NOAO Newsletter - December 1992 - Number 32

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Director's Office

AURA Corporate Office

Cerro Tololo Inter-American Observatory

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National Solar Observatory

Global Oscillation Network Group

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Comments concerning this Newsletter are welcome and will be forwarded to the appropriate editors.

Hard Times for These Times (1Dec92)

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Hard Times for These Times (1Dec92)
(from the Director's Office, NOAO Newsletter No. 32, 1 December 1992)

NOAO users and management have gained a growing awareness in recent weeks that there appears to be a fundamental change in the way that Congress approaches funding for basic research and that NSF is preparing to respond to that change. In October, Kent Wilson (Acting Director of the Astronomy Division of the NSF) visited Tucson and addressed a joint meeting of the CTIO and KPNO Users' Committees. The following week, a group from NOAO attended the Advisory Committee of the Astronomy Division (ACAST) meeting in Washington, during which we heard from Walter Massey (Director of the NSF) and Bill Harris (Associate Director for the Math and Physical Sciences Division).

The deep issue is that the rationale for supporting basic research is undergoing careful scrutiny and fundamental revision. That support was originally sold to Congress on the basis of strengthening defense, increasing economic competitiveness, and improving health care. The Cold War is over, the status of the US economy is a subject of considerable debate, and the control of health care costs is now a major issue. There is a growing sentiment in Congress that they wish to see more accountability in terms of direct return on their research investment. Consequences include an increased emphasis on research with direct application, an increased involvement of the "end users" (i.e., in industry and education) in the evaluation of the effectiveness of funded programs, and a generally closer coupling of supported research to defined societal goals.

The NSF is receiving advice from a commission of the National Science Board on how to increase its involvement as an interface between university and national laboratory research and industrial application. That commission received over 600 letters from the research community in reaction to this contemplated new direction. The exact structure of such a new interface is yet to be decided, but two trends seem very clear. One is that the current intention of NSF is to move in the direction of supporting technology transfer and research of interest to industry and of value to economic competitiveness. The second is that fields of research with easily identifiable application, such as materials science, will have a demonstrably stronger claim to funding priority.

The development of this year's funding situation provides a portent for the near-term direction of astronomy support. Despite a strong request in the President's budget, the House-Senate conference committee finally committed to a total allocation for Research and Related Activities (our grants and centers) that is about 1% less than last year's total. However, this year's bill contained an unprecedented level of direction for the NSF, both in terms of fields of emphasis and individually earmarked projects. To show allocations responsive to Congressional guidelines in targeted science areas, the NSF has to reduce the other areas of the program, given the flat funding profile. As a result, at the time of this writing, the budget for the Astronomy Division was starting out at a level down by about 10% from last year's. The NSF then must wrestle with accommodating the three projects earmarked for Math and Physical Sciences: LIGO, Gemini and the High Magnetic Fields Lab.

The consequence for NOAO must inevitably be reduced support for the current fiscal year. Many university departments have suffered similar difficulties recently, but there is an important difference. In many cases, the universities had been enjoying a period of substantial growth prior to the current downturn. NOAO has incurred a loss of support of over 20% in real terms in the last ten years. There is little to no flexibility left to respond to a sharp reduction in funding by imposing across the board cuts. Each division within the observatories is now struggling to define new modes of operation. The goal is to preserve as much access as possible to the telescope data stream (even if not directly to the telescopes) and to maintain the core of excellence in instrument development that makes forefront science possible and leads to a defining role for NOAO in the era of Gemini and new solar physics projects.

In this context, I would like your input on two very general questions. What are the aspects of NOAO that are most important to you and should receive the highest priority for sustained support? For example, there are several models of nighttime operation that could be considered. Resources could be concentrated on the largest aperture telescopes, with the smaller instruments closed or given over to consortia. Limited direct access could be given to the broader range of telescopes, with a substantial increase in queue scheduling for the programs with fewer requirements for real-time decision making. Significant shares of telescope time could be "sold" to user groups in exchange for operations or instrumentation development support. Do you view the availability of reliable, cutting-edge instrumentation as critical to your programs? Does NOAO's active development of data reduction or instrument interface software strongly benefit your research productivity?

The other question is: How can we successfully promote ground-based optical astronomy, both solar and night-time, in an era of emphasis on applied research and measurable return on research investment? We as a community must develop that case and be prepared to offer it high visibility to justify continuing support in an increasingly competitive environment. The notion of research funding as an entitlement based solely on excellence is coming under sharp attack. Should we emphasize our impact on the general public, on attracting young people to scientific careers, and on training researchers of high caliber to enhance the relevance of our field? Should we attempt to define a set of priorities for operations, infrastructure, and grants in the same spirit as project prioritization in the decade surveys, in order to offer a more united voice to our funding agencies?

NOAO takes pride in the unique combination of facilities and instrumentation that it offers to its users and in the level of support it provides in maintaining the quality of the data obtained here. We anticipate a strong future through the vitality of our current facilities and in our role as the focus for the US participation in the Gemini Project and in new solar physics initiatives. We ask your advice on our choice of new, reduced operating modes so that we can be positioned for maximum effectiveness to achieve our shared goal of US leadership in astronomical science.

Please send your responses to me, rgreen@noao.edu.

Richard F. Green

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John Leibacher to Change Focus (1Dec92)

John Leibacher to Change Focus (1Dec92)
(from the Director's Office, NOAO Newsletter No. 32, 1 December 1992)

The Director of the National Solar Observatory, John W. Leibacher, has announced that he will not pursue an additional directorship term. He will complete his five-year term on 1 April 1993. Leibacher was encouraged to consider continuing for a second term by NOAO, AURA, members of the community and staff. He stated the following in a notice to colleagues, "... I have really enjoyed working with the staff and the community in this position, and feel that we have accomplished an enormous amount together. However, on balance, I have decided that I have contributed as much as is reasonable, and that it is best for the Observatory, and for me, if I do not pursue an additional term. With GONG approaching its operational phase, I am looking forward to being able to devote more of my energy to my job as GONG Project Scientist, and to returning to my own research." The selection of the next NSO Director and the transition have been discussed, and Leibacher is "confident that the Observatory will continue to operate smoothly during this transition period." In closing, he remarked, "I just wanted to assure you, as a friend of the National Solar Observatory, of my commitment to the continuing excellence of our program."

NOAO has set up a search committee, and we are pleased that it is being chaired by Robert MacQueen, the immediate past Chairman of the AURA Board. Please contact either MacQueen or me with suggestions or nominations for the NSO Directorship.

Richard F. Green

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John Jefferies Becomes Emeritus Astronomer (1Dec92)

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John Jefferies Becomes Emeritus Astronomer (1Dec92)
(from the Director's Office, NOAO Newsletter No. 32, 1 December 1992)

A gathering on the Tucson patio in late September marked the occasion of John Jefferies receiving emeritus status in the National Solar Observatory. Goetz Oertel and Sidney Wolff spoke to commend Jefferies on behalf of AURA and NOAO for his distinguished service to the organization. They noted that, as the first Director of the newly founded NOAO, he successfully employed his vision and abilities to combine its disparate elements into an organization with identity and shared purpose. He dealt unflaggingly with the difficulties presented by decreasing institutional funding, and created an organizational structure with lasting vitality and increasing effectiveness. He was recognized for undertaking a challenging job with energy and dedication, for which the national astronomical community is grateful. They also reminded the group that it was Jefferies' vision and drive that opened the unique opportunities of observing from Mauna Kea to the astronomical world.

Jefferies' version of retirement will be to devote ALL his energies to research and new projects. He is actively involved with a small explorer proposal and continues his work with solar infrared research, eclipse studies, and theoretical investigations of spectral line formation in magnetic fields. At NSO and NOAO we are pleased to have the association of a colleague continuing to make a distinguished contribution to his field as John Jefferies moves into this new stage of his career.

Richard F. Green

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Todd Boroson and George Jacoby Become Astronomers (1Dec92)

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Todd Boroson and George Jacoby Become Astronomers (1Dec92)
(from the Director's Office, NOAO Newsletter No. 32, 1 December 1992)

With the strong recommendation of the KPNO personnel committee, Todd Boroson and George Jacoby were promoted to the rank of Astronomer in KPNO/NOAO. Both were recognized for their combination of outstanding research and service to the organization. Boroson was cited for his crucial contribution to the Observatory in supervising the O/UV instrumentation group and his leadership in developing state of the art CCD detectors and mosaic arrays. His research on populations and structures of galaxies and on the emission-line regions of quasars and Seyfert galaxies was praised for its quality and significance.

Jacoby was recognized for his outstanding contribution as Mayall 4-m telescope scientist, for his role in the seeing improvements effort at all sites on Kitt Peak, and his overall concern with improving the quality of the data and the data taking process on the mountain. He is touted internationally for his work on the extragalactic distance scale based on the luminosity function of planetary nebulae.

The mix of excellence in research and dedicated service to the community is the model for a National Observatories scientific staff member. We commend both Boroson and Jacoby for fitting that model so well and for their well-deserved promotions.

Richard F. Green

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NOAO Preprint Series (1Dec92)

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NOAO Preprint Series (1Dec92)
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The following preprints were submitted during the period 1 August to 31 October 1992. Please direct all requests for copies of preprints to the NOAO author marked with an asterisk.

Number	Author(s)	Title
(449) (Number reassigned)	*Walker, A.	"The LMC Cluster NGC 1835: Photometry of the RR Lyraes"
452	*Komm, R.W., Howard, R.F., Harvey, J.W.	"Torsional Oscillation Patterns in Photospheric Magnetic Features"
453	*Neidig, D.F.	"Consequences of Chromospheric Irradiation in White Light Flares: An Observer's Point of View"
454	*Neidig, D.F., Wiborg, P.H., Gilliam, L.B.	"Physical Properties of White-Light Flares Derived from their Center-to-Limb Distribution"

455	*Morrison, H.	"Thick Disk Formation - Merger or Dissipational Collapse? Some New Observational Constraints"
456	*Lauer, T.R., Postman, M.	"The Hubble Flow from Brightest Cluster Galaxies"
457	Ryden, B.S., *Lauer, T.R., Postman, M.	"The Shapes of Brightest Cluster Galaxies"
458	*Wise, M.W., O'Connell, R.W., Bregman, J.N., Roberts, M.S.	"Far-Infrared Emission from the Intracluster Medium"
459	*November, L.J.	"Exploiting Spatial Transformations of the Light State for Precise Polarimetry"
460	*Rice, W.	"An Atlas of High-Resolution IRAS Maps of Nearby Galaxies"
461	*Boroson, T.A.	"Evidence Against Some Orientation Effects in Radio-Quiet Quasars"
462	*Silva, D.R., Elston, R.	"Near-IR Color Gradients in Early-Type Galaxies"
463	*Walker, A.	"A BV Color-Magnitude Diagram for the Galactic Globular Cluster NGC 1851"
464	*Armandroff, T.E.	"The Disk Population of Globular Clusters"
465	*Zirker, J.B., Cleveland, F.M.	"Nanoflare Mechanisms: Twisting and Braiding"
466	Green, E.M., *Morrison, H.	"Local BHB Stars: BHB Density, HB Morphology and Halo Flattening"
467	*De Young, D.S.	"The Evolution of Compact Steep Spectrum Sources"
468	*November, L.J.	"FITS Library: FITS Interactive Task and Shell-Script Library"
469	*November, L.J.	"Recovery of the Matrix Operators in the Similarity and Congruency Transformations: Applications in Polarimetry"
470	Dougados, C., Lna, P., *Ridgway, S.T., Christou, J.C., Probst, R.G.	"Near-Infrared Imaging of the BN-IRC2 Region in Orion with Sub-arcsecond Resolution"
471	*Neidig, D.F., Kiplinger, A.L., Cohl, H.S., Wiborg, P.H.	"The Solar White-Light Flare of 1989 March 7: Simultaneous Multiwavelength Observations at High Time Resolution"
472	*Neidig, D.F., Kane, S.R.	"Energetics and Timing of the Hard and Soft X-ray Emissions in White Light Flares"
473	*Morrison, H.L.	"Kinematics of Metal-Poor Giants in an Inner-Halo Field, with Implications for Disk Formation"
474	*Durney, B.R., De Young, D.S., Roxburgh, I.W.	"On the Generation of the Large-Scale and Turbulent Magnetic Fields in Solar-Type Stars"
475	Lazrek, M., *Hill, F.	"The Deconvolution of Temporal Window Effects from Solar Oscillation Spectra"
476	*Harvey, J., Hill, F., Kennedy, J., Leibacher, J.	"GONG Project Update"
477	*Patron, J., Hill, F, Rhodes, Jr., E.J., Korzennik, S.G., Cacciani, A., Brown, T.M.	"Ring Diagram Analysis of Mt. Wilson Data"
478	*Williams, W., Hill, F., Toner, C.	"Test of a Simple GONG P-Mode Merging Algorithm"

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Non-NOAO Preprints (1Dec92)
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Preprints that were not included in the NOAO preprint series but are available from staff members are listed below in alphabetical order by first author. Please direct all requests for copies of these preprints to the NOAO author marked with an asterisk.

Author(s)	Title
*Altrock, R.C.	"Ground-Based Coronagraphic Observations of Solar Streamers"
Campbell, B., *Lauer, T.R., Lynds, R., O'Neil, Jr., E.J., Westphal, J.A.	"Hubble Space Telescope Planetary Camera Images of R136"
*Cauzzi, G.	"Two-Dimensional Solar Spectroscopy With a Narrow Passband Filter"
Denker, C., *Restaino, S.R., Radick, R.R.	"A Comparison of Two Wavefront Sensors"
Fitzpatrick, E.L., *Bohannan, B.	"Evidence for Processed Material in the Atmospheres of LMC B Supergiants"
Fulbright, M.S., Liebert, J., Bergeron, P., *Green, R.	"Spectroscopic Observations of the Detached Binary PG 1413+015"
*Geisler, D., Forte, J.C., Harris, G.L.H., Harris, H.H., Hesser, J.E., Ostrov, P.	"The Metallicity Distribution Functions for Globular Clusters in NGC 1399 and NGC 5128"
*Hamuy, M., Phillips, M.M., Wells, L.A., Maza, J.	"K-Corrections for Type Ia SNe"
*Howard, R.F.	"Axial Tilt Angles of Active Regions and Their Polarity Separations"
Hubbard, W.B., Porco, C.C., Hunten, D.M., Rieke, G.H., Rieke, M.J., McCarthy, D.W., Haemmerle, V., Clark, R., Turtle, E.P., Haller, J., McLeod, B., Lebofsky, L.A., Marcialis, R., Holberg, J.B., Landau, R., Carrasco, L., *Elias, J., Buie, M.W., Persson, S.E., Boroson, T., West, S.	"The Occultation of 28 Sgr by Saturn: Saturn Pole Position and Astrometry"
Hutchings, J.B., Bianchi, L., Lamers, H.J.G.L.M., *Massey, P., Morris, S.C.	"HST Spectroscopy of OB Stars in M31"
Jannuzi, B.T., *Green, R.F., French, H.	"An Optical Polarization Survey for BL Lacertae Objects and Highly Polarized Quasars"
Lavery, R.J., *Pierce, M.J., McClure, R.D.	"High-Resolution Imaging of Distant Clusters: 1. Close Pairs, Interactions and the "Butcher-Oemler" Effect at z=0.4"
Lee, M.G., *Geisler, D.	"Washington CCD Photometry of Globular Clusters in M87"
Leibundgut, B., Kirshner, R.P., *Phillips, M.M., Wells, L.A., Suntzeff, N.B., Hamuy, M., Schommer, R.A., Walker, A.R., Gonzlez, L., Ugarte, P., Williams, R.E., Williger, G., Gmez, M., Marzke, R., Schmidt, B.P., Whitney, B., Caldwell, N., Peters, N.,	"SN 1991bg: A Type Ia Supernova with a Difference"

Chaffee, F.H., Foltz, C.B., Rehner, D., Siciliano, L., Barnes, T.G., Cheng, K.-P., Hintzen, P.M.N., Kim, Y.-C., Maza, J., Parker, J. Wm., Porter, A.C., Schmidtke, P.C., Sonneborn, G.,	
Lockwood, G.W., Skiff, B.A., Baliunas, S.L., *Radick, R.R.	"Estimating Long-Term Solar Brightness Changes Using Stellar Observations"
Mazzarella, J.M., *Boroson, T.A.	"Optical Imaging and Long-Slit Spectroscopy of Markarian Galaxies with Multiple Nuclei. I. Basic Data"
Minniti, D., *Geisler, D., Peterson, R.C., Claria, J.J.	"High Dispersion Spectroscopy of Giants in Metal-Poor Globular Clusters. I. Iron Abundances"
Minniti, D., Peterson, R.C., *Geisler, D., Claria, J.J.	"Oxygen Abundances of Metal-Poor Globular Cluster Giants"
*November, L.J., Wilkins, L.M.	"The Liquid Crystal Polarimeter for Solid-State Imaging of Solar Vector Magnetic Fields"
Olszewski, E.W., Pryor, C., *Schommer, R.A.	"The Velocity Dispersion of the Distant Halo Globular Cluster NGC 2419"
*Restaino, S.R.	"Focal Volume Technique for Solar Applications"
*Restaino, S.R., Anderson, S.	"A New Deconvolution Algorithm for Astronomical Images"
Sarazin, C.L., *Wise, M.W.	"BL Lac Objects, FR I Radio Sources, and Cluster Cooling Flows"
*Smartt, R.N., Zhang, Z.	"Morphology of Coronal Loop Interactions"
*Smith, R.C., Kirshner, R.P., Blair, W.P., Long, K.S., Winkler, P.F.	"Optical Emission-Line Properties of M33 Supernova Remnants"
*Suntzeff, N.B., Mateo, M., Terndrup, D.M., Olszewski, E.W., Geisler, D., Weller, W.	"Spectroscopy of Giants in the Sextans Dwarf Spheroidal Galaxy"
*Walker, A.R.	"Photometry with CCDs"
*Walker, A.R.	"RR Lyraes in the Magellanic Clouds"
*Wise, M.W., Sarazin, C.L.	"The X-ray Spectra of Cluster Cooling Flows. I. Optically Thin Models"
*Zirker, J.B.	"Coronal Heating"
*Zirker, J.B., Cleveland, F.M.	"Avalanche Models of Active Region Heating and Flaring"

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AURA Board Recognizes Pat Osmer's Contributions to Gemini (1Dec92)

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AURA Board Recognizes Pat Osmer's Contributions...(1Dec92)
to Gemini
(from the AURA Corporate Office, NOAO Newsletter No. 32, 1 December 1992)

At its 5 October meeting, the AURA Executive Committee unanimously adopted a formal commendation for Pat Osmer for sustained superior service as Interim Gemini Project Scientist.

Osmer led the science effort in developing NOAO's proposal to build two 8-m telescopes. He organized its scientific defense and saw it through to its acceptance by NSF as the international Gemini project. As Gemini's first project scientist, Osmer managed its scientific development and coordinated it with colleagues in the Gemini countries. This effort demanded unusual scientific, organizational, and diplomatic talents and much hard work. In meeting the many challenges of Gemini, he set the common good ahead of personal interests, including his science, and ahead of institutional interests. Osmer set an example of outstanding service to the astronomy community.

Thanks, Pat!

Goetz Oertel

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International Affiliate Representatives Named (1Dec92)

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International Affiliate Representatives Named (1Dec92)
(from the AURA Corporate Office, NOAO Newsletter No. 32, 1 December 1992)

The AURA Board established an International Affiliate class of membership at its annual meeting in April. We are pleased that Maria Teresa Ruiz will represent the Universidad de Chile at Santiago and that Gloria Koenigsberger will represent the Universidad Nacional Autonoma de Mexico (UNAM). Ruiz is a full professor of astronomy and has been on the Universidad de Chile faculty since 1979. Koenigsberger is the Director of the Instituto de Astronomia at UNAM.

Lorraine Reams

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Iowa State Board Member Named (1Dec92)

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Iowa State Board Member Named (1Dec92)
(from the AURA Corporate Office, NOAO Newsletter No. 32, 1 December 1992)

David Glenn-Lewin has been named as Iowa State University's first institutional Director on the AURA Board. Glenn-Lewin is the Interim Dean of the College of Liberal Arts and Sciences. Iowa State was admitted to the Board in April 1992. Lee Anne Willson, also from Iowa State, continues to serve on the AURA Board as director-at-large.

Lorraine Reams

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CTIO Instrumentation (1Dec92)

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CTIO Instrumentation (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

The CTIO instrumentation program is continuing to mainly devote its resources to two key areas: work on the new array controllers and improving the 4-m telescope's image quality. However, there has also been progress in other areas.

The ARCON project is now in the process of building the first batch of "production" controllers; details are presented in an accompanying article. Because the detector control will in future be done through a Sun computer, and because the demands of data reduction have in general increased, we have begun the process of acquiring Sparcstation-10 machines for the telescopes. Depending on the details of delivery, installation, and ARCON implementation, we should have two or three Sparcstation 10s on Tololo, at the 4-m telescope and the 1.5-m and/or the 0.9-m telescopes.

Two Sparcstation 10-41 machines will eventually replace ctios3 and ctios4 (currently Sparcstation 2s) as public-access data reduction machines in La Serena. Installation of these new machines is expected to be done around Christmas (of course).

The console-room move on the 4-m telescope was successfully carried out in August, and most major instruments have been successfully operated from the new location (the remainder should be checked out by the end of the current semester). The old console room will be used only for instrument set-ups and for visitor instruments that cannot be operated from the ground floor console room. The smooth transition from the old location to the new one is the result of a major effort by the Tololo electronics section; they deserve considerable credit for the smoothness with which the transition was accomplished. The removal of heat sources from the observing floor should contribute to improving the dome seeing. Observers will also note that the new console room and adjoining computer room also represent a better environment in which to work (not surprisingly, given that the original console room was designed for the instruments and computers of twenty years ago).

Installation of the dome venting doors is now complete, but routine operation has not yet begun, as there are still some safety interlocks and barriers which have to be implemented. This is expected to occur shortly. Observers should note that the 4-m outside catwalk is now and henceforth closed to general access. (The access doors are now locked, for this reason.)

Construction of the 4-m Prime Focus CCD unit is now largely completed, and the instrument appears to be on schedule for commissioning in December. Barring major setbacks, the PFCCD unit is expected to be routinely available from first semester of next year onward. The elements of the Prime Focus Corrector and Atmospheric Dispersion Corrector are still being cemented in Tucson. As stated in the last Newsletter, they will be shipped to Chile once this step is completed, and final assembly of the PFC/ADC will then take place.

Design work on the HgCdTe IR Imager has now begun. Specifications are described in an accompanying article. This instrument is presently expected to be available second semester of 1993. This schedule is still tentative, however---check the March 1993 Newsletter for an update.

Jay Elias

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OSIRIS Visits CTIO (1Dec92)

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OSIRIS Visits CTIO (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

OSIRIS is not, in this case, the Egyptian god of the dead coming to check up on staff members who are slow to publish, but rather the acronym standing for "Ohio State IR Imaging Spectrometer." CTIO has reached an agreement with the Ohio State University (OSU) infrared group whereby this instrument will be made available during the second semester of 1993 for use by visiting astronomers. The agreement, similar to that originally covering the Rutgers Fabry-Perot, ensures that the instrument will be supported by OSU staff; it provides a quick and economical means of providing additional infrared capabilities at CTIO.

In the rest of the article, we provide a brief summary of the instrument's characteristics, followed by our evaluation of the circumstances under which we recommend that visitors apply to use it. The intention is that the instrument will be available during the entire semester. However, because of the burden on OSU personnel implied by support of the instrument, we intend to schedule its use only when reasonably large blocks of time can be arranged---that is, there will not be any isolated two-night runs.

OSIRIS Characteristics
Briefly, OSIRIS at CTIO will work at the f/30 foci of both the 4-m and 1.5-m telescopes. It has two imaging configurations and several spectroscopic configurations. The detector used is a 256 x 256 Rockwell HgCdTe array (NICMOS III array). Switching between the different configurations can be done in less than a minute. A description of the instrument may also be found in the proceedings of the ESO Large Telescope Conference (Atwood et al. 1992, in press). The construction of OSIRIS was partially supported by the NSF under a grant to OSU.

Imaging Configurations
Two different plate scales are available through use of two different cameras in the system. The plate scales provided are:

	Scale (Arcsec/Pixel)	
Telescope	4-m	1.5-m
Coarse	0.38	0.95
Fine	0.15	0.37

The following filters are currently expected to be available:

Broadband JHK and K', also a "long K" for planetary work.
Narrowband (1%): 1.083, 2.090, 2.124, 2.140, 2.162, 2.190, 2.270, 2.305 um
Narrowband (3%): 1.995, 2.205, 2.360 um (standard H_2O and CO filters).

Potential users are reminded that the Rockwell arrays are not sensitive longward of 2.5 um.

Spectroscopic Configurations
Several spectroscopic configurations will be available. Two use a grating to provide the dispersion, plus a blocking filter for order separation. In these configurations, the resolution is set by the choice of camera optics. The low resolution configuration gives R ~ 550, while the higher resolution configuration gives R ~ 1550. (In both cases, resolution is defined as two pixels). The scales along the slit are the same as for imaging, but there is anamorphic demagnification along the dispersion direction, resulting in slit widths (on the 4-m telescope; 1.5-m values are three times greater) matched to the resolution of 1.2 arcsec for R = 500 and 0.45 arcsec for R = 1550. In all cases the usable slit extends the full height of the array. At R = 550, an atmospheric "window" is covered with a single grating setting; at R = 1550 three or four settings (depending on the amount of overlap desired) are required.

In addition, a grism cross-disperser can be used instead of a blocking filter; this provides coverage in multiple orders at the price of a shorter usable slit. This configuration is only useful at R = 550. If coverage only from 1.18 to 2.45 um is desired, the usable slit length is roughly 30 pixels. If an additional order is to be included, which would extend down below 1.0 um, the usable slit length is reduced to approximately 10 pixels. This last configuration is likely to complicate sky subtraction because of the very short slit, and prospective users may find it easier to get the short wavelength coverage separately but with a longer slit.

When to Use OSIRIS
By second semester, CTIO instrumentation is expected to include (1) the SBRC array IR Imager, (2) the SBRC array IRS, and (3) the CTIO HgCdTe Imager (see accompanying article for details).

OSIRIS's imaging capabilities do not differ significantly from those of the new CTIO instrument, except for the ability to easily switch plate scales at the telescope. We would therefore recommend use of OSIRIS mainly for those proposals where switching quickly between the two plate scales is important to the science. Since it is also the case that the CTIO Imager will achieve 0.4 arcsec pixels only using the f/8 secondary on the 4-m, which will not be available during the first months of the semester, proposals which require this scale should also request OSIRIS.

For spectroscopic work, OSIRIS offers substantial improvements in performance over the CTIO IRS except for work beyond 2.5 um or where a resolution greater than R = 1550 is needed (the IRS offers R = 2000 and R = 3000 configurations). We therefore recommend that it be requested for all proposals except those involving long wavelength observations or requiring high resolution. In addition, prospective users planning to observe at R = 2000 with the IRS should consider that the greater wavelength coverage of OSIRIS for a given grating setting may well offset the higher signal to noise required (1.3 times higher at R = 1550) to detect a weak feature against a strong continuum.

How to Apply for Time
We will provide an update on instrument performance in the next Newsletter (March 1993), based on the results of further lab and telescope tests of the instrument; interested users may also contact any of the undersigned. Proposals should be written as for any CTIO facility instrument. Scheduling of the instrument does not require that you specify the configuration to be used, but it is important to do so from the point of view of evaluating technical feasibility and amounts of time required. Proposals will be handled in the same way as proposals for facility instruments, except that technical feasibility review will be done in consultation with OSU staff.

Bob Williams, Jay Elias (jelias@noao.edu),
Brooke Gregory (bgregory@noao.edu),
Richard Elston (relston@noao.edu),
Jay Frogel, Darren DePoy (OSU)

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CTIO HgCdTe Imager (1Dec92)

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CTIO HgCdTe Imager (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

This article is intended to provide a brief summary of the specifications for CTIO's second generation IR Imager, now under construction. This instrument is based on a 256 x 256 Rockwell HgCdTe array, and will accept a larger format (512 x 512) array with the addition of a simple field-flattener, when such devices become available, if and when CTIO has the funds to purchase one. Our current schedule would have it becoming available roughly at the beginning of second semester 1993.

The imager has optics which provide a fixed demagnification ratio of 1.5, of the focal plane onto the detector. The instrument will work at f/ ratios of 7.5 or slower, with optimization for a particular telescope and secondary provided by use of an internally selectable cold stop. Thus, a range of pixel scales are available through selection of telescope and secondary, but changes in scale at the telescope are generally inconvenient.

The virtue of this approach is the extreme simplicity of the mechanical design - an important factor considering the limited resources of the

CTIO instrumentation program - and the high efficiency of the optical design (four elements including the dewar window).

A focal ratio converter has also been designed and ordered for use on the Schmidt telescope. This converts the f/3.5 beam of the telescope to f/7.5, which is the fastest beam with which the imager will function.

A list of approximate plate scales is attached for all telescopes on which operation of the imager is expected to be scheduled:

Telescope	Focal Ratio	Arcsec/ Pixel	Field (Arcmin)
4-m	f/30	0.10	0.4
	f/8	0.40	1.7
1.5-m	f/30	0.27	1.1
	f/13.5	0.60	2.5
	f/7.5	1.08	4.6
0.9-m	f/13.5	1.0	4.2
Schmidt	f/3.5+conv	2.72	11.6

The imager will have all presently available 1-2.5 um IR filters, plus a variety more presently on order. The final complement will include IJHK and K' broadband filters, H2O and CO filters, plus 1% bandwidth filters for most emission lines of astrophysical interest in the 1-2.5 um region.

When to Use It
The Rockwell HgCdTe arrays are not sensitive beyond roughly 2.5 um, and therefore the new imager will not be useful for programs requiring L band photometry or using the 3 m narrowband filters. For all other imaging programs it will clearly be the instrument of choice.

Because there continue to be programs requiring 3 um observations, the present IR imager will continue to be supported, but it will be reconfigured with broadband JHKK' and L, plus our narrowband 3 um filters.

Note also that Ohio State's OSIRIS (see accompanying article) will be available during second semester 1993, providing both an alternative and a backup on the two largest CTIO telescopes.

We will provide an update on the status of all the imagers in the March 1993 Newsletter. Prospective users may also contact any of the undersigned in February or early March for more details.

Jay Elias (jelias@noao.edu),
Brooke Gregory (bgregory@noao.edu),
Richard Elston (relston@noao.edu)

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CCD and Controller News (1Dec92)

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CCD and Controller News (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

Reticon has delivered the Grade 1 1200J CCD (1200 x 400, 27 um pixels), on order for more than two years. This is a thinned device upon which a flashgate and AR coating have been deposited by Lloyd Robinson (Lick Observatory). The quantum efficiency is much higher than that of our present Reticon #2, especially in the blue (75% vs. 40% at 4000 A), and read noise is expected to be about 3 electrons rms. We plan to swap the new CCD (Reticon #3) for Reticon #2 during November. As a reminder, the Reticon is installed in a special dewar dedicated to the Blue Air Schmidt camera, which sees use with the three 4-m spectrographs (ARGUS, R-C and Echelle).

A second, similar dewar contains an EEV CCD (576 x 384, 22 um pixels) which is dedicated for use with the Red Air Schmidt camera. This CCD has QE little inferior to the Reticon in the far red, and being a front-illuminated CCD, does not suffer from fringing. We have increased the versatility of this option by substituting a coated CCD which is sensitive shortwards of the 4800 cutoff of the uncoated device. Secondly, a field flattener has been installed which has a multi-layer broad-band AR coating. The useful wavelength range of this combination is approximately 3800-10000 A.

Work to convert our CCDs to operate with the new ARCON controllers is proceeding apace. As discussed in previous Newsletters (No. 30 p. 8, No. 31 p. 10), a prototype version (ARCON 2.1) has been successfully taking data at the Schmidt telescope this year, and will be offered for visitor use at that telescope next semester. Three production ARCONs are being produced almost in parallel; one of these is a laboratory system, and the other two will operate a Tek 1024 and Tek 2048. We expect to begin using these at the telescopes during November and December. Although we warned (Newsletter No. 30, p. 8) that the conversion to ARCONs would mean a restriction in the types of CCD offered at the 0.9-m telescope, in actuality we will need to keep the old VEB controllers in service for a few more months just to operate the filters and preflash. At this time we plan to switch over to using a new motor controller, and the VEB and LSI-11 computer will be retired. Until this time CCDs at the 0.9-m can in principle be operated with either the old or new controllers. Notwithstanding, we plan to restrict as much as possible the changing of CCDs at the 0.9-m, and the ARCON-based Tek 1024 #2 will be the default detector.

Alistair Walker

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CCD Photometry: Some Problems with Reductions (1Dec92)

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CCD Photometry: Some Problems with Reductions (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

We have recently received several comments about possible photometric problems found from measurements based on CCD images from our 1.5-m and 0.9-m telescopes. We wish to point out that there are in principle several possible causes of these problems, including detector faults, telescope/dome misalignments, reduction procedures and algorithms, shutter timing errors, and sky conditions.

The CCDs are regularly checked for linearity and charge transfer performance in our laboratories. Our old controllers, in use for more than a decade, have recurrent noise problems, and the analog-to-digital converters (ADC) have degraded in performance. Also, some of them have only 14-bit resolution. These latter ADCs are connected to the (15 bit) computer system so that the least significant bit of the latter is always zero, which means that the raw data contain only even numbers. Spectroscopic observers usually set their CCD gain near 1 electron/ADU so that in low background conditions readout noise always dominates quantization noise. However photometric observers commonly set the gain to a few electrons/adu in order to achieve more dynamic range. Consequently, with low noise CCDs the quantization noise will be comparable to, or maybe even dominate, the readout noise. In the low background case the data will then appear quantized near values 0, 2, 4, 6, 8, etc. (14 bit ADCs) or 1, 2, 3, 4, etc. (16 bit ADCs). Our old CCD controllers are in the process of being replaced, and in the meantime we have retro-fitted new ADCs which give the full 15 bits of resolution (0-32767). The new controllers will use all 16 bits (0-65535). Notwithstanding, the current information shows that the detectors have excellent photometric performance. However, we recommend that observers consult their staff contact if they are uncertain which gain setting is appropriate for their program.

The shutter timing errors are constant for a given CCD and shutter/preflash assembly and can be calibrated out of the data. Typical errors (0.9-m) are additive constants of about 50 ms in the center, falling to 0 ms at the corners of the Tek 2048.

Both the 0.9-m and 1.5-m suffer some image quality degradation, due to problems with mirror supports and alignment (unfortunately typical of old telescopes). These problems may affect PSF fitting routines. As we have noted before, the 0.9-m is a classical Cassegrain and has field coma, which becomes important for the larger CCDs. Users should be very careful when attempting to do PSF photometry on these telescopes, and consult the relevant staff contact. We are currently evaluating these effects, and hope to provide a corrector in the coming year for the 0.9-m.

We have noted two problems that definitely do affect recent photometry. On rare occasions the autodome gets "lost" in the telescope control system, and of course this can occult the aperture. Observer Support on the mountain checks this routinely, and the night assistants easily recognize this problem. Observers should go into the dome at least once during the run to make sure they feel confident about the dome positioning.

The second problem concerns reduction routines, and has recently been (re-)discovered. Under some conditions several of the IRAF APPHOT/DAOPHOT algorithms used for determining "sky" perform poorly. Specifically, in the case where the background is only a few counts and detector read noise is not dominant, the width of the histogram of sky values is comparable to the quantization of the data, and thus methods assuming a smooth histogram may be inappropriate. This includes mode and median estimators (e.g., the routine QPHOT uses modal sky). Experiments by Mario Hamuy show that for a star with peak counts of 500-1000 ADU and near-zero sky, random errors of 0.2-0.4 mag. (several tenths) are possible. In these cases an estimator such as the mean, perhaps with rejection of outlying values, is much superior. The circumstance where sky background is small most often arises when making observations of standard stars or observations with narrow-band filters. Frequently, standard stars are exposed to have almost full-scale counts at peak, and precise location of the sky is not needed. However recently, particularly with the advent of large CCDs, it has become common to observe fields containing standard stars with a wide range in magnitude (e.g. Landolt, AJ, 104, 340, 1992). In order to use all the available standards in these fields, correct placement of the sky background is essential. Note that the above comments do not apply to the original (Stetson) versions of DAOPHOT. Peter Stetson informs us that presently there is no evidence to show that his method of calculating the sky (if mean &gt median, then sky = 3 median - 2 mean, or if mean &lt median, then sky = mean, where the median is taken as the average of the 5% of the pixels around the numerical median) introduces serious errors.

Finally, atmospheric extinction is presently elevated due to volcanic dust from Mt. Pinatubo. Kv is still in excess of 0.20. Although it appears that the absorbing layers are now relatively uniform, observers engaged in all-sky photometry should proceed with caution.

A. Walker, R. Schommer, N. Suntzeff,
S. Heathcote, M. Hamuy

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New Telescope Control Program Installed at 1.5-m Telescope (1Dec92)

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New Telescope Control Program Installed at 1.5-m...(1Dec92)
Telescope
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

In mid-September the new telescope control program (TCP) was brought into full time service at the 1.5-m telescope. This system is closely modeled on the one which has been in use at the 4-m telescope for over two years and provides very nearly the same functionality. The TCP software consists of two parts, each running on a different processor. The program which actually controls the telescope resides on a VME bus based Heuricon computer, while the menu driven user interface runs on a separate PC. The TCP software was written by Germn Schumacher, while the interface electronics were designed and built by various members of the mountain electronics group, in particular Ramon Galvez and Rolando Rogers. The project was largely carried out under the supervision of Bill Weller.

The TCP implements all (or nearly all) the functions one would expect of a modern telescope control system. The telescope can be slewed to coordinates specified for any epoch. These may be entered at the keyboard, taken from one of several on-line catalogs (e.g. the bright star catalog, lists of CTIO photometric and spectrophotometric standards), or selected from a user supplied coordinate list (see below). A "slew stack" is also provided which automatically records the target coordinates for each slew operation, so that one can return to an earlier position without re-entering the coordinates. An important enhancement over the previous software is that the TCP properly takes into account the position angle of the instrument rotator. Thus it is possible to make offsets in the direction parallel or perpendicular to the spectrograph slit, and one can also request that the hand-paddle move the telescope along these directions instead of in RA and Dec. The TCP also resolves pulses from the leaky-guider so that it is now possible to use the auto-guider with the instrument rotator set to any position angle. Another useful feature, for instance when working in globular clusters, is the ability to use positions which are known only in the form of offsets relative to some reference position. Once any star in the list has been identified, the location of the reference point can be made known to the TCP by entering the offset of that star; there need not be any actual object at the reference position. The telescope can then be moved to other objects in the list by entering their offset. All of these functions are also available on the 4-m telescope, of course.

One difference from the 4-m system is that the offset guide probe (GAM) at the 1.5-m cannot currently be moved under the control of the TCP computer. The probe can, however, be moved manually in order to acquire guide stars. This deficiency will be rectified in a future project.

As far as actual performance is concerned, an RMS pointing accuracy of 10 arcsec over the entire sky can be routinely achieved. Precision offsets of up to several degrees, relative to a known position, can be made to an accuracy of better than 1 arcsec, primarily limited by the ability to center the reference object on the acquisition TV. The open-loop (unguided) tracking accuracy is +-2 arcsec per hour.

Users may wish to prepare coordinate lists in the form of ASCII text files in advance of their run. The format of these is the same for both the 4-m and 1.5-m TCPs. The entry for each object consists of a label, three numbers for the RA (hours, minutes and seconds), three numbers for DEC (degree, minutes and seconds), the epoch in years, proper motion in RA and DEC (both in arcsec per year) and finally an arbitrary comment. Each entry is one line of text, containing a maximum of 80 characters, in free format, each of the above fields being delimited by spaces. For example:

```
6-CMi 7 29 09.4 12 01 52 1988.5 0.0 0.0 Sp. = K2 III
```

The label field must contain printable characters only, with no commas, semicolons, spaces or tabs. The number of entries is in principle very large, however, speed of access suggests that no more than about 1000 objects be recorded in a single file. The TCP computer itself can read both 5.25 inch and 3.5 inch DOS format floppy disks (either regular or high density). Alternatively, coordinate lists can be imported directly from the Sun computer at each telescope using PC-NFS. In this case the lists could be brought to Chile on magnetic tape, in UNIX tar or IRAF card-image format, or could be transferred electronically using E-mail or FTP.

Steve Heathcote, German Schumacher

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CTIO Manuals Available via FTP (1Dec92)

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CTIO Manuals Available via FTP (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

Over the next few months we plan to make electronic copies of all the CTIO instrumentation manuals available via ftp. These documents will be stored both as postscript files and as simple ASCII text files, although any accompanying figures will be missing in the latter case. They can be retrieved with ftp by connecting to ctios1.ctio.edu (139.229.2.1) using anonymous as user name and supplying your own name as password. The manuals will be found in the directory /pub/manuals; consult the file README in that directory to obtain an up-to-date listing of what is available.

Paper copies of all CTIO manuals will continue to be available on request from:

```
RE: Manuals                           RE: Manuals
CTIO Support Office      or           CTIO
P.O. Box 26732                        Casilla 603
Tucson, AZ 85726                      La Serena, Chile.
```

Steve Heathcote

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Long Distance Phone Calls from CTIO (1Dec92)

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Long Distance Phone Calls from CTIO (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

The placement of direct long-distance phone calls from CTIO by visiting astronomers has become a serious accounting problem for the observatory, resulting in many thousands of dollars of unpaid calls each year.

Unfortunately, there is no solution to this problem at present, other than to block such direct long-distance calls from public-access observatory phones in the future. Fortunately, alternatives are available that allow rapid communication via phone.

First, AT&T USA Direct (or its equivalent via Sprint and MCI) is available from Chile; this service enables you to place a direct call to the USA using a telephone credit card. Equivalent services may be available to non-US astronomers; please check with your long-distance telephone company. If you advise our receptionist, they can place the call to the USA Direct (or other) operator for you. Otherwise, all long distance calls should be made "collect," this should also be done through the receptionist. This policy applies to calls made from the Santiago Guesthouse as well. If you wish to be able to call your colleagues, family, or friends from Chile easily, we recommend that you bring a telephone credit card with you that will allow you to do so. For reference, the receptionist's schedule is now:

```
                 Monday-Friday:    8:30 am - 9 pm
                 Saturday:         9 am - 9 pm
                 Sunday:           9 am - 5 pm
```

These times are local time, which is the same as EDT during the northern summer and 2 hours ahead of EST during the northern winter (Chile is then on daylight time).

Second, as noted in the last Newsletter, it is now possible to call any CTIO phone extension directly, night or day, without having to pass through our receptionist. From the US, one dials 011-56-51-205-xxx, where xxx = the extension number of the phone. Some useful extensions follow:

Tololo:

4-m telescope console	400
1.5-m telescope console	466, 464
0.9-m telescope console	469, 468
1.0-m telescope console	472, 473
Curtis Schmidt console	474
0.6-m Lowell telescope	487
Observer Support	420, 421
Dining Room	461
Tololo FAX	462

La Serena:

Director's Office	200, 217, 215
Computer Room	310
La Serena FAX	342

Note: where two or more numbers are listed, the first is "preferred," since the others often ring in additional locations and may be picked up there.

Bob Williams, Jay Elias

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Driving in Chile (1Dec92)

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Driving in Chile (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

Visiting observers who plan to rent a car while in Chile, or longer-term visitors who expect to use CTIO vehicles, should be aware that they must have a valid international driver's license to do so. The international license can be easily obtained from your local auto club; it is valid for a year, anywhere (or almost anywhere) in the world. However, if you are only going to drive the Tololo Volkswagens around the mountain top, the international license is not needed.

Bob Williams, Enrique Figueroa

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Observing Request Statistics: February - July 1993 (1Dec92)

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Observing Request Statistics: February - July 1993 (1Dec92)
(from CTIO, NOAO Newsletter No. 32, 1 December 1992)

4-m Telescope

# of Requests		# of Nights Requested				
Dark	Bright	Dark	Bright	Instrument	Nights	%
24	6	81	20	CS/CCD	101	28.0
1	9	3	36	IRS	39	10.8
15	-	44	-	PF/CCD	44	12.1

10	7	35	17	Argus	52	14.3
2	9	9	38	Ech/CCD	47	13.0
1	6	3	20	IR/Imager	23	6.3
1	-	1	-	PF/Plates	1	0.3
1	1	1	3	RF-P	4	1.1
-	1	-	1	CF/CCD	1	0.3
-	2	-	5	ASCAP	5	1.4
-	2	-	5	IR/Phot	5	1.4
-	10	-	40	Visitor	40	11.1
55	53	177	185		362	100%

	Now	Last Semester	Semester Before Last
No. of requests	108	124	109
No. of nights requested	362	452	397
Oversubscription*	2.18	2.77	2.55
Average request	3.35	3.64	3.64

* 166 nights available after engineering

1.5-m Telescope

# of Requests		# of Nights Requested				
Dark	Bright	Dark	Bright	Instrument	Nights	%
11	2	49	7	CF/CCD	56	15.3
13	12	80	81	CS/CCD	161	44.0
1	6	6	27	Ech/CCD	33	9.0
1	6	4	29	IR/Imager	33	9.0
1	6	4	33	RF-P	37	10.1
-	3	-	13	IR/IRS	13	3.6
-	3	-	17	ASCAP	17	4.6
-	1	-	1	IR/Phot	1	0.3
-	2	-	15	Visitor	15	4.1
27	41	143	223		366	100%

	Now	Last Semester	Semester Before Last
No. of requests	68	61	59
No. of nights requested	366	324	329.5
Oversubscription*	2.09	1.91	1.97
Average request	5.38	5.31	5.59

* 175 nights available after engineering

1-m Telescope

# of Requests		# of Nights Requested				
Dark	Bright	Dark	Bright	Instrument	Nights	%
3	2	20	9	CS/2DF	29	17.7
5	9	36	99	ASCAP	135	82.3
8	11	56	108		164	100%

No. of requests = 19
No. of nights requested = 164
Oversubscription* = 0.92
Average Request = 8.63 nights
* 177 nights available after engineering

0.9-m Telescope

# of Requests		# of Nights Requested			
Dark	Bright	Dark	Bright	Instrument	Nights
23	18	108	150	CF/CCD	258

No. of requests = 41
No. of nights requested = 258
Oversubscription* = 1.54
Average Request = 6.29 nights
* 167 nights available after engineering

Curtis Schmidt

Pt:Si	1 req. for	12 nights	13.5%
Plates	2 req. for	40 nights	44.9%
CCD	7 req. for	37 nights	41.6%
	10 req.	89 nights	100%

No. of requests = 10
No. of nights requested = 89
Oversubscription* = 0.49

Average request   = 8.90 nights
* 179 nights available

0.6-m Telescope
          ASCAP 4 requests for 129 nights

Doug Geisler

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The WIYN Report: Progress on the New 3.5-m Telescope (1Dec92)

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The WIYN Report: Progress on the New 3.5-m Telescope (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

Construction of the WIYN enclosure is nearing completion approximately three months ahead of schedule. The control building is finished, and exterior panels are being installed on the telescope enclosure. Work remains on the enclosure building, and the electrical and mechanical systems need to be connected and tested. Once construction of the enclosure building and control building are complete, the WIYN staff will prepare the building for the arrival of the telescope mount and installation of the control system during the spring and summer. We are obviously pleased at the anticipated timely completion of the construction!

The fabrication of the telescope mount is in full swing at L&F Industries in California. Once the telescope mount is assembled, the motion of the axes and the operation of the various subsystems will be tested, using dummy weights in lieu of the primary, secondary and tertiary mirror assemblies. Following the tests, the mount will be disassembled and shipped to Kitt Peak for installation starting in April.

The 3.5-m primary mirror, cast at the Steward Observatory Mirror Laboratory, has returned there for asphherizing and polishing. They are fine grinding the surface of the mirror into the proper asphere and will begin polishing soon. The mirror should be completed by the end of April. More details on the status of the primary can be found in the following article. Once the mirror is returned, NOAO will complete fabrication, installation and testing of the final mirror cell, supports, and thermal control system in time for installation in the telescope in October.

Work on the other optics for the WIYN telescope is also progressing. Contraves has received the secondary mirror blank at its facility in Pennsylvania and is preparing to generate the surface. The mirror will be polished and tested using the 100 inch Hindel sphere on loan from NOAO. The contract for polishing the tertiary mirror has been awarded to Kodak, and the mirror blank will be shipped to them in November. The optical design for the wide-field corrector is being optimized, and WIYN will soon request bids for the fused silica blanks and optical fabrication.

A critical design review of the telescope control system was held in early October at the University of Wisconsin. Fabrication of the system is getting underway, and installation of the control system in the observatory is expected next summer.

Two "facility" instruments are being planned for early use at the WIYN Observatory. NOAO has detailed its plans to move the Hydra fiber positioner and the Bench Spectrograph from the 4-m to the WIYN telescope during the summer of 1994. The design of a CCD imager for the other Nasmyth focus is underway at Indiana University. NOAO expects to supply a "mini-mosaic" CCD detector with 4096 x 4096 pixels for use in the imager.

Plans for the commissioning and early operations phases of the telescope are being developed for discussion with the WIYN Board of Directors during the next year.

Matt Johns, Caty Pilachowski

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The WIYN Mirror (1Dec92)

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The WIYN Mirror (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

This quarter saw the completion of the test program for the active optics system and the thermal control system of the WIYN 3.5-m primary mirror. Scatterplate interferograms were taken with the systems under test in both vertical and horizontal orientation. A list of system upgrades has been identified and will be incorporated.

The next phase is the grinding and polishing activity which takes the current sphere to an f/1.75 asphere. At the beginning of August, the University of Arizona submitted a proposal to do the grinding and polishing at the Steward Observatory Mirror Lab. Because the polishing facilities were ultimately made available to NOAO starting in September, the accepted proposal specifies a completion date of 30 April 1993 for the WIYN mirror, and it provides a polished mirror at least six months ahead of the NOAO in-house polishing schedule.

Contract negotiations and approval required considerable effort to complete in the allotted time. We are grateful for the assistance of the AURA Corporate Office and the NSF in expediting this process, and to our own Contracts and Administrative Services personnel for their heroic efforts. The signed contract was delivered on 15 September. Later that day, the mirror was delivered to Steward Mirror Lab.

Development of the bar lap polishing technique has been halted; the Steward stressed lap approach will be used instead. The WIYN mirror will be ground in the Steward polishing cell and then transferred to the NOAO mirror cell for final polishing. This transfer will allow use of the NOAO polishing supports and thermal control system for final polishing.

Larry Daggert, Richard Green

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Revised Instrument Manuals Available (1Dec92)

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Revised Instrument Manuals Available (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

We have revised four of our instrument manuals to reflect recent changes in the hardware and software. These are all available in the usual way from the Observing Support Office in Tucson (attention: Judy Schneider or Marlene Saltzman).

The revised manuals are:

The CCD Direct-Imaging Camera - 4-m Telescope
The CCD Direct-Imaging Camera - 2.1-m Telescope
Burrell Schmidt Direct CCD Imaging Manual
The R-C Spectrograph for the Mayall 4-m Telescope

In addition, the first three of these manuals are also available electronically "over the net." This makes it easy for us to make revisions, and it makes it easy for you to obtain these manuals.

To obtain one of the direct-imaging manuals via "anonymous ftp," type the following:

```
ftp orion.tuc.noao.edu or ftp 140.252.1.22
login as: anonymous
password&gt  your lastname@machine
ftp&gt  cd kpno/manuals
ftp&gt  ls -l [list available manuals and their dates]
ftp&gt  binary
ftp&gt  get (manual name)
after transfer is complete
ftp&gt  bye
```

In addition, note that other manuals are available electronically in this subdirectory, including the Hydra manual and the ICE CCD software manual. These manuals are all "encapsulated PostScript" files, with figures and tables embedded.

Once you have obtained these compressed files, you can reconstitute and print them using the following commands:

```
   uncompress manualname.ps.Z
   lpr -s -PlwN manualname.ps
```

Bill Schoening

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Becoming Environmentally Conscious with ICE (1Dec92)

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Becoming Environmentally Conscious with ICE (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

With the dawn of the ICE age at Kitt Peak comes the opportunity to create observing scripts to automate some frequently performed observing tasks. Most users have used ICE only as a pleasant, simple way to take and store their data and examine the results. However, the "E" in ICE stands for "environment," and many observers may benefit from the powerful possibilities inherent in unleashing the "full power of IRAF." Using ICE, the observer can construct simple observing scripts that may make his/her life much easier. These scripts can be as simple as stringing together a series of OBSERVE commands, or as complex as doing an automated, guided, image grid. Unfortunately, most observers are either unaware of this possibility or too harried at the telescope to take advantage of the intrinsic scripting potential of IRAF/ICE. To improve this situation, a set of example IRAF/ICE observing scripts has been created.

The template scripts are usable "as is" by the observer and have been organized on the mountain workstations as an IRAF package for ease of use. This package comes complete with help pages. The package is also available downtown on ursa.

The real power of these templates is that they can be modified to do custom observing procedures. The template scripts live in a sub-directory of the observer's home directory called "scripts".

A typical customization session might look like this:

```
cl&gt  cd scripts
cl&gt  edit obslooper.cl [edit the "obslooper" file to do something else]
```

cl&gt cd
cl&gt obslooper [run "obslooper" to do this new, modified thing]

More complete information can be found in the revised ICE manual and in the README file found in the "scripts" subdirectory on the mountain, or by contacting dsilva@noao.edu.

Creating custom scripts based on the examples provided should be fairly straightforward. However, no scripter should be without a copy of An Introductory User's Guide to IRAF Scripts by Ed Anderson and Rob Seaman. This document is available from NOAO Central Computer Services (try e-mail to Jeannette Barnes at jbarnes@noao.edu). It is also currently in the white IRAF binders (the Telescope Scientists' selection of "IRAF's Greatest Hits") found at every ICE'd KPNO telescope.

The current task list is described below. Our intent is that these scripts be templates for observers to modify and use for their own nefarious purposes. Additional suggestions are encouraged and welcomed. It is intended that these scripts will evolve with time. Suggested changes and/or new scripts may be sent to one of the authors using the task CONTRIB (see help page for more details).

Disclaimer: These scripts are provided on an "as is" basis. We have made a good faith effort to check them for errors, but they are "experimental" and not considered to be part of the fully supported IRAF/CCDACQ/ICE system. Permission is given to copy and modify these scripts at will as long as the original scripts are not used for commercial purposes. (We could be making money off of this?) Observers use these scripts at their own risk. (But then, what else is new?)

The currently available scripts (22 October 1992):

boaa_constrictor - acquire a guided square grid of images (0.9-m, 4-m only)
contrib - contribute an observing script to the moderator
domeflats - acquire UBVRI domeflats at 0.9-m
dostds - acquire images of standard star fields
obslooper - template script to repetitively run some set of observing tasks
photstds - IMEXAMINE front-end to do quick-look stellar aperture photometry
reformat - reformat CCD to centered square region
tcpcom - an external program to issue TCP commands from ICE (0.9-m, 4-m only)

Dave Silva, Phil Massey, Rob Seaman

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Astrometry for Hydra (1Dec92)

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Astrometry for Hydra (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

For years we optical spectroscopists have been able to get by just fine with crummy coordinates, due, in part, to the ease of identification of objects on a slit viewing TV, combined with the fact that most telescopes did not point all that well anyway. However, as our telescopes have begun to perform better and better, and as we have continued to observe fainter and fainter objects, most of us have found that our observing efficiency is considerably enhanced if we arrive at the telescope with coordinates good to an arcsec or two. Now, with the advent of multi-fiber spectrometers, we suddenly find ourselves in a different regime, where an error of "an arcsec or two" means that virtually no light will go down a fiber.

Users of Hydra must come prepared with coordinates good to &lt 0.5 arcsec over the entire 45 arcmin field if they are to have any hope of success, and furthermore the astrometry of their program objects must be on the same "system" as the brighter stars used for tweaking up the telescope alignment (the so-called "FOPS" stars). In good seeing an error of 0.5 arcsec will result in negligible light-losses; an error of 1.0 arcsec, however, results in losing 50-75% of the light with our 2.0

arcsec fibers, depending upon the seeing. Exact details can be extracted from Figures 1 and 2 in the paper by Donnelly et al. (1989, PASP, 101, 1046). The physical positioning of the Hydra fibers is believed to be accurate to of order 20 um (0.15 arcsec).

There are a number of resources available through NOAO that can help Hydra users determine good coordinates. We list these below.

1) Guide Star Catalog. If the objects you plan to observe with Hydra are bright (V &lt 15-16), stellar, and relatively uncrowded, chances are good that they will be in the Space Telescope Guide Star Catalog (GSC). If you have the approximate positions, then the Fortran routine FINDER can be used to search the GSC, (which we keep on-line on two CD-ROMS). Care must be taken to select coordinates that all come from a single "plate," as it is well known that the positions of GSC stars that occur on multiple plates have coordinates that are typically offset by 1-2 arcsec. Aside from this concern, we have found that the GSC provides coordinates which have excellent internal consistency (&lt = 0.2 arcsec). In addition, since their coordinates were determined from recent (circa 1985) plates, corrections for proper motion are likely negligible.

2) POSS plates and the Grant Machine. In the downtown Kitt Peak plate vault, we have glass copies of the old (circa 1952) POSS. Positions of objects down to a stellar magnitude of 21 can be readily measured on these using the 2-axis Grant machine and reduced using FINDER/ASTRO routines. However, because the epoch of the plate material is 40 years old, great care must be taken to assure that proper motion for your FOPS stars and/or program objects is either explicitly accounted for, or is demonstrably negligible. Assuming that one is measuring "faint, far away" things, one could use stars from the SAO catalog as the reference system; to use these same stars as FOPS stars, however, you will need to explicitly correct the catalogued positions using the proper motions listed in the SAO catalog when you construct the Hydra coordinate file. Unfortunately, the proper motions listed in the SAO catalog are of variable quality, and care must be taken to select stars whose listed errors in proper motion are small. Alternatively, one can use the GSC as the reference standards, and simply keep only those stars whose residuals are small in the solution; these stars must have low proper motion (19851952). Again, care must be taken to select only GSC stars whose coordinates come from a single plate.

3) CCD frames and IRAF's "finder/tfinder" routines. If you have selected your objects from wide-field CCD frames, then you can use this material directly for determining excellent coordinates. To aid in this, Rob Seaman has provided a set of routines in the "nlocal" package "finder." These routines will allow you to search the Guide Star Catalog for stars that are on your CCD frames, and display your image overlaying the predicted location of the GSC stars it finds. Interactive cursor options allow you to shift and find "astrometric quality" x and y centers for these reference stars on your frame. Good x and y centers for your program objects can be found using any of a variety of routines within IRAF, that range in complexity from positioning a cursor on a star and striking a key to obtaining centers with psf-fitting in "daophot." Once you have good x and y centers for your reference stars and program objects, the AAT/STARLINK "astrom" routine is then used to find the six-coefficient plate solution, and the coordinates of the program stars are then output directly in a format that is needed for the Hydra assignment program. As long as one restricts oneself to GSC coordinates determined for a single plate, solutions are typically good to &lt = 0.2 arcsec RMS. (The software is designed to make this easy.) Because the "tfinder" routines are considered a prototype, and because they require access to the GSC CD-ROMS, these routines are not generally exported, although Rob Seaman has successfully transported them elsewhere; first time users should plan on using them in Tucson. Potential Hydra users are reminded that the wide fields covered by 2048 x 2048 CCDs on the KPNO 0.9-m and Burrell Schmidt telescopes are very useful for isolating samples of objects and performing astrometry.

4) Digitized sky survey images. In a trial agreement between NOAO and Space Telescope Science Institute, STScI has agreed to provide the digitized scans of the "Quick V" (1985) Palomar Schmidt survey used in producing the Guide Star Catalog. These scans contain stars as faint as V = 19 (i.e., several magnitudes fainter than the GSC itself), and come with an accurate "plate solution" as part of the header information. Routines in STSDAS (usually distributed with IRAF) can then be used to take x and y positions and output accurate celestial coordinates. Measurements on two test fields provided by STScI have yielded good results. The advantage to using this material is that the astronomer can perform his/her astrometry at home, rather than traveling to NOAO, and since the "Quick V" plate material is of recent vintage, proper motions are usually immaterial. In addition, STScI has agreed to include the southern SRC survey and the old POSS E plates, if these are

needed instead. The field size is limited to 1 degree per side. Tod Lauer has agreed to coordinate requests to Space Telescope for this material in support of Hydra runs; contact him directly (tlauer@noao.edu). Requests should specify field center coordinates (including equinox), field size (limited to 1 degree per side) and what plate material (Quick V, POSS E, or SRC). Please contact Tod by 15 January 1993 with this information if you wish to obtain fields for any time in the spring semester.

5) Mix and match. If you have a small-field CCD image for which you need accurate positions, it may be necessary to measure "secondary reference stars" using either (1) or (4), and then use these as the basis for computing the "plate solution" for your frame. This can be done using either "astrom" or "astro", but will doubtless require a good deal of hand editing.

In order to make use of any of the NOAO facilities significantly in advance of an observing run, you should write to David De Young. Additional advice can be obtained from the Astrometry Subdivision of the Hydra crew (pmassey@noao.edu, tarmandroff@noao.edu).

Phil Massey

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Hydra Usage Proves Amazing (1Dec92)

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Hydra Usage Proves Amazing (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

Hydra and the Bench Spectrograph have been receiving considerable use at the Mayall 4-m telescope this semester. The demand for this instrument, which performs multiple-object spectroscopy on up to about 100 objects in a 45 arcmin field of view, has been steady over the past two semesters and for the proposals recently submitted for the upcoming spring semester. The following table lists the number of proposals submitted, the total number of nights requested, and the total number of "science" nights actually scheduled.

Semester	Proposals Submitted	Nights Requested	Proposals Granted	Nights Scheduled
Spring 92	26	94.5	11	36
Fall 92	26	87	17	52
Spring 93	26	91	--	--

The instrument has proven to be quite reliable, and we are currently finishing a trouble-free, 36-night continuous Hydra block, possibly the longest instrument block on the 4-m telescope since the heyday of prime-focus photography! Needless to say, there are now many happy astronomers with a large backlog of data.

Recent improvements in the instrument have focused on software issues related to the user-level interaction with the positioner. We have been developing an OpenWindows version of the simulator which provides a graphics display with zoom, pan, and cursor readback capability. The next step is to implement a "hand" assignment capability utilizing the new graphics which would allow the observers to augment their fiber assignments with additional skies or objects.

We are also ready to upgrade the TV camera that views the field orientation probes. The current camera has insufficient sensitivity to allow these probes to be placed on stars fainter than 14th magnitude. Unfortunately, due to problems with the procurement of the new camera, we do not know when the upgrade will take place.

Additional work has also been done on the Bench Spectrograph. The automated filter insertion/ retraction mechanism has been completed, interfaced with Bench automation software, and commissioned. We have also been acquiring order-separation filters for use with the 316 line/mm echelle grating. Eleven such filters, isolating orders that contain frequently observed features, have been procured and tested. Work continues on the high throughput spectrograph camera, the higher-level automation software, and the simultaneous comparison sources.

A new version of the Hydra manual was completed on 27 August, reflecting a number of enhancements to the instrument. We plan to release another version of the manual prior to the next Hydra block, which starts on 28 December. Copies may be obtained by anonymous ftp as explained in the article by Bill Schoening elsewhere in this Newsletter.

Sam Barden, Taft Armandroff

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Better Images Now Available at the 4-m! (1Dec92)

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Better Images Now Available at the 4-m! (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

A seeing monitor has been in use at the 4-m since September 1990. The system is capable of analyzing image size and image motion using any of the various TV cameras attached to the 4-m. A histogram of the nightly measurements for the months of September and October 1992 is shown below. One should not draw any hard conclusions from these results because the measurements do not represent a proper statistical sample. This is due to the fact that the telescope operators may be much busier on some nights than others and do not have time to take even a single measurement. In contrast, there are nights when 5-6 measurements are taken. In the long run, this should all balance out.

With this caveat in mind, we report that the apparent median seeing for the month of September was 1.11 arcsec. The weather pattern during September was unusually stable, leading to the better-than-typical (1.2-1.3 arcsec) result. However, October more than made up for this, with a median seeing of 1.51 arcsec.

It is crucial to be aware that the seeing measurements are almost always upper limits. The TV cameras used to collect the data are all fed through mirrors and lenses of unknown quality, and they may not be optimally focussed. Thus, the true seeing may be somewhat better than indicated by the figure. For instance, we might normally be inclined to interpret the skewness of the histogram to suggest that there is a "hard wall" near 0.9 arcsec, representing, say, the intrinsic limitations of the telescope optics. However, we know this is not the case since we have also measured the images on direct CCD frames on one night to be 0.68 arcsec, which is far less than we ever see with the TVs.

During the summer shutdown, we did make an improvement which should be evidenced in the seeing data over time. The 4-m f/8 secondary mirror was collimated very accurately for the very first time. Prior to the big move, careful measurements were made to determine the mechanical relationship of all the optical configurations, and to quantify the optical aberrations present using the Wavefront Curvature Sensing technique developed by the Roddiers and implemented locally by Fred Forbes and Nick Roddier. The axes of the f/8 secondary and prime focus were found to be misaligned by 1.5 mm. The center of the prime focus pedestal was chosen as the fiducial to center both the f/8 and the new f/15 secondary. This was not a simple decision as there are many degrees of freedom in a telescope with five foci.

The images are now much more symmetric, especially those off-axis. This correction should have a very positive impact on the throughput of Hydra, our only instrument which uses the full 40 arcmin field of view. Plates taken at the R-C focus illustrate the improvement: those taken during the commissioning phase of the telescope (1973) as well as those taken in recent years, exhibit serious off-axis aberrations. Plates taken after the re-collimation have excellent images across the full field of view.

[figure not included]

George Jacoby, Paul Harding, Phil Massey

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Risley Prisms at the 4-m: Better Than Nothing (1Dec92)

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Risley Prisms at the 4-m: Better Than Nothing (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

Although we all learned about differential atmospheric refraction back in Astronomy 101, the current generation of spectroscopists owes a debt to Filippenko (1982, PASP, 94, 715) for reminding us exactly how severe the implications can be for spectrophotometry. With the proliferation of CCDs on Cassegrain spectrographs, it is not uncommon for an astronomer to believe she/he is doing spectrophotometry with a 1.5-2.0 arcsec slit, when in fact much of the blue light is falling outside the slit. (Even at a "modest" airmass of 1.5, the light at 4000 A will be displaced by 0.7 arcsec relative to the light at 5000 A.) Mark Phillips recently gave an excellent illustration of this in the December 1991 NOAO Newsletter No. 28, p. 17.

If the spectrograph slit is aligned with the direction of refraction (i.e., the line from the zenith to the horizon), then there is little wavelength-dependent light loss. However, aligning the slit with this "parallactic angle" can be a mild pain with most telescopes. At the 2.1-m, for instance, the telescope must be moved to the zenith and the spectrograph rotator adjusted by hand from the platform. Although the rotator at the 4-m can be controlled remotely from the control room, the telescope must be first slewed near the zenith in order to protect the rotator's bearings from too much strain. An alternative to rotating the slit is to use optics to compensate for refraction. These "atmospheric dispersion correctors" (ADCs) are an intrinsic part of the design of most modern telescopes, due in large part to the desire to use multi-object fiber feeds, for which alignment with the parallactic angle is meaningless since fibers ends tend to be round.

Many users of the 4-m telescope may be surprised to learn that in fact there are a pair of prisms available designed to act as ADCs. These "Risley prisms" can be inserted into the beam remotely using software commands, and are automatically rotated to compensate for atmospheric dispersion at a given telescope position, in principle. (Their field size is too small to be used with Hydra, however.) During two recent runs with the R-C Spectrograph, two staff observing teams opted to use the Risleys.

Our experiments on standard stars suggest that the Risleys do help, but they do not do the whole job. The plot below shows the observed flux of the standard star Feige 110, calibrated by observations of a standard star near the zenith, observed both with and without the Risleys. The observed flux of Feige 110, obtained at an airmass of 2.2, is a reasonable match to that expected when the slit is rotated to the parallactic angle. (The two spectra at the top show the observations at the parallactic angle both with and without the Risleys; the small differences between these are due to small differences in the fit of the sensitivities curves.)

[figure not included]

The bottom-most curve shows what would happen if we attempted to determine the flux of Feige 110 with the slit rotated 90 degrees to the parallactic angle. This is about the worst case imaginable, but would actually be what you are doing if you attempted to observe an object at a declination of -30 degrees on the meridian with the slit oriented east-west. (Our slit width was 1.8 arcsec for this experiment.) Filippenko's Table I reminds us that the light at 3500 A was displaced by 2.1 arcsec relative to that at 5000 A; we were lucky the seeing was poor, or we might not have gotten any UV light into the slit at all!

The middle spectrum shows how effective the Risleys were in this "horrible-case scenario." Clearly they help, and yet, it is also clear that they do not quite do the whole job, either. Note that the glass cannot match the atmospheric dispersion at all wavelengths, and so the prisms represent a compromise by the designer over some spectral range. Furthermore, the prisms introduce a small (~ 7%) transmission loss above 4000 A which worsens to a 30% loss by 3700 A.

We are planning to conduct further tests this spring, and substantiate that the Risleys are being aligned correctly. As we approach the era of the ADCs, it behooves us to understand the ones we already have. In the meantime, we recommend rotating to the parallactic angle to really "get it right."

Phil Massey, Todd Boroson,
George Jacoby, Richard Green

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Lurking About at the 2.1-m Telescope (1Dec92)

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Lurking About at the 2.1-m Telescope (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

Bill Keel recently completed a run at the 2.1-m telescope in which he never left home (probably could not find his American Express card...). Instead, he "observed" in what has become known as "eavesdropping" or "lurking" mode, in which he logged into the 2.1-m data computer over Internet to "watch" the data come in and to keep abreast of the data quality while a collaborator was present at the telescope. Bill provided us with the following account of his experience.

"Remote observing has not been my favorite notion in the past, but once you have a family and faculty position time pressures can make it an attractive option. In this case, it went very successfully. Communication with my collaborator at the telescope was straightforward via the Unix talk utility, and direct use of the CCD computer (lapis) was reasonably fast. In no case was the network connection lost. The only holdup was in looking at fully two-dimensional data. The network connection never goes much faster than 5 kbytes/second, so bringing the image to a local machine by IRAF networking is more sensible than trying to display directly from the remote node and running the risk of having to do it twice to see the full dynamic range of the data. For typical long-slit spectra, it took 3-5 minutes to copy the relevant range of rows. This is no problem for routine observing (our exposures were 10-40 minutes), but when checking calibration and focus tests, I had to rely on doing row and column plots. The only aggravating problem was that when plotting on the remote machine, it is possible to send IRAF plotting tasks into limbo if certain keys are struck before the remote signal to enable cursor readout has been received.

"There were some positive advantages to having a remote observer. First, with three people on the project, we would do little more than bump elbows in the control room, especially since all the data interaction takes place via a single workstation. Having a second person free to look at the data full-time gives a real addition in capability, as well as something to do. The distant partner also may have access to extra information that becomes useful during the run (say the complete dataset from an earlier observing run) that is not practical from the mountaintop.

"I also kept notes on how close this capability currently is to genuine remote observing, since that is a capability that will be desirable for dynamic scheduling in the future. I set up several monitors with useful information, including a PC running a planetarium program set to show the sky over KPNO so I could easily track hour angles and air mass. (For interested parties, there is a $20 piece of shareware called

Skyglobe that did the job nicely). I also have an X-windows tool to show weather satellite photos, but admittedly I did not get hold of it until after the run. Fully routine observing is basically possible now, in the sense that if the operator has no trouble identifying the object or its placement in the field, one can exercise full control over data taking by network. It would be very useful to experiment with the frame grabber at the 4-m and see whether a remote user can access an acquisition TV image quickly enough for real-time object identification.

"Fully remote observing is a close possibility, but doing it now would take an extra measure of responsibility from the setup people and telescope operators. I realize that these are both delicate issues, but this is a direction that many new instrumental developments are driving at several observatories, and it may be gratifying to see how close the existing setup is to being able to work in this way."

For those interested in lurking about, keep in mind some of the consequences of not being at the telescope. For example, while you may be close to your family, it is unlikely that they will encounter you in a conscious state; and, if you have a noisy daytime household (dogs, cats, kids), sleep may not come easy. In a more scientific vein, most lurkers find it very important to have a collaborator at the telescope to be in harmony with the conditions and observations ("what was that loud bang I just heard when the comparison came on?", or "did not the shutter sound like it opened kinda slowly that time?"). Also, many "remote" observers find the distractions of their home institution interfere with the more important act of observing, whereas when one is sequestered on Kitt Peak, the cross-section for interruptions is much lower.

Nevertheless, eavesdropping provides an attractive alternative under certain conditions as Bill noted, and we are interested in seeing others participate.

George Jacoby

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CoudÃ© Request Night in Januar (1Dec92)

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Coude Request Night in Januar (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

For many years we have had a program by which you could ask us to obtain for you a limited amount of spectroscopic data on the Coude Feed telescope. This semester the request night is scheduled for 6 January 1993 with the T1KA CCD. The selection of camera and gratings will depend upon the requests received. Requests are limited to two hours per investigator per semester, including set-up, flat fields, and standards.

Requests for observations should be submitted to David De Young. A letter will do; please do not use the standard proposal form. Include the names of the object(s), finding charts, coordinates, and any other details needed to carry out the program. Requests will be reviewed internally for feasibility and merit.

David De Young

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Open Observing Time Available on CoudÃ© Feed (1Dec92)

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Open Observing Time Available on Coude Fee (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

It now appears that there may be some periods of unscheduled time on the Coude Feed during the spring 1993 semester. To apply for this open time write to David De Young, Director of Kitt Peak National Observatory, outlining the science you expect to accomplish. Please mention whether your request is an addition to a continuing program for which you have been allocated time or if it is a new program. Include in your letter of request a full description of your instrumentation needs (the CCD will be preassigned based on availability) and the exact time you desire. The spring 1993 observing schedule is not known at this writing and will not be available until 14 December. After this date the list of available open time can be obtained by contacting Vicki Miller in the Director's Office either by phone (602-322-8514) or e-mail (vmiller@noao.edu).

The deadline for receipt of the open time requests is 15 January 1993. Your request will be evaluated by the KPNO members of the Telescope Allocation Committee for scientific merit, as well as for compatibility with the existing observing schedule. This procedure is followed for all requests, both for visiting observers and for NOAO staff. We will inform you of the decision at least five weeks before the time requested. All applications should include a justification for bypassing the normal TAC procedures. Preference will be given to proposals that are particularly timely or that fall into the following categories:

1) Programs that recently were seriously affected by weather or instrument/telescope problems.

2) Programs that require engineering time to repair and/or check out an instrument or for the training of personnel.

As is the case for normally scheduled observing, travel funds are not available for any open time granted. Thesis work will be supported in the normal fashion provided the proposal has previously been approved through the normal TAC process.

David De Young

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Photoelectric Photometry Consolidated to the 1.3-m Telescope (1Dec92)

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Photoelectric Photometry Consolidated to the 1.3-m...(1Dec92)
Telescope
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

As mentioned in NOAO Newsletter No. 28 (December 1991, p. 21), photoelectric photometry will be restricted to the 1.3-m telescope beginning with the August 1993 scheduling period. The reasons for this decision are the fewer numbers of proposals we receive for this type of work and the aging state of the equipment. Restricting this equipment to one site will ease the support requirements and provide increased numbers of spares. Many observers are changing their programs to the CCDPHOT package that will be supported at the 0.9-m telescope. The staff contacts for the CCDPHOT package are Caty Pilachowski and Tom Kinman.

David De Young

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Auto-focus at the 0.9-m (1Dec92)

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Auto-focus at the 0.9-m (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

Recent changes in the FORTH code at the 0.9-m telescope have improved the auto-focus mechanism. The problem was that often during an auto-focus sequence the system would "hang." The auto-focus is now much more reliable. However, if this problem does occur, it can be quickly cleared by pressing the TIC-disable and then TIC-enable buttons on the control panel.

Bob Marshall

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A Reminder for Schmidt Observers (1Dec92)

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A Reminder for Schmidt Observers (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

We would like to remind those of you who observe with the Burrell Schmidt telescope that a special acknowledgement is required on papers resulting from these observations. In addition to the usual KPNO byline, the following is also required: "Observations made with the Burrell Schmidt of the Warner and Swasey Observatory, Case Western Reserve University."

David De Young

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Summer Shutdown Activities (1Dec92)

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Summer Shutdown Activities (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

This past summer shutdown on Kitt Peak involved a record number of projects. The schedule was extremely tight, with little room for error or delays. Our thanks go to Bruce Bohannan and Tony Abraham for their careful and detailed planning of the work to be done during this time, and a special "thank you" is sent to the many people from the mountain and downtown staffs who worked with cooperation and enthusiasm to get all of the projects completed. A brief list of the summer shutdown projects is given below.

4-m Telescope
Prime focus pedestal maintenance
Realign f/8 secondary mirror
Install new f/15 mirror assembly
General telescope wiring maintenance
Survey building foundation for differential settlement
Install closed-cycle cooling system for SQIID
Test prototype servos for new control system
Install new RA and Dec encoders
Repair dome seals
SQIID system test run
Optical alignment and new pointing map

2.1-m Telescope
Guider maintenance
Re-aluminize primary mirror
General telescope wiring maintenance
Replace console room floor
Install automated clamp for #3 mirror
Clean dome and telescope
Repair dome leaks
Optical alignment and new pointing map

Coude Feed
Repaint #2 tower
Replace grating motor power supply
New pointing map
Software check

1.3-m Telescope
Repair dome leaks
Clean dome and telescope
General telescope wiring maintenance
Install new secondary mirror shims
Install new RA and Dec final limits
New pointing map

0.9-m Telescope
Guider maintenance
Repair dome leaks
Repaint dome
Service secondary focus mechanism
General telescope wiring maintenance
New pointing map

David De Young

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Welcome New Post-Docs (1Dec92)

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Welcome New Post-Docs (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

We are pleased to welcome this year's new post-docs to KPNO. Ata Sarajedini, a new KPNO post-doc, arrived in August from Yale University, where he recently completed a dissertation titled Globular Cluster Photometry Near the Turnoff. Ed Ajhar, a new post-doc working with Tod Lauer on Space Telescope imaging data, arrived in September. Ed recently received his Ph.D. at MIT with a thesis on Surface Brightness Fluctuations in Globular Clusters. We look forward to the arrival of Sylvain Veilleux, a Hubble Fellow, in November.

David De Young

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Kitt Peak Museum on Brink of Renovation (1Dec92)

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Kitt Peak Museum on Brink of Renovation (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

As many readers know, the Kitt Peak Museum and Visitor Center is the owner of one of KPNO's retired sixteen-inch telescopes, and we have long planned to install the telescope in a dome at the Museum. A draft of the renovation plan, including the addition of a dome, was approved at the last meeting of the Museum Steering Committee. Pending approval of the final plan, which is being drawn up by NOAO architect Jeff Barr, the project will go out to bid. We hope to begin construction early in 1993, with final installation of the 16-inch telescope in the fall of that year. Phase I of the renovation includes the addition of the dome and telescope and new exhibits for the areas near the telescope. In future phases II and III, we hope to refurbish all exhibits, add front and back patio space, and build a separate theater/conference room. Our aim is not to increase the number of visitors to the mountain, but rather to enhance the experience of those who visit, in part by being able to handle large crowds better. The renovation project is funded entirely by the donations of visitors to the mountain.

Please stop into the Museum on your next trip to the Mountain to see the architect's rendition of our future building. Any suggestions about the renovation or the new exhibits should be made to me (kmeyers@noao.edu) or to Melissa Collier, the Museum manager on the Mountain.

Karie Meyers

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Notes from the Hippy-Dippy Computer Weatherman (1Dec92)

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Notes from the Hippy-Dippy Computer Weatherman (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

Since the summer of 1991, NOAO/Tucson has had continuously improving access to a local archive of hourly geosynchronous weather satellite pictures of the continental United States. These are similar to pictures that are available over the Internet, but are acquired in a different format from a source that is closer to the US Government agency responsible for distributing them.

Three times an hour, 24 hours a day, a new picture is downloaded in one of three different wavelength bands: visible, infrared, and water vapor (narrow band IR sensitive to atmospheric moisture). These are first processed to translate the obscure native image format into IRAF. The IRAF images are then registered to the nearest pixel and overlaid with the North American geo-political boundaries as solid yellow lines. The pictures are also translated into the popular GIF format.

We archive the last 24 hours worth of pictures for each of the three bandpasses in the directory /weather on our machine gemini. The archive also includes GIFs of the Internet surface analysis maps indicating radar echoes, atmospheric pressure, weather fronts, and local conditions at cities around the United States and Canada. The downtown archive is mirrored over the T1 link to a machine on our Kitt Peak network which is accessible from the Sun workstations at each of the telescopes.

A local IRAF task, wdisplay, can be used to view the pictures in a variety of revealing ways.

Display the latest visible light picture:

```
    wdisplay vis
```

Display the last four IR pictures in successive imtool frame buffers:

```
    wdisp ir four+
```

Display the latest from each of the three bands:

```
    wdisp all
```

Or, you can display the surface analysis maps:

```
    wdisp sa
```

Type help weather for more examples and for hints for making imtool blink movies.

An allied facility is supplied by the local Unix nws command, which will retrieve the current weather forecast and conditions for many cities around the US and Canada. Some examples:

Retrieve the forecast for Tucson:

```
    nws tus (or simply nws)
```

Retrieve the current conditions for Arizona:

```
    nws az
```

Retrieve the national weather roundup:

```
    nws usa
```

For more examples, type help nws from within IRAF, or type nws -help from Unix. Folks using X windows can access the same information using the xforecast client, which will display a North American map and allow the desired city to be selected with the mouse.

Many incremental improvements have been made to our support for the weather archive over the past year, and these should continue at a steady pace. Future additions will include new sources of data, new image formats, new display options, and improved networking support. Only some of the current capabilities have been described here.

Suggestions and inquiries should be directed to rseaman@noao.edu, and are welcome from outside organizations as well as from NOAO.

The National Weather Service data are provided courtesy of the NSF-funded Unidata Project, the University of Arizona, the University of Michigan, and the University of Illinois, Urbana-Champaign.

Rob Seaman

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LTOs Going and Coming (1Dec92)

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LTOs Going and Coming (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

We are sad to say farewell to two of our telescope operators, Dave Chamberlin and Jean Nowakowski. Chamberlin, who has been an LTO since June 1986, has headed back to Utah where he will be working as a laboratory coordinator in the chemistry department at the University of Utah. Nowakowski, who began work at Kitt Peak in September 1989, has moved downtown to do data reduction and programming for the GONG

Project. We wish them both all the best in their new endeavors.

There are two new faces on the mountain, Bridget Watts and Kurt Loken, who you are sure to meet if you observe on the 2.1-m or 4-m telescopes. Watts, a December 1991 graduate of the Washington University physics program, worked for several years as a laboratory assistant in a NASA project which evaluated materials exposed to space on the LDEF satellite. Loken comes to us from just across Cherry Avenue at the University of Arizona where he obtained a bachelor degree in physics and astronomy in 1992. While at Steward Observatory, he was a student researcher with George Rieke.

Paul Harding

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An Observatory Travels on Its Coffee (1Dec92)

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An Observatory Travels on Its Coffee (1Dec92)
(from KPNO, NOAO Newsletter No. 32, 1 December 1992)

If you drink coffee and have been to the mountain since the beginning of the fall semester, you probably noticed that we have upgraded the quality of the coffee we serve in the kitchen. If you observed at one of the Kitt Peak telescopes, you also should have noticed that we are providing coffee makers of reasonable quality so that you need not run to the kitchen in the middle of an exposure to satisfy your habit.

The coffee being served is Guatemalan, this being an excellent compromise across the various flavor preferences, cost, and availability. We chose this particular variety and a local vendor after very careful consideration. A Coffee Advisory Committee (CAC) was formed consisting of Taft Armandroff, Todd Boroson, Suzanne Jacoby, Phil Massey, Karie Meyers, and me. The CAC rated each of 5 potential coffees on a purely subjective basis using a scale of 1 to 5 (sound familiar?) where 1 is the best. Included in the 5 choices were the Kitt Peak "standard" coffee, and a coffee from an obscure mail order house in Berkeley. The latter, being familiar to many on the CAC, was used to set the "zero point" of the double-blind taste testing, but since we contract for the coffee beans AND equipment service, a mail order company was not eligible for the contract.

The results of the taste test were that the "standard" coffee received an average grade of 4.0, while the mail order coffee received a grade of 1.6. The coffee that is now served on the mountain received a second place grade of 1.8. The remaining two coffees were rated at 2.1 and 3.0. Clearly, the "standard" coffee will not be receiving any more time on the mountain.

Georgee Jacoby

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The McMath-Pierce Facility (1Dec92)

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The McMath-Pierce Facility (1Dec92)

(from NSO, NOAO Newsletter No. 32, 1 December 1992)

On 15 September, the Assistant Director of the National Science Foundation for Mathematical and Physical Sciences, William C. Harris, approved our request "that the National Solar Observatory facility on Kitt Peak, presently known as the McMath Solar Telescope, be renamed the McMath-Pierce Solar Telescope Facility honoring A. Keith Pierce for his long and distinguished career in solar physics and at one of our National Centers. We agree that attaching his name to the facility with which he has been so closely involved since its inception is an appropriate and deserved honor."

Pierce was responsible for the concept, the initial layout, and the optical design of the McMath telescope, and during the design and construction stages he was involved in every detail of the work. His leadership has been critical to the success of the implementation of what remains after thirty years the world's largest solar telescope, and which because of its unique, unobstructed, all- reflecting design is extremely well suited to the rapidly developing interest in solar infrared studies. In addition to being one of the greatest of the astronomical instrumentalists of the twentieth century, and in spite of his administrative responsibilities leading the solar program over the years, Pierce has been a very productive researcher, turning out many excellent research papers. Pierce, along with Leo Goldberg and Orren Mohler, was one of the pioneers in infrared solar spectroscopy, a field whose potential and importance are only now being fully realized. In a remarkable series of papers, for all of which Pierce is the first author, he published work done in collaboration with Goldberg, Lawrence Aller and others. This work represented not only the first definitive studies of the solar infrared spectrum, but also the best models of solar atmospheric structure produced to that time, based in part on his own limb darkening measures, some of which are still the standard against which such measurements are judged. Along the way, Pierce published the definitive measurements of photospheric and chromospheric line wavelengths. These are among the most important reference materials ever to come from Kitt Peak. More recently Pierce's attention has turned to high-precision determinations of the gravitational red-shift of the Sun. Here again he is creating the definitive body of work in this area, which will be referenced for years to come. Over the years Pierce's research has been characterized by careful and thorough work in important areas of fundamental science. His legacy as a research scientist as well as an instrumentalist will live for a very long time.

Pierce has served AURA as a scientific staff member longer than any other astronomer--he was one of the first two members (with Aden Meinel) of the scientific staff of KPNO, starting in 1958--and he continues to work very actively, as AURA's first astronomer emeritus. He is currently the Project Scientist for a major activity to upgrade the vertical spectrograph, with a new visible grating and incorporation of the world's largest IR grating. (See a separate article in this Newsletter.)

A rededication of the McMath-Pierce facility took place at the Facility on Kitt Peak, on 7 November, on the occasion of the 30th anniversary of the facility's dedication with nearly 100 participants from Hawaii to Washington attending, including several of the engineers responsible for its construction.

John Leibacher

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Sac Peak Workshop (1Dec92)

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Sac Peak Workshop (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

The Real Time and Post-Facto Solar Image Correction workshop, held 15-18 September 1992, at Sac Peak, was the thirteenth in the series.

The organizing committee consisted of R. Radick (Phillips Lab./Solar Research Branch, Sacramento Peak) (chair), R. Dunn (NSO), G. Loos (Phillips Lab./Imaging Technology Branch), S. Restaino (New Jersey Inst. of Tech.), and O. von der Lhe (European Southern Obs.). The workshop dealt with the current and perspective application of adaptive optics, deconvolution, and speckle techniques to high spatial resolution imaging. Because of growing recent interest in solar imaging using interferometric arrays, this topic was also included. There were about sixty participants, with twenty from thirteen foreign countries.

A consensus emerged that a resolution of 10-20 km (a few hundredths of an arcsec) is required to adequately resolve small scale magnetic structures on the Sun. This is well beyond the capability of existing solar techniques, even with perfect atmospheric correction. Achieving such resolution will require the development of solar interferometers.

It is time to start developing a second generation of solar correlation trackers, using contemporary components, that should be both faster and cheaper than existing devices.

Phase diversity, which involves recovering phase from comparison of simultaneous in-focus and out-of-focus images, offers a potentially powerful method for phasing interferometric arrays, and for wavefront sensing for both real-time and post-facto imaging systems. It should also offer an attractive alternative for phase recovery in speckle imaging applications.

Extended-field interferometry is feasible, especially for bright sources such as the Sun. Infrared seems attractive for technical as well as scientific reasons in solar interferometry.

Existing large-aperture telescopes can be reconfigured using pupil masks to operate as solar IR interferometers. Heat rejection is feasible, thereby protecting such telescopes from damage due to solar exposure. Experiments on such telescopes would provide valuable experience in dealing with extended source solar interferometric data, and serve as a proof-of-concept for larger arrays that may eventually be built.

Richard Radick

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The Dawn of RISE (1Dec92)

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The Dawn of RISE (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

Measurement and understanding of the Sun's variable outputs poses one of the most important problems in solar research. In 1987 and 1989, two workshops were held at the National Center for Atmospheric Research and the National Solar Observatory to discuss progress in measurement and understanding of the Sun's radiative outputs, of stellar light variations, and of their impact on studies of the Earth's climate and atmospheric chemistry. The report of the working groups formed at the first workshop entitled RISE, Radiative Inputs of the Sun to Earth laid out a systematic research program for the 1990s aimed at increasing our knowledge in this area.

In September 1991 a proposal was prepared by the RISE/PSPT Scientific Advisory Committee and submitted by NSO to the National Science Foundation aimed at creating a network of precision solar photometric telescopes (PSPT) as outlined in the RISE plan. The proposed instruments will obtain high precision measurements of continuum images of the Sun, as well as measurements in the core of the Ca II K line. These measurements will yield important data on the diminution of the total irradiance of the Sun by sunspots as well as the enhancement of this irradiance by faculae and the distribution and strength of plages and network in the chromosphere.

The NSF Division of Atmospheric Sciences has provided NSO with some seed funding to initiate the first steps toward the RISE program. In anticipation of the creation of the PSPT network and to gain some operational experience, data will be taken with the NSO/Kitt Peak Vacuum Telescope and High-Degree Helioseismometer. The High-Degree Helioseismometer was developed jointly by NSO, Bartol Research Institute, and NASA/GSFC. The instrument was designed to take precision Ca II K line full-disk images of the Sun to study solar oscillations. It was operated for nearly three months at the South Pole in the austral summer of 1990-1991.

The instrument has now been mounted on top of the NSO/Kitt Peak Vacuum Telescope where it is fed by the same coelostat that feeds the telescope and may be operated simultaneously. The NSO/Kitt Peak Vacuum Telescope synoptic observers will attempt observations with this instrument once per day during the normal synoptic program. The observations will be a few integrations per minute, with ten minutes of such one-minute integrations being recorded in order to suppress the 5 minute oscillation. Darks and flats will be taken for each observing sequence.

An REU-funded student in Tucson will process the data recorded on Exabyte tapes weekly. Processing will consist of correction for dark and flat, and integration of the 10 minutes of corrected images. Scattered light and smearing determination using the Toner-Jefferies algorithm may be done if practical. Deconvolution of the scattered light and smearing may also be attempted using the Jefferies iterative deconvolution. Both corrected and deconvolved images will be binned into multidimensional histograms. The dimensions will include distance from disk center and coarse latitude and meridian distance. The resulting data cube will be such that summing can be done in any and all dimensions to get a meaningful result. It may prove useful to compute image excess and deficit indices relative to the mean disk. An archive of all the data will be maintained on Exabyte tapes (and possibly CD-ROMs).

A few of the most recent images will be kept in a circular buffer on an anonymous FTP disk to enable access by anyone. Daily indices derived from the images will be kept as an ASCII data file on the same disk. A mail server will distribute recent indices to those in the community who query a special mail address. This small project should provide good experience for the RISE/PSPT program as well as establish a data base useful to a wide range of researchers.

Jack Harvey, Jeremy Wagner

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Prospects for Adaptive Optics in the Near IR (1Dec92)

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Prospects for Adaptive Optics in the Near IR (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

The first experiment for a quantitative assessment of daytime seeing at near infrared (NIR) (1.0-2.2 um) wavelengths was carried out at the NSO/SP Vacuum Tower Telescope in September 1992. The experiment measured: 1) image motion of a bright star (30 Hz) using the VTT's capability of pointing at stars during daytime, 2) solar limb scans (30 Hz), and 3) temporal power spectra (5000 Hz) of angle-of-arrival fluctuations using the solar limb with a Foucault knife-edge test. Various pairs of filters widely separated in wavelength (within the 0.4-2.2 um range) allowed simultaneous measurements in the visible and NIR. Results show markedly smaller image motion in the NIR. Ro (Fried's parameter) followed closely a 6/5 power law with wavelength, as expected from turbulence theory, most of the time. There are, however, also indications that early morning seeing in the NIR is much better than given by this relationship. Ro values as high as 130 cm were measured at 1.6 and 2.2 um, leaving the isoplanatic angle correspondingly large. An implication is that NIR solar adaptive optics systems are favored, as expected, over systems in the visible in terms of simpler and less costly designs.

Tron Darvann, Steven Hegwer, Serge Koutchmy,
Dick Mann, Fritz Stauffer,
Eric Stratton, Larry Wilkins

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USAF Team at NSO/SP Receives Major AF Award (1Dec92)

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USAF Team at NSO/SP Receives Major AF Award (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

The Solar Research Branch of the Phillips Laboratory Geophysics Directorate, which is resident at the National Solar Observatory/Sacramento Peak, was recently awarded the designation of 1991 Air Force Laboratory Star Team for excellence in basic research during the period 1991-1992 by the Air Force Office of Scientific Research. The Air Force Laboratory Star Team award showcases the best of laboratory research and promotes the critical role of fundamental research within the Air Force's broad technology thrusts. The Branch was recognized specifically for excellence in their work in Solar Environmental Disturbances through studies of solar activity, magneto-convection, high-resolution solar imaging, coronal instrumentation and mass emissions. Criteria included publications, invited talks, collaboration with renowned scientists, participation in professional activities and citations.

Dick Altrock

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The McMath-Pierce Facility Dual-Grating Spectrometer (1Dec92)

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The McMath-Pierce Facility Dual-Grating Spectrometer (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

A shutdown of solar observing at Kitt Peak in October gave us the opportunity to dismantle the spectrometer at the McMath-Pierce Solar Facility, with its original 10-inch Babcock grating, which has served us so well for 30 years, and to install a dual-grating system. Kurt Cramer successfully decoded the wiring of the old system and has wired the new grating's scan and slew drives prior to making the interconnections to electrical power, controls and computer. Ed Perkins, engineer, and Russ Cole, instrument maker, have nearly completed the design and construction of the flip- grating mount. Two gratings--visible and infrared--are nested in the wavelength drive-spool. Stainless steel tapes attached to a precision screw and to the rims of the drive-spool rotate the gratings to scan the spectrum. The visible grating, weighing 60 lbs., ruled with 632 grooves per millimeter, has dimensions 3.0 x 12.6 x 16.5 inches. The infrared grating, weighing 100 lbs., with 120 grooves per millimeter, has dimensions 4.0 x 14.5 x 18.5 inches. A test of the system began in mid-October in our Tucson shops prior to a planned careful move and installation at Kitt Peak by early November. The new system will permit observations from the UV cutoff at 2900 A to 15 um in the infrared.

Keith Pierce

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USAF Team at NSO/SP Works in Number-One Technology Thrust (1Dec92)

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USAF Team at NSO/SP Works in Number-One Technology...(1Dec92)
Thrust
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

Of sixty-four Technology Thrusts in the whole of the US Air Force R&D, the thrust Space Effects on USAF Systems, managed by the Phillips Laboratory Geophysics Directorate (PL/GP), was rated number one for FY 1992. Much of the effort in the Thrust is being produced by the Solar Research Branch (PL/GPSS), which is resident at the National Solar Observatory/Sacramento Peak. Rankings of the value of R&D are produced annually by those USAF commands affected by the work. Their rankings generally reflect the value of the work to the individual commands. The work is partially funded under the Air Force Office of Scientific Research Project 2311 and includes work done by a "sister" task, PL/GPSG, at Hanscom AFB, Massachusetts. Major components of the work include solar instrument development, advanced solar activity models and the Soft-X-ray/Extreme Ultraviolet Imager (XUVI), all managed by GPSS; the Solar Mass Ejection Imager (SMEI), with shared management between GPSS and GPSG; and solar-wind dynamics at GPSG.

Dick Altrock

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Mid-Infrared Solar Imaging at the McMath-Pierce Solar Facility (1Dec92)

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Mid-Infrared Solar Imaging at the McMath-Pierce...(1Dec92)
Solar Facility
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

Dan Gezari (NASA/Goddard), William Livingston and Greg Kopp recently imaged active regions and the quiet Sun at several mid-infrared wavelengths, acquiring the most detailed thermal images to date of the solar photosphere. The all-reflecting, windowless McMath-Pierce Solar Facility was used to feed the infrared signal to a cryogenically-cooled 58 x 62 Si:Ge camera system built by Dan Gezari at NASA/Goddard Space Flight Center. Images of sunspots, surrounding plage, and the solar limb were made at 4.8, 12.4, and 18 um. These are basically thermal maps, the infrared intensity being nearly linearly proportional to temperature at these wavelengths.

Thermal structure within sunspot penumbrae and the surrounding plage is evident in several images, although umbrae appear homogeneous on scales greater than the 2 arcsec diffraction limit of the telescope at 12 um. Movies of the quiet Sun show temperature changes of about 2% in spatial patterns that change slowly with time. Limb profiles and off-disk measurements will allow for a quantitative characterization of stray light. Seeing in the mid-infrared may be better than in the visible, but seeing distortions are nevertheless present.

The infrared capabilities of the McMath-Pierce Solar Facility are promising, this being the first attempt at using it for direct imaging in the thermal infrared.

Greg Kopp

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"One-Shot" Coronagraph Upgrade (1Dec92)

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"One-Shot" Coronagraph Upgrade (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

This program involves the addition of a CCD camera while retaining the original 70 mm film capability of the "One-Shot" Full-Limb Coronagraph at the NSO/SP Hilltop Dome. The CCD camera control system is now complete. The system is VME based and includes a 68030 CPU, custom control and data routing board, 8 Mbytes of additional memory and 1.2 Gbytes of disk storage. The system is linked via Ethernet to a SUN IPC workstation. The camera is a Videk MEGAPLUS CCD with 1320 x 1035 pixels, digitized to 8 bits. A 12 MHz fiber-optic data link from the Hilltop Dome to the observing room is nearly complete and provides lightning immunity for the system. The CCD camera has been installed on the coronagraph, and test images and data sequences have been taken. These data are in the process of being analyzed to determine proper reduction techniques and further define the observing process. The fiber-optic link includes an instrument-ready line from the One-Shot controller allowing interrupt-driven image acquisition. Hardware for a VME based controller has been ordered, and engineering work on controller replacement is underway. The new controller will replace antiquated equipment and allow communication of telescope parameters and observing condition information along with each CCD image. The instrument is operational but will be taking data in a limited mode for the next several months. Good images have been obtained in H, and "first- light" images have been obtained in Fe XIV 5303 A.

Roy Coulter, Dick Altrock

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McMath-Pierce Solar-Stellar Program Update (1Dec92)

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McMath-Pierce Solar-Stellar Program Update (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

We are pleased to report on some upgrades to the facility that will enhance our capabilities in the stellar synoptic and visitor program, and generally make the observing environment for visiting PIs more user-friendly. The instrument and mountain data reduction now operate under the ICE system (IRAF Control Environment). We also have installed a Sparc2 (named PACIFICA) along with (in response to a number of visitor requests) IDL. The new workstation is in a small observing room in which we have installed two monitors. One is for the digital output of the video guider, and the other is a telescope VDU. The video guider itself will, however, have to remain near the spectrograph. We will also have a VT100 emulator that will enable telescope control to be accomplished from the observing room.

As of this writing, the installation of one of the 1024 x 3072 chips in a dewar to replace our present TI 800 x 800 chip is being planned for the November-December time frame. This large format CCD is the first step in our planned effort to cross disperse our echelle grating. Finally, new and updated manuals are available, and we now have a computer-based observing log system at the telescope.

Mark Giampapa, Dave Jaksha,
Jeremy Wagner, Paul Avellar

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A Successful Comparison of Two Wavefront Sensors (1Dec92)

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A Successful Comparison of Two Wavefront Sensors (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

In our effort to characterize wavefront sensors for solar applications, we have compared, using real data, two fundamentally different approaches at the NSO/SP Vacuum Tower Telescope. This work represents the only known effort to compare directly the performance of different wavefront sensors simultaneously, in real time. The comparison was between the traditional Shack-Hartmann wavefront sensor and the Focal Volume Technique (FVT) for recovering wavefront phase. The analysis shows that the two wavefront sensors do produce comparable wavefront measurement values, and underlines the importance of specifying accurately the boundary condition for the FVT approach.

Sergio Restaino, Richard Radick, Carsten Denker

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New Observing Port on the Littrow Spectrograph (1Dec92)

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New Observing Port on the Littrow Spectrograph (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

The hardware for a new observing port on the Littrow Spectrograph (LSG) of the Evans Solar Facility at NSO/SP has been completed. The new port will allow for the mounting of two additional detectors on the LSG. This will greatly benefit the operation of the standby and bumping programs.

Lou Gilliam

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Fe XIV Corona Seen with MAC II (1Dec92)

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Fe XIV Corona Seen with MAC II (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

"First-light" images of the Fe XIV solar corona have been obtained with the Mirror Advanced Coronagraph (MAC) II. This 15-cm diameter reflecting coronagraph has been under development at the National Solar Observatory site at Sacramento Peak, by USAF/PL/GPSS, NSO/SP, and the Paris Institut d'Astrophysique sponsored by the French CNRS. This unique instrument is the first research-grade, ground-based coronagraph using a mirror instead of a lens as the primary imaging optic to obtain images of the two-million-degree solar corona. The only previous images were obtained by the MAC I, also developed by the same consortium. On 9 September 1992, as an active region went over the West limb near 10 degrees South, a flare occurred at approximately 1519 UT. The MAC II, equipped with a Lyot filter tuned to Fe XIV 530.3 nm and a Videk CCD camera, began to record data at this time. Images were obtained from 1519 to 1827 UT with a 5-second exposure time. Off- band images were subtracted from the on-band images to remove non-coronal artifacts. The images show evolution in the corona over the active region at 1519, 1739 and 1827 UT. The structure obtained in the images was verified by comparison with an image obtained with the NSO/SP and PL/GPSS Emission-Line Coronal Photometer at 1411 UT.

The MAC II will continue to be tested and modified to optimize its design, which will provide valuable information on critical aspects of the design of reflecting coronagraphs, which will be incorporated in the 55-cm diameter MAC III.

Serge Koutchmy, Ray Smartt, Dick Altrock,
Roy Coulter, Craig Gullixson, Jean-P. Zimmerman

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Daily Coronal Images Available from NSO/SP FTP Site (1Dec92)

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Daily Coronal Images Available from NSO/SP ftp Site (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

Full-disk coronal maps in Fe XIV and Ca XV made using data from the Emission- Line Coronal Photometer at the NSO/SP Evans Solar Facility are now available on Internet directly from NSO/SP as well as from NOAO. An article describing the maps and the procedure for obtaining them from the Tucson NOAO ftp site was published in the 1 June 1992 issue of this Newsletter on page 29. The procedure for obtaining them from NSO/SP is given below.

Map file names are ion.mmddyyl, where ion is fexiv or caxv, mm is the month, dd is the day, yy is the year and l is the limb from which the data are taken (e or w).

```
Representative INTERNET procedures:
  You type:
ftp ftp.sunspot.noao.edu
  When connected, respond with login as:
anonymous
  When asked for a password, please enter your e-mail address; e.g.:
jblow@icu.edu
  Change to the coronal map directory:
cd pub/corona.maps
  Copy the readme file:
```

```
get readme
  Enter a data directory:
cd fexiv (or caxv or idl [see below])
  To get a directory listing (caution: there are many files!):
ls
  or copy the data using:
get filename (e.g., get fexiv.101992e)
  To go from, e.g., fexiv to caxv:
cd ../caxv
bye

Representative SPAN/DECnet procedures:
  To get a directory listing, type the following on one line (caution:
  there are many files!):
dir east"ftp.sunspot.noao.edu!anonymous
login_name"::"pub/ corona.maps/fexiv"
  (or replace fexiv with caxv or idl [see below])
  login_name should be your alphanumeric username (use no symbols).
  Be sure that spaces, quotes, etc.  are typed exactly as above.
  To get the readme file, type the following on one line:
copy east"ftp.sunspot.noao.edu!anonymous
login_name"::"pub/corona.maps/readme" localname
  To copy a data file, type the following on one line:
copy east"ftp.sunspot.noao.edu!anonymous
login_name"::"pub/corona.maps/fexiv/filename" localname
  (or replace fexiv with caxv or idl)
```

Directory idl contains two simple procedures for displaying the data as contours or a gray-scale plot under the IDL graphics language. A readme file in that directory describes the programs. For information on these procedures, contact thenry at the addresses below.

For further information, contact thenry or raltrock at NOAO:: or noao.edu.

Dick Altrock

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NSO Observing Proposals (1Dec92)

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NSO Observing Proposals (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

The deadline for submitting observing proposals to the National Solar Observatory for the second quarter of 1993 is 15 January 1993. Forms, information and a Users' Manual may be obtained from R.N. Smartt, P.O. Box 62, Sunspot, NM 88349, for the Sacramento Peak facilities (sp@sunspot.noao.edu) and J.W. Brault, P.O. Box 26732, Tucson, AZ 85726, for the Kitt Peak facilities (nso@noao.edu). At your request, a TeX or UNIX roff version can be e-mailed.

Dick Altrock

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NSO Telescope/Instrument Combinations (1Dec92)

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NSO Telescope/Instrument Combinations (1Dec92)
(from NSO, NOAO Newsletter No. 32, 1 December 1992)

Vacuum Tower Telescope (SP):
- Echelle Spectrograph
- Universal Spectrograph
- Horizontal Spectrograph
- Universal Birefringent Filter
- Fabry-Perot Interferometer 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 Facility (KP):
- 160-cm Main Unobstructed Telescope
- 76-cm East Auxiliary Telescope
- 76-cm West Auxiliary Telescope
- Vertical Spectrograph
- Infrared Imager
- Image Stabilizers
- 1-m Fourier Transform Spectrometer
- Stellar Spectrograph System
- 3 Semi-Permanent Observing Stations for visitor equipment

Vacuum Telescope (KP):
- Spectromagnetograph
- High-l Helioseismograph

Razdow (KP):
- Ha patrol instrument

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GONG Update (1Dec92)

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GONG Update (1Dec92)
from GONG, NOAO Newsletter No. 32, 1 December 1992

The Global Oscillation Network Group (GONG) project is a community-based activity to develop and operate a six- site helioseismic observing network for at least three years, to do the basic data reduction and provide the data and software tools to the community, and to coordinate analysis of the rich data set that should result. The project is currently looking forward to an operational network and data management and analysis center in 1994. GONG data will be available to any qualified investigator whose proposal has been accepted, however active membership in a GONG Scientific Team will allow early access to the data and the collaborative scientific analysis that the Teams have already initiated. The GONG Newsletter provides status reports on all aspects of the project and related helioseismic science.

GONG has recently signed Memoranda of Understanding (MOU) with our sites at Tenerife (Spain), Udaipur (India), and Learmonth (Australia), following those at CTIO and Big Bear (California). Goetz Oertel and Jim Kennedy participated in the signing of the MOU at the Instituto d'Astrofisica Canarias with Francisco Snchez (Director, IAC), in the presence of Marisa Tejedor (Rectora, U. of La Laguna), and other dignitaries. Jim Kennedy represented the project and AURA in signing the MOUs with R.K. Varma (Director, Physical Research Laboratory), in a ceremony in Ahmedabad, and with Senator Nick Bolkus (Minister for Administrative Services), in a ceremony at Parliament House in Canberra, with members of the US diplomatic delegation, David Cole (Director, Ionospheric Prediction Service), and other notables.

This year, the annual GONG meeting in Tucson was replaced with a more general meeting on helio- and astero-seismology sponsored by the High Altitude Observatory (HAO) at their new facility in Boulder. It was decided that the project had developed to the point that every other year the annual gathering should be in the form of a regular scientific meeting, held in some other location. Also, it was felt that the scientific concern of the meeting should be broadened to include discussion of multi-mode pulsations in stars other than the Sun. The result was this year's meeting, GONG 1992: Seismic Investigation of the Sun and Stars. With 129 attendees from more than a dozen countries, the meeting was a terrific success. Next year's meeting will take place back in Tucson in April, and Roger Ulrich has started organizing the 1994 meeting, Helio- and Astero-Seismology from the Earth and Space, which will be held in the Los Angeles area.

On the data management and analysis front, the project has successfully merged artificial data. Merging of imaged helioseismic data had been the one major unknown in our processing pipeline, and this initial success is a major accomplishment, and source of relief. Dave Hathaway (Marshall Space Flight Ctr.) generated solar velocity images with a variety of solar velocity fields, and Tim Brown (HAO) contributed a code to degrade those images into network images with realistic noise models. Winifred Williams, Cliff Toner and Frank Hill then extended Brown's software and successfully merged the data with a simple averaging algorithm.

One outgrowth of the Data Management and Analysis Center (DMAC) Review Panel--reported on in the last NOAO Newsletter--was a Users Group, to meet three or four times per year in Tucson. The purpose of the group is to act as a conduit between the DMAC development group and the GONG community. The Group is intended to advise on cost/schedule decisions in a manner which reflects community priorities and to ensure that the resulting product is acceptable to the community. The current membership of the group is Tuck Stebbins (Chair), Tim Brown, Jrgen Christensen-Dalsgaard, Todd Hoeksema and Roger Ulrich. Data Reduction and Analysis Team (DRAT) members suggested that the name be changed from DMAC Users Group (DUG) to DMAC Users Committee (DUC). So, it has been. Members of the greater GONG community are encouraged to voice their opinions about the DMAC to DUC members. The DUC has now met twice and promises to be a significant factor in the further development of the DMAC.

The prototype instrument has now been in service for more than a year, and production of the field instruments is well underway. A great deal of work has been done on the calibration of the GONG data, and we now believe that we have a reliable procedure in place. The basic calibration is to send sunlight into the instrument in such a way that all pixels in the final image plane see the same solar Doppler shift, and repeat this for two different Doppler shifts. This allows the properties of the instrument to be separated out by a rather complicated scheme. Originally it was planned to use a stabilized laser to monitor low-frequency drift of the instrument. After much effort, we were unable to reduce the noise of the apparent velocity signal of the laser below 1 m/s. This is two orders of magnitude larger than the instrumental noise level so the laser will not be used in the final instruments. Low frequency drift will be monitored by watching quiet parts of the Sun itself. The frequency of calibrations was originally planned to be at one-hour intervals at each site (staggered by 20 minutes at successive sites). Experience has shown that the instrument is stable enough to use just one calibration per day, and that frequent, periodic interruptions are a significant source of contamination of the oscillation spectra and are to be avoided.

We had considered removing the magnetograph capability when confronted with potential schedule delays due in large measure to difficulties with the polarization modulator. However, recently we have acquired very respectable magnetograms, and they will be taken once per hour per site, but this will not interrupt the flow of Doppler images.

Production of the final field instruments is well underway. The shelters for the six sites are nearly complete and will be moved in November 1992 to a nearby site where they will be placed side by side for integration. During 1993, the six stations should be finished and cross calibrated, for fielding in 1994. However, there remain many uncertainties

The GONG project has had a budget history not unlike many other Federally funded programs. The proposal, prepared in 1985, called for funding of about $3 M in three of the first five years in order to finance the technical development and major purchases necessary to construct and deploy the network. The proposal was approved and first funded in FY 1987. However, the vagaries of the Federal budget have caused the project to be funded at the levels varying from $1 M to $2.3 M, far below the optimum profile. Nevertheless, excellent progress has been made, although the program is necessarily taking more time to complete than originally proposed.

Various adjustments in both the strategy and tactics of the project plan have been made over time to deal with the realities of the funding. Since 1990, the project has pursued a work plan that calls for network operations in June of 1994. The success of this plan depends on annual budget increases from $2.3 M in FY 1992, to $2.55 M and $2.68 M in FY 1993 and FY 1994, respectively. However, at this writing, the FY 1993 and the FY 1994 increases are in some question. The actual cumulative funding to date has been more consistent with a "full-network first-light" date of December 1994. However, if funding remains at the current level in both 1993 and 1994 there will be a shortfall of about $400 K for even the December 1994 date.

For the past several months the project has been engaged in a very detailed re- planning process directed at understanding the impacts of both the funding and the development issues, and the alternative responses. The objective has been to develop a program that will provide the earliest possible fielding of the complete network of robust, scientifically acceptable instruments.

Network deployment strategies have been devised for both the June 1994 and December 1994 full network operations dates. The average deployment time for a station will be about one month. There will be two different teams each doing the "rough" installation of three stations, and one team that will do the final alignment and certification for operation. The teams will alternate in the field so that the unavailability of any one person will not obstruct an installation; that skill can be borrowed from the other team. Similarly, if a particular installation runs into trouble, as much as two months can be devoted to it without delaying the overall schedule.

The order of the first two deployments is driven by logistics, training, and merging considerations. The California site is the physically closest site to Tucson, and it will represent a first "baby step" deployment effort. Supply and communications lines are shortest here. It will represent a training exercise for both teams under fairly controlled circumstances. Moreover, the prototype instrument will be in daily operation in Tucson. As soon as the Big Bear instrument comes up, the DMAC team will have its first access to real data to test and practice merging. The Hawaiian installation represents the next logical extension of these same philosophies. Here the testing of three- site merging will become practical. The balance of the deployment order is based on expectations of weather.

The final decisions on schedule, scope, and budget will be made by the project in consultation with the Scientific Advisory Committee and the Science Team leaders during the late Fall, as hard fiscal information becomes available.

On the people front, Jean Nowakowski--familiar to many readers of the Newsletter from her previous incarnation as an LTO on Kitt Peak--has joined the project to help with the data reduction, primarily the upstream calibration processing; Jeff Vernon has joined Bret Goodrich in working on the data acquisition and instrument control computer; and Sang Ngunyen, Marilyn Heffelfinger, and Deanna Stover have joined the electronics team.

John Leibacher

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1992 Software Conference Update (1Dec92)

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1992 Software Conference Update (1Dec92)
(from CCS, NOAO Newsletter No. 32, 1 December 1992)

As this Newsletter goes to press, the Second Annual Conference on Astronomical Data Analysis Software and Systems (ADASS) is being held in Boston on 2-4 November 1992. The conference is sponsored by NOAO, SAO, and STScI, and is being hosted this year by SAO. Additional funding for the conference has been provided by grants from NASA and NSF. The ADASS conference provides a forum for scientists and programmers concerned with algorithms, software, and software systems employed in the reduction and analysis of astronomical data.

Over 285 people are registered for the conference including 66 international registrants representing 11 countries. There will be 43 oral presentations during the General Sessions including 12 invited talks. More than 80 poster papers and several software demos will be presented as well. Five special sessions (BOFs) are also planned. The proceedings for ADASS II, like those of the first conference, will be published as part of the Astronomical Society of the Pacific (ASP) Conference Series. Based on the superb turnaround time that we experienced with the ASP last year, we expect this volume to be available mid-summer 1993.

Plans are already in progress for the next ADASS conference to be held in Victoria, British Columbia, Canada in October 1993, hosted by the DAO. We will keep you posted as plans develop.

Jeannette Barnes, George Jacoby, Doug Tody

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IRAF Update (1Dec92)

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IRAF Update (1Dec92)
(from CCS, NOAO Newsletter No. 32, 1 December 1992)

Several V2.10.1 platform upgrades were completed during the summer months and released for distribution in early September; these included upgrades for the Sun 386i (this will be the last IRAF release for this platform), for Decstation Ultrix, for VAX Ultrix, and for the SGI. All of these are available in the IRAF network archive now. The first release of IRAF for the IBM RS/6000, running under AIX Version 3.2, was completed in late October and is being prepared for distribution as this Newsletter goes to press. The VMS/IRAF V2.10.1 upgrade and the IRAF port to the Macintosh running A/UX 3.0 have been completed, and these systems are now in testing. We expect both VMS/IRAF and Mac/IRAF to be available later this year. The VMS/IRAF upgrade includes many VMS-specific fixes and some major enhancements to the networking and magtape support.

A few ports and upgrades are planned or being considered for the next six months including Solaris 2.0 (Sun), MIPS, HP (pending a loaner from the HP office), and DEC/Alpha (pending a loaner from the DEC office).

Work has begun on the X11 support package for IRAF. An early version of the XGterm color graphics terminal emulator for X11 is now operational and will be demonstrated at the ADASS software conference in Boston, along with the rest of the X11 support package and lots of other new IRAF software. We currently plan to release this host level package early next year.

Frank Valdes has written an add-on package for searching the text copy of the ADC CD-ROM catalogues, a new task Specfocus for helping focus spectrographs, and some prototype IRAF tasks for rendering RGB color images. Lindsey Davis has completed the integration of Peter Stetson's DAOPHOT II algorithms into the IRAF version of DAOPHOT. Testing of the new package is now in progress. Mike Fitzpatrick is finishing up a package of software tools for SPP program development. Dyer Lytle is working on transferring two large solar (NSO) archives from magnetic tape to CD-ROM, using our new write once CD-ROM unit. Rob Seaman is now working full time on ICE support and development, and has completed a facility for viewing satellite weather pictures on workstations, e.g. while observing on the mountain. Suzanne Jacoby continues her work in system and site support.

The IRAF project plans to have an IRAF demo at the AAS in Phoenix in January 1993. We look forward to seeing many of our IRAF users at this meeting-- please stop by and say hello and let us know if you have any questions or concerns. We will be demonstrating some of the latest IRAF software as well.

For further information about the IRAF project, please contact Jeannette Barnes, Central Computer Services.

Doug Tody, Jeannette Barnes

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The SBRC 256 x 256 InSb Evaluation Results (1Dec92)

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The SBRC 256 x 256 InSb Evaluation Results (1Dec92)
(from ETS, NOAO Newsletter No. 32, 1 December 1992)

The IR program has completed testing on a SBRC engineering and science grade device. The science grade device has been installed in the Cryogenic Optical Bench (COB), and observations have been made at the 1.3-m telescope. It can be said without reservations that these new SBRC devices are great. The telescope tests confirm the lab testing and did not uncover any new problems. The higher quantum efficiency of these devices has made the COB a truly powerful astronomical instrument.

The dark current in these new devices is less than 1 electron per second with median results as low as 0.15 electrons per second. There is a picture frame effect (around the four sides) in the dark current which we believe is due to LED effects and which we have not yet eliminated. This effect is low and subtracts out of the reduced data. The output drain voltage and the voltage controlling the source follower current source must be lowered during integration to achieve these low values. Another problem is that the temperature sensor provided by SBRC in the package is also a LED source. It is necessary to paint over the diode or switch it off for best results.

The quantum efficiency (QE) is very high, and we will have to improve our calibration to say how high for sure. We measured QEs of 100%+ in the J, H, and K bands, which is consistent with what SBRC reports. The University of Rochester reports a QE of ~80% at 3.3 um. We have not yet measured QEs in the thermal IR as our system saturates before we can read out the array. Our new data gathering, processing and reduction system on a SPARC station will not have this problem.

There is no residual image retention problem in these devices. We imaged a very strong signal on the focal plane assembly and immediately did a series of 100 second darks and saw NO residual effects. The new passivation being used by SBRC has eliminated the need for a gate to control dark current and has also eliminated image retention effects.

We confirmed this result at the telescope with the COB by setting up on a 0 magnitude star and then going to something very faint, and no residual effects of the bright star were seen.

The read noise using our reset-read-read technique is 26 electrons rms and is very well behaved. We have not tried our multiple correlated read technique, but the University of Rochester reports it works, and they have seen read noise results in the 10 electron rms range. When we get the system running under the SPARC station, multiple correlated reading will be provided.

The one problem area is the low full well capacity. With the small detectors (30 um) the capacity is around 350 K electrons per volt. Since the bias is low for InSb, we are getting around 70 K electrons full well. We will be working on this problem more in the future. With the faster readout system this will prove to be less of a problem, but it does provide a bound on the dynamic range.

All in all we can say that SBRC has done a magnificent job of providing a new device which will be as important to astronomers as the older 58 x 62 InSb was in 1987.

Al Fowler

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