF Update is is now available from the IRAF network archives ( *iraf.noao.edu*) in the *iraf/x11iraf* directory. Manual pages have been added for xgterm, ximtool, and xtapemon. Ximtool has many new features: hardcopy capability (encapsulated PostScript files can be sent to a PostScript printer or saved to a file); images can be loaded into the display operating as a stand-alone image browser (currently IRAF, FITS, GIF and Sun Rasterfile images are supported); displayed images can be saved to disk; online hypertext help has been added; keystroke accelerators are available for common operations; and much more. The *x11iraf* directory was updated on 5 April with bug fixes for problems reported after the initial release in mid-March, so if you downloaded *x11iraf* shortly after the initial announcement you may want to update your installation.

Mike Fitzpatrick has completed work on a client display library (CDL) that will allow host C or Fortran programs to display images or draw into the graphics overlay using the ximtool image server and image viewers that emulate the ximtool client protocol such as SAOtng, SAOimage, and IPAC Skyview. CDL provides most of the algorithms and functionality found in standard IRAF tasks such as DISPLAY and TVMARK, but provides these in library form for use in host level user programs, much as the IMFORT library provides access to IRAF images on disk. CDL may be used in IMFORT programs or in any host program needing an image display/marking capability. CDL is available from the */iraf/x11iraf* directory in the IRAF network archives. CDL development was supported in part by the Open IRAF initiative, which is funded by a NASA ADP grant.

We are pleased to announce that ESO and Japan now join the UK as IRAF mirror sites. We would like to thank these sites for their help in making IRAF information and distributions more accessible over the network to our non-US users. All mirror sites are updated from the Tucson archives on a nightly basis.

```
Japan WWW Mirror:
               http://sinobu.mtk.nao.ac.jp/iraf/web/

UK WWW Mirror: http://star-www.rl.ac.uk/iraf
UK FTP Mirror: ftp://star.rl.ac.uk/pub/iraf

ESO FTP Mirror: ftp://ecf.hq.eso.org/iraf
ESO WWW Mirror: http://ecf.hq.eso.org/iraf/web
```

Work on the NOAO Mosaic data handling system (DHS) has concentrated on ongoing work on data reductions, and on data capture including development of the message-bus infrastructure. An early version of the message bus, a data capture agent (DCA), and a message bus data feed for the Arcon have been completed. The DCA is instrument independent, using a keyword translation module implemented as a Tcl script to map instrument keywords into the data dictionary used by the Mosaic DHS. The DCA directly writes multi-extension FITS files suitable for archiving and other post-processing including IRAF-based data reduction using the FITS image kernel to access the archival data. Recent work on Mosaic data reductions has concentrated on development of the keyword translation module, on image combination, and on astrometry, including calibration of the new wide field prime focus corrector for the 4-m telescope. A new overview paper for the Mosaic DHS is now available via the Mosaic DHS web page, http://iraf.noao.edu/projects/mosaic.

Nelson Zarate is developing the FITS image kernel, and is currently working on a new IRAF library to be used by various tasks to access multiple extension FITS files (MEF). This set of routines will manipulate FITS files with multiple extensions using file-type operations at a lower level than the image i/o (pixel matrix) interface where the FITS kernel operates. The MEF interface will allow an application developer to write SPP programs that handle a set of extensions at any one time. Some new IRAF tasks are planned for operations such as extracting extensions into files or inserting files into MEF files.

Lindsey Davis is continuing to work on the IRAF ASTROMETRY package and related software. Last quarter she modified the IRAF surface fitting library and used the new library to investigate the astrometric properties of the NOAO Mosaic. She also completed a task for converting Cartesian pixel and standard coordinates to polar pixel and standard coordinates. Lindsey also completed the reorganization of the IMAGES and PROTO packages in preparation for the IRAF V2.11 release.

Frank Valdes continues to devote most of his time to software for the NOAO Mosaic. First versions of the basic data reduction and data formatting software are nearing completion. Outside of this effort he has written two new spectroscopy tasks for doing telluric removal and sky subtraction and improved the spectral calibration tools to allow the user a choice of dispersion units throughout the data reductions.

Rob Seaman continued his work with the ICE CCD data acquisition software and other observing environment issues, and with the KPNO and CTIO "save the bits" archives. He is currently working on the WIYN CD-ROM based archive and data distribution system. The FINDER package update (discussed in the last issue of this *Newsletter*) is in internal beta testing. This software will be chiefly used within NOAO for observing support for the Hydra multi-object spectrogragh and other astrometric work.

For further information about the IRAF project please see the IRAF Web pages at http://iraf.noao.edu/ or send email 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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# IRAF Version 2.11 Release

We include here only a brief summary of the additions and enhancements to IRAF included in the release of V2.11. A more complete revisions summary will be provided with the release. This is a major IRAF release and it will be available for all supported IRAF platforms. Beta testing is being done on Sun platforms and we will release for this platform first (both SunOS and Solaris), but the other major platforms should follow shortly thereafter and distributions for all supported platforms should be available by the end of the summer.

A partial list of system changes:

- SunOS/IRAF and Solaris/IRAF have been merged, and a single IRAF installation can now support both at the same time if all the necessary binaries are installed.
- The tapecap mechanism, used to interface magtape devices, has been modified to allow a single shared IRAF installation to more easily support multiple hosts. Each host can have its own tapecap file, e.g., tapecap.ursa, tapecap.tofu, and so on. This feature is useful for example if a number of workstations, each with a local tape drive, mount an IRAF installation maintained on a central server.
- A new image kernel, the FITS image kernel, has been added to support direct runtime access to disk FITS images. All IRAF tasks will now be able to read and write FITS images as well as all the other supported IRAF image formats. Various other FITS support has been added as well, e.g., to support the IMAGE extension and multi-extension FITS files.
- The binary disk file format for the default runtime IRAF image format (.imh images) has changed. This change was necessary to allow for longer file path names. Images produced from earlier versions of IRAF are transparently readable with IRAF V2.11 but not vice versa. The path length for header and pixel files can now be up to 255 characters long.
- Since we had to change the file format of .imh images we took the opportunity to also make the format machine independent. Images now have byte-packed headers and the pixel data is byte-swapped and transparently readable on any IEEE-compatible host. This includes all modern platforms, the most notable exception being the VAX.
- The maximum number of open IRAF logical files was increased from 128 to 256. This is a benefit to tasks such as IMCOMBINE which must simultaneously access a large number of images.
- Various buffer limits were increased throughout the system:
  - The IRAF line buffer length was increased from 162 to 1024 characters.
  - The command buffer size is now 2048 characters long (the old limit was 1024).
  - IRAF file names can now be up to 256 characters long. Pathnames can be up to 512 characters. The root portion of a filename can be up to 128 characters.
- A number of new tasks were added to the IMAGES package and as a result the package had to be reorganized as it was getting too large. This reorganization should be transparent to the user and should not affect existing scripts, except for any task parameter changes.
- The Starlink positional astronomy library SLALIB was added to the math package.
- Various QPOE bugs were fixed and enhancements added in support of the the PROS and AXAF projects.
- The IRAF software development tools XC and MKPKG and the IRAF C runtime library LIBC were modified to improve support for C language programming, as an early part of the Open IRAF initiative.

A partial list of package changes:

- The tasks from the external package IMCNV (image convert) were merged into the DATAIO package. This includes tasks used to import and export numerous external image formats.
- The external package IMMATCH (image matching) was added to the IMAGES package.
- Most of the tasks in the external NMISC package have been incorporated into V2.11.
- The old VTEL (vacuum telescope data reduction) package has been removed from the NOAO distribution and moved to the NSO external package, which contains a newer version of VTEL and a number of other packages and tasks used for Solar data.

New tasks: there are roughly 35 new tasks in V2.11. 24 of these new tasks are in the reorganized IMAGES package.

Modified tasks: Over 75 tasks have been modified or have had parameter file changes.

A complete list of changes will be available in the IRAF Web pages at the time of the release of V2.11.

Doug Tody

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# NOAO FTP Archives

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

```
ftp ctios1.ctio.noao.edu (139.229.2.1), cd ctio
   CTIO archives---Argus and 1.5m 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 (146.5.2.181), cd pub
   SP software and data products--- coronal maps, active region lists, sunspot
   numbers, SP Workshop paper templates, meeting information, SP observing
   schedules, NSO observing proposal templates, Radiative Inputs of the Sun to
   the Earth (RISE) Newsletters and SP newsletters (The Sunspotter).

ftp ftp.gemini.edu (140.252.15.71), cd pub
   The FTP archives for the Gemini 8-m Telescopes Project.

ftp ftp.noao.edu (140.252.1.24), cd to:

   catalogs---Jacoby et al. catalog, "A Library of Stellar Spectra";
   "Catalogue of Principal Galaxies"; "Hipparcos Input Catalogue"; "Lick
   Northern Proper Motion Program: NPM1"; "Coud Feed Spectral Library."

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

   gong (helios.tuc.noao.edu, cd pub/gong)---GONG helioseismology software and
   data productsvelocity, 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 archive of 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, 4m PF platelogs, reference documents, and sqiid data
   reduction scripts.

   kpvt (argo.tuc.noao.edu)---KP VTT solar data productsmagnetic field, He I
   1083 nm equivalent width, Ca II Kline intensity.

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

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

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

   tex---LaTeX utilities for the AAS and ASP.

   utils---PostScript tools.

   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 additional IP numbers are available for the machines mentioned above:

```
   argo.tuc.noao.edu = 140.252.1.21
   gemini.tuc.noao.edu = 140.252.1.11
   helios.tuc.noao.edu = 140.252.26.105
   iraf.noao.edu = 140.252.1.1
   orion.tuc.noao.edu = 140.252.1.22
```

Questions may be directed to: 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.

For further information about NOAO, visit the Web at: http://www.noao.edu/.

Jeannette Barnes

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