NOAO Newsletter - December 1996 - Number 48

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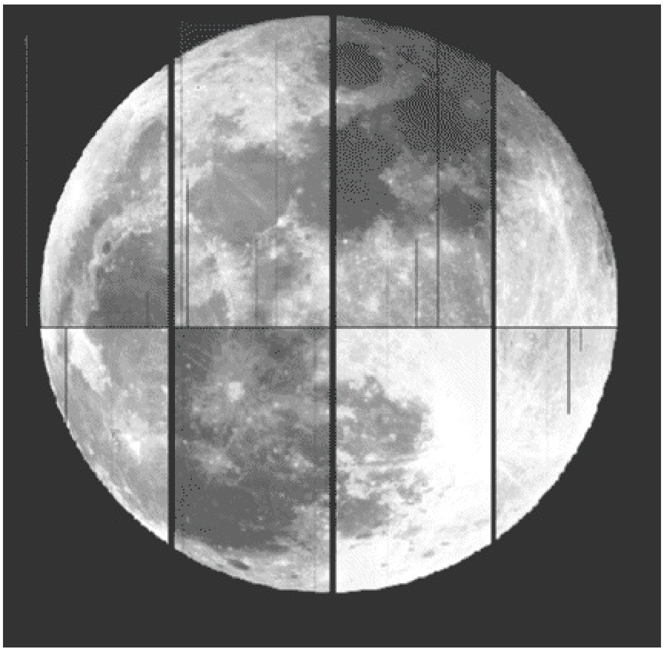
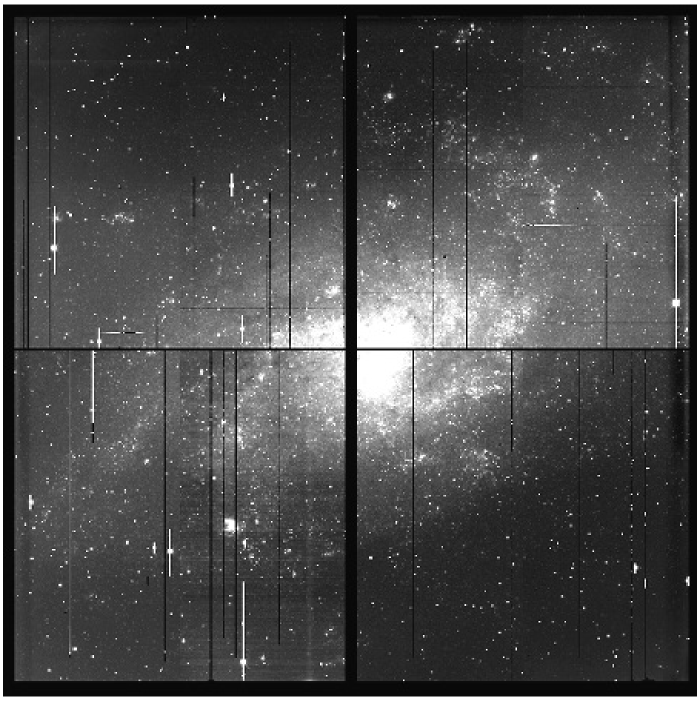
Mosaic Gets the Big Picture



NOAO has developed a large 8192 X 8192 CCD mosaic for wide-field optical imaging. Mosaic commissioning with thick CCDs is currently underway at the KPNO 4-m and 0.9-m telescopes; thinned CCDs will be installed as they become available. Eventually, the instrument will be available at both these telescopes and the CTIO 4-m. The Mosaic Imager features eight 2048 X 4096 15m pixel CCDs arranged as an 8192 X 8192 pixel detector. The full mosaic is a square about 5 inches on a side. The field of view is 36' X 36' at the KPNO 4-m and 59' X 59' at the KPNO 0.9-m. This large field size, coupled with excellent image quality and sampling, should enable numerous scientific investigations that are presently impossible or impractical. The CCD Mosaic project represents the collaboration of many groups within NOAO, including the Instrumentation Projects Group, the ARCON group at CTIO, both IRAF and mountain programmers, scientific staff members from both north and south, and the KPNO mountain engineering and support teams. For more information, see the article in the KPNO section and the Mosaic page on the World Wide Web (http://www.noao.edu/kpno/mosaic/mosaic.html).



Caption: The images of the Moon (cover) and M33 (this page) were taken with the CCD Mosaic Imager and the Mayall 4-m telescope. The field of view is 36 arcmin on a side. The exposure time for the M33 image was 300 seconds. These images were processed only through dark subtraction and flat fielding in order to show the locations of the bad columns. Prior Mosaic experience shows that combining multiple shifted images eliminates the defects and fills the inter-CCD gaps.

CTIO Will SOAR into the 21st Century!

We are pleased to announce that the SOAR project, which has as its goal the construction of a 4-m class telescope at CTIO, now has received letters of intent that have identified sufficient funding to proceed with design and construction. The following is abstracted from a statement that was released to the press in Tucson on Friday, 18 October 1996:

The Tucson-based National Optical Astronomy Observatories (NOAO), the Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (CNPq) of Brazil, the University of North Carolina at Chapel Hill, and Michigan State University announced today a joint decision to proceed with the construction and operation of "SOAR," the Southern Observatory for Astrophysical Research.

SOAR's centerpiece will be a new-generation, light-weight, computer controlled, four-meter telescope with active optics and other advanced design features. This telescope will provide superb images at visible and infrared wavelengths. In the infrared region, with the addition of optics capable of rapid compensation for atmospheric turbulence, the quality of the images will rival those of the Hubble Space Telescope. Located near La Serena on the westward side of the Chilean Andes, the SOAR telescope will be the first 4-meter high-resolution telescope in the Southern Hemisphere. The astronomical consortium chose the Southern Hemisphere site for several reasons: The site has dark skies and clear, dry air. The location is near the large, existing Cerro Tololo observatory and the new Gemini 8-meter telescope, now under construction and managed by another international consortium based in Tucson. The Southern skies offer astronomers the additional viewing advantage of our nearest neighbor galaxies, the Magellanic Clouds, the center of our Milky Way Galaxy, and the brightest nearby stars. Many of these regions of the sky are not accessible to existing telescopes situated north of the equator.

Plans call for a high speed Internet link between SOAR and participating astronomers in Brazil and the US. Astronomers will also design the light-analyzing instruments to be operated remotely. Scientists and students in their labs at their home universities or at NOAO Headquarters will then be able to carry out their observations on the telescope in Chile. The plan calls for several instruments to be mounted on the telescope simultaneously. A quick change capability will allow a wide variety of programs to be carried out during any observing session.

Astronomers are planning for the SOAR telescope to be up and running within 5 years. NOAO will get about 1/3 of the time on the SOAR telescope. Astronomers throughout the US will compete for that time on the basis of project proposals. Astronomers from Chile will also get time on SOAR because the country provides access to the excellent site.

The University of North Carolina at Chapel Hill and Michigan State University are research-intensive institutions with membership in the American Association of Universities (AAU). More information concerning the universities' participation in SOAR may be found at http://jabiru.pa.msu.edu/pages/soar/soar.html and at http://www.physics.unc.edu/~cecil/SOAR.html.

The Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (CNPq) promotes scientific and technological research in support of Brazil's social, economic, and cultural progress. More information about CNPq may be obtained at http://www.cnpq.br/.

Gerald Cecil (UNC) has been named Acting Project Scientist and has been charged with developing the science requirements document and a plan for a study that will evaluate various options for the design of the telescope. He will be resident in Tucson while this study is in progress. The goal is to present a detailed project plan and costs for approval by the interim SOAR Board in about four months time. A detailed agreement among the partners will be developed on the basis of this project plan. This agreement is subject to approval by both AURA and the NSF.

The draft science requirements document will be reviewed at the upcoming meeting of the joint CTIO/KPNO Users Committee so that we have a clear sense of the priorities of the user community for this new facility. In general terms, however, we expect that a primary design goal for SOAR will be to achieve excellent image quality over a field of view of several arcminutes, thereby complementing the wide field of view of the Blanco telescope. The telescope will also be designed to perform well in the near-infrared region of the spectrum.

Sidney Wolff, Malcolm Smith

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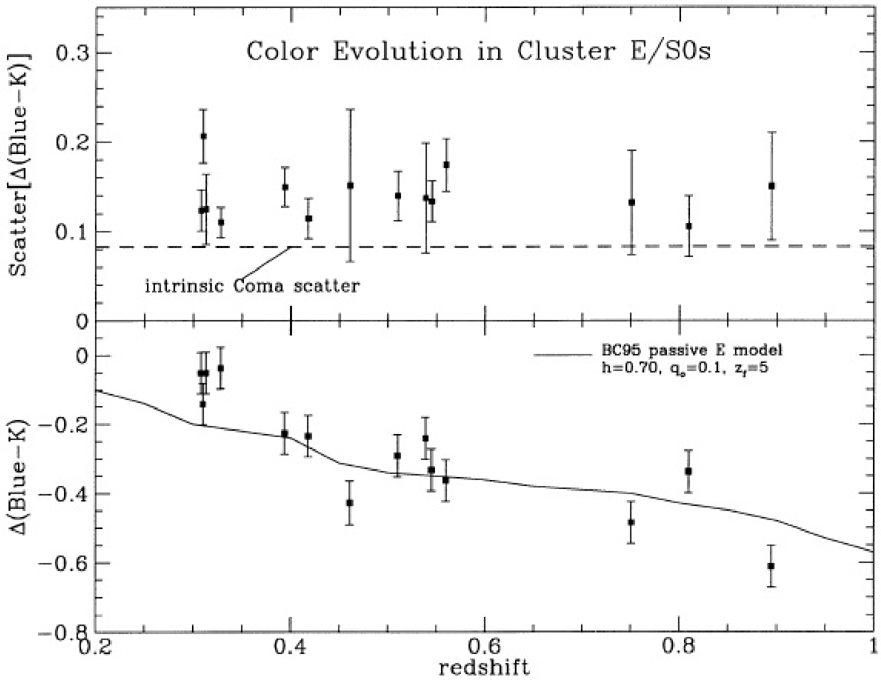
When Did Elliptical Galaxies Form?

Adam Stanford (LLNL), Peter Eisenhardt (JPL), and Mark Dickinson (JHU) are using NOAO near-IR imagers to deduce the formation epoch of elliptical galaxies. Their goal is to look for *scatter* in the optical-IR colors of high-redshift ellipticals galaxies that would indicate relatively recent star-formation at the corresponding lookback time. Their observations suggest that most of the stars in luminous elliptical galaxies had already formed when the universe was less than 25% of its current age.

The standard elliptical galaxy formation scenario begins with a single burst of star formation at high redshift; ellipticals would form the vast majority of their stellar mass during this initial episode. Several observations suggest that present-epoch ellipticals do in fact descend from such a coeval population formed at z > 3. Notably, little scatter at a given galaxy luminosity is seen in the UVK colors of present-epoch E/S0s such as those in Coma (Bower, Lucey, and Ellis 1992). Restframe broadband colors spanning the 4000Ã... break are sensitive to recent star formation---even small starbursts greatly increase the U band flux, and thus the scatter in colors like U-H. However, critical application of this test requires the colors to be observed at high-redshift. For example, an alternative galaxy formation scenario developed in the context of the cold dark matter (CDM) model suggests that massive galaxies form later, at $z \lesssim 2$, from the gradual merging of smaller galaxies. The small color scatter seen in *nearby* ellipticals can also be explained by CDM because, even though this model entails more recent star formation compared to the high z_f scenario, sufficient time elapses from z ~ 2 to z ~ 0 for starburst-induced color variations to damp out. Accordingly, the CDM model predicts an increase in the color scatter at higher redshifts. Until recently, the scatter in the color-mag relation of early-type galaxies in clusters was well-determined only at z ~ 0, which allowed both galaxy formation theories a wide range of possible star formation histories.



Caption: The bottom panel shows median colors of cluster E/S0s vs redshift. The colors are zeropointed to a no-evolution prediction based on Coma E/S0 photometry. Errorbars include systematics; they do not represent scatter. The top panel shows intrinsic color scatter against redshift for the early-type galaxies in a subsample of z < 1 clusters. The dashed line is the intrinsic scatter for a sample of Coma E/S0s.

Using NOAO telescopes over the last four years, Stanford, Eisenhardt, and Dickinson have been conducting a large scale optical-IR imaging survey of galaxy clusters from Coma to z ~ 0.9. Using WFPC2 images currently available from the HST Archive of 16 of the 40 clusters in their sample, early-type galaxies were selected by their morphologies so that their color distribution could be measured with minimal contamination. The resulting subsample contains ~480 E/S0s, down to 2 mag below a no-evolution K^*. The optical-K colors of the E/S0s become bluer with redshift, relative to the present epoch as shown in the bottom panel of the figure. The measured color changes are consistent with the predictions of a passive-evolution elliptical from the Bruzual and Charlot (solar metallicity version) models for the formation-redshift, $z_f \geq 4$, $q_0 = 0.1$, $H_0 = 70 km/s/Mpc$---that is, the only major thing that is happening is the slow aging of the stellar population after z_f. Moreover, after accounting for observational error, the intrinsic scatter in the optical-IR colors of the E/S0s was found to be small, and to be roughly constant with redshift, as shown in the top panel of the figure. Following the method outlined in Bower, Lucey, and Ellis (1992), a limit on the formation redshift may be obtained from the color scatter. Using GHO 1603+4313, their highest redshift cluster at 0.895, Stanford *et al.* find $z_f \geq 3.2$ for a reasonable degree of coherence among the cluster E/S0s during their formation epoch. This formation redshift is in closer agreement with the single-burst scenario than with the CDM model. Stanford it et al. plan to continue to study the properties of early-type galaxies in high redshift clusters by using the sample at z > 1, which Dickinson *et al.* have been assembling (see NOAO Newsletter No. 37).

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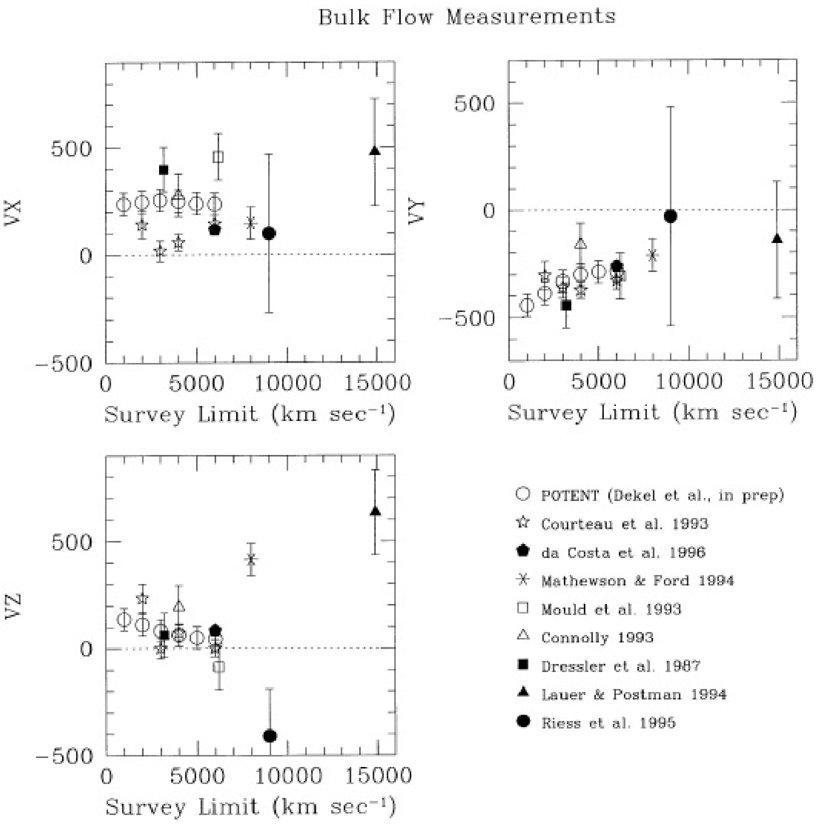
Chasing the Flow of Galaxies

About a decade ago, measurements of galaxy streaming motions (peculiar velocities) revealed the presence of a large concentration of Galaxies dubbed the "Great Attractor" (GA), which was thought to create a large fraction of the drift of our Local Group of galaxies with respect to the cosmic microwave background (CMB). Further peculiar velocity surveys however reveal a more complex picture. There is now evidence that the GA, itself, is moving with respect to the CMB, as part of a global flow of galaxies out to at least 6000 km/s from the Local Group. This flow has an amplitude of roughly 350 km/s within that sphere. Going out further, Tod Lauer (NOAO) and Marc Postman (STScI) used telescopes at KPNO and CTIO in an attempt to find the termination of flows at distances well-beyond the GA, but instead measured a bulk flow of high amplitude (750 km/s) extending out to three times the distance previously surveyed. These large amplitudes, and bulk flows in general, are a strong test of cosmological models, and thus require confirmation. The figure, however, shows that there is still no consensus as to the amplitude or direction of the flow---especially at distances beyond 6000 km/s. Reiss, Press, and Kirshner, for example, using Type Ia Supernovae as distance indicators, argue against the existence of large bulk galaxy flows at large distances.



Caption: Compilation of the bulk flow of galaxies on various scales from the literature. Error bars are taken from the papers quoted.

Stephane Courteau (NOAO/DAO), Michael Strauss (Princeton), David Schlegel (Durham), Marc Postman (STScI), and Jeff Willick (Stanford) are using NOAO facilities to make a definitive measurement of the bulk flow at 6000 km/s with the aim of clarifying the confusing picture of galaxy flows at large distances. This new project relies entirely on KPNO and CTIO facilities. Distance estimates are based on the Tully-Fisher relation between rotation velocity and luminosity of spiral galaxies. Their it *full-sky* sample includes 300 late-type spirals between 4500 and 7000 km/s. With the exception of the Lauer-Postman survey, most peculiar velocity surveys carried out to date do not cover the entire sky uniformly, and are thus limited by systematics in the photometry and spectroscopy of galaxies in different parts of the sky. The Courteau *et al*. survey will be the first well-defined full-sky survey to sample the velocity field at 6000 km/s, free of uncertainties from matching heterogeneous datasets. Because of the overlap with existing surveys at comparable depth, this new compilation will also be of fundamental importance in tying these datasets together in a uniform way, which will greatly increase their usefulness for global analyses of mass fluctuations in the universe. Photometry and long-slit $H\alpha$ spectroscopy of the galaxies in the sample was started in spring 1996, and should be completed in roughly one year.

This all-sky new survey will be pivotal in establishing with high confidence whether a bulk flow extends beyond the shell of matter at 6000 km/s. Moreover, it will provide a firm pillar in building a bridge between the nearby well-sampled universe and surveys to much larger distances.

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Instrumention Plan for FY 1997

The Instrument Projects Advisory Group met in October to set priorities for the current fiscal year. The program may be characterized as completing the commissioning of major new instruments and upgrades, while starting in earnest on work for Gemini and a new instrument for CTIO.

The three instruments in commissioning are Phoenix, the CCD Mosaic Imager, and COB upgraded to a 512^2 InSb array. Phoenix will receive a boost to its current reconfiguration speed and a more user friendly version of the interface software. Each outing of the CCD Mosaic Imager for test and engineering finds its hardware and software more robust. Please see the article in this Newsletter for further details. Efforts associated with the Mosaic this year will include characterization of scientific grade 2K X 4K SITe CCDs for replacement of the eight current engineering grade detectors. At this writing, the COB upgrade is nearly completed, and it will soon be shipped to CTIO.

Work for Gemini will occupy much of the Instrument Project Group's attention for the coming year. The first instrument required for commissioning the first Gemini telescope is the Near-Infrared Imager (NIRI) under development at the University of Hawaii. NOAO is producing an upgraded version of the WILDFIRE controller that relies on the digital signal processor produced by Datacube. That system will be delivered to Hawaii for integration into NIRI. The design will serve as the basis for controlling the arrays in the other near-infrared instruments that will be used on Gemini, some of which will be provided by and shared with NOAO, such as COB and Phoenix. The Gemini Near-Infrared Spectrograph team faces a year of concerted design effort. They successfully passed the Preliminary Design Review in October, and will be working up the detailed designs for Critical Design Review a year after the PDR. The Infrared R&D lab will be working with the US Gemini Program in procuring and characterizing ALADDIN-type 1024^2 InSb arrays for use in Gemini instruments.

The major new O/UV instrument is a version of the Hydra multi-fiber positioner that will work at the R-C focus of the CTIO Blanco Telescope. This capability has been the highest priority of the Users Committee and is first in the O/UV queue after completion of the CCD Mosaic Imager. A significant part of the effort is the production of a wide-field corrector, including atmospheric dispersion compensation. Delivery and integration of the system at CTIO is planned for FY 1998. We will discuss with the Users Committee in December the desirability of producing a clone to the CCD Mosaic Imager as soon as possible, to optimize the wide-field imaging in both hemispheres. We also expect progress on the upgrade to the GoldCam spectrograph optics for the Kitt Peak 2.1-m.

Several projects are in the design or exploration phases. They include an adaptive optics system for the WIYN telescope, a high-throughput optical spectrograph based on new grating technology, and a collaborative effort with the Ohio State University to produce a new infrared capability for Kitt Peak.

The Instrument Projects Group and their colleagues at CTIO obviously do not get to rest on their laurels. We anticipate that the addition of the CCD Mosaic, Phoenix, and upgraded COB to the complement of NOAO facility instruments will have significant positive impact on user science.

Richard Green for IPAC and IPG

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A Status Report on the Procyon Campaign

The Stellar Oscillations Network Group at NOAO will monitor the star Procyon with the CoudÃ© Feed Telescope on Kitt Peak to search for p-mode oscillations using the equivalent width technique. Weather permitting, observations will commence on 10 January 1997, and will continue for five weeks. Spectra will cover the region from 3800-5300Ã…, at a reciprocal dispersion of 0.4Ã…/pixel. Primary emphasis will be on the measurement of the equivalent widths of Hβ, Hγ, and Hδ for asteroseismology.

As we write this, we are in the process of setting up protocols for calibrations, observations, and data reductions. As information becomes available, we will post it to our web pages, accessible via the NOAO home page at http://www.noao.edu.

Tim Bedding and his collaborators have obtained 12 nights at Mt. Stromlo at the end of January to participate in the Procyon campaign, and we have received expressions of interest from a few other observatories as well. Both Doppler velocity data and equivalent width data are needed.

If you are interested in participating in this campaign, please contact one of us at NOAO (S. Barden, M. Giampapa, J. Harvey, F. Hill, C. Keller, or C. Pilachowski) or send email to song@noao.edu for details.

The SONG Team at NOAO

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Proposals to NSF: An Assessment

During the past year, AURA submitted two proposals to the NSF. One proposal was to renew the cooperative agreement under which we operate NOAO facilities for the NSF. The second was to renew the facilities at NOAO by replacing some of the existing telescopes with new ones that would offer better performance, lower cost operation, and/or be more suitable for supporting observations with larger telescopes and spacecraft. We have now received the referees' reports on these two proposals, and we would like to share with you the recommendations from the consensus report of the panel that met in Tucson last summer to discuss the proposals themselves and the reports of the sub-panels that visited each of the sites. In future newsletters, we will give our reactions to these recommendations and keep you informed about progress in responding to them. We will also provide more detailed summaries of the comments of the sub-panels concerning their assessments of the three operating observatories---NSO, KPNO, and CTIO---as well as the reactions of the directors and users committees to those assessments.

To quote from the report:

"It is the panel's unanimous recommendation that the Cooperative Agreement between NSF and AURA to manage NOAO be renewed. AURA's performance in the previous cooperative agreement and the plan outlined here merit this trust. CTIO, KPNO, and NSO are first-rate research facilities. NOAO provides telescopes, instruments, observing assistance, and data analysis tools (such as IRAF) that lead to important contributions to scientific understanding through the published literature. The National Observatories are based on an appealing vision embedding fairness and opportunity in a vigorous scientific enterprise. We endorse that idea.

"Despite a difficult financial climate, in the past seven years NOAO has created the Gemini Project, NSF's premier project in night-time astronomy; the WIYN telescope, which sets new standards of technical excellence and demonstrates a new approach to cooperation with universities; and the GONG project, a far-flung collaboration probing the structure of the sun through its oscillations. These are examples of ambitious and beautifully executed scientific instruments that will lead to deeply intriguing scientific results. [Elsewhere in their remarks, the panel comments, `These achievements have been possible, despite a long series of losses in real support, only through careful management and painful choices. NOAO has been stretched as thin as it will go without ripping....'] NOAO has developed new technology for astronomical instrumentation including IR arrays, CCD mosaics, and an automated fiber-fed spectrograph that are powerful new tools for exploration. The demand for these instruments by a large stream of visitors is evidence that NOAO is making good on its promise to be the place where the nation's astronomers can go to carry out their ideas at the edge of understanding, independent of their institution's resources."

The report of the panel also contains recommendations to the NSF and AURA for improving service to the astronomical community:

NSF

An improved policy for allowing for currency fluctuations in international operations would lead to smoother and more effective operation at CTIO.

The panel notes that NSF has announced its intention to recompete the cooperative agreement in four years but has not yet established the process for doing so, expresses strong concern about the morale issues that are already apparent among NOAO staff, and suggests that such a competition should occur at such a time and in such a way as to be least disruptive to the observatories.

The panel also notes that large programs like NOAO "are quite different from single-investigator research projects....The need for funds for infrastructure, for safety and environmental improvements, and for ongoing maintenance of the scientific and support facilities must be recognized....NSF could help NOAO by making every effort to maintain a reasonable consistency in funding."

AURA Board

"The new formulation of the AURA Board of Directors has potential benefits if the Board has the right size, the right composition for its tasks, and formulates a clear path of fiducial responsibility.....AURA has taken on an expanding range of activities, which, up to this point, have provided helpful points of contact between NOAO and STScI and between NSF and NASA. There is risk that the variety of activities might soon become so broad that the Board could not give adequate attention to this Cooperative Agreement."

AURA Corporate Office

After noting the positive contributions of the corporate office in working as a partner with the NSF and helping to advance astronomy in many ways, including fostering collaborations between STScI and NOAO in public outreach, the panel recommends that the corporate office provide more active guidance to NOAO in resolving such long standing issues as the relationship of NSO to NOAO, deferred maintenance, especially at NSO/SP, and the situation with respect to the failed search for a KPNO Director.

The committee comments that the current situation, in which the NOAO Director is effectively the KPNO Director, "creates the impression that not all components of NOAO have equal access to the NOAO Director. At the same time, unlike CTIO and NSO and USGPO, KPNO does not have an independent advocate. A resolution of the KPNO Director anomaly needs a better-articulated statement of the role, resources, and responsibilities of the KPNO Director."

The committee also believes that "the role of NSO within NOAO remains an area of difficulty. The present `hands-off' approach [by the NOAO Director] neither integrates NSO into the rest of the observatory nor removes all the sources of friction. An external review of the field, and of NSO's role within the field, by the NRC would be timely and could lead to new arrangements for NSO."

NOAO

"NOAO has chosen to maintain a vigorous instrumentation program capable of producing complex instruments of high quality. Hydra, Phoenix, and the Mosaic imager all are state-of-the-art instruments. As part of this program, NOAO has developed strength in real-time software for instrument control and data delivery, and has provided IRAF data reduction tools that are widely used throughout the international astronomical community, especially among the Gemini partners. Within NOAO, the combined instrumentation program seems to be functioning well, reducing tension between CTIO and the North. Because the ETS headcount includes both maintenance staff for the KPNO and Tucson facilities and the technical development staff, it appears to be very large. This, however, does not reflect the actual size of the instrumentation effort, which does not appear to be overstaffed. Even so, cooperation with capable groups in the university community is desirable and should continue to be cultivated during this cooperative agreement."

"After a complex sequence of events, the institutional arrangements for US participation in the Gemini international project have been sorted out, with NOAO playing an important role. The US Gemini Project Office is now functioning well, providing good representation of US interests within the project and developing contact with the US astronomical community. During the period of this cooperative agreement, the project office will grow in importance as Gemini moves from construction toward operation."

With respect to the proposal to renew the facilities operated by NOAO, the panel made the following remarks:

"The panel endorses NOAO's vision for the institution in the next decade: a vibrant solar program with the SOLIS suite of instruments in place and a nighttime set of well-instrumented modern telescopes in the Northern and Southern hemispheres. This NOAO proposal provides a path to achieving this vision which, with the Gemini Project, will give U.S. astronomers access to outstanding facilities for forefront science. The proposal is in accord with the recommendations of the McCray panel, which stated, (p.23) `After the direct support of the Gemini telescopes, the second priority of NOAO must be the support of moderate (2- to 4-meter-class) telescopes with the best possible capabilities. NOAO needs a variety of such telescopes to (1) support the Gemini scientific programs and instrument development, (2) provide other unique national capabilities, and (3) support the scientific programs of the best researchers and students throughout the nation.'

"The separate components of this proposal are in different states of readiness for implementation. SOLIS is ready to go, and should have its schedule set by the coming solar maximum in 2001, which requires prompt action. SOAR is technically well-defined and awaits the outcome of unfinished negotiations for financing and division of user time. The 2.4 meter telescope proposals are, however, in an earlier state of development and are still rapidly evolving toward a clear scientific and technical concept."

In their remarks to us, NSF staff indicated that approval had not been sought for any of these projects from the National Science Board because a clear path for funding had not been identified. They did indicate that continued effort would be made to find funds for SOLIS. It now appears likely that SOAR can go ahead with funds already identified (see articles elsewhere in this Newsletter), albeit with a correspondingly smaller share of observing time for the NOAO user community than was anticipated in the proposal. We are continuing to work to develop community consensus concerning the science requirements for the 2.4-m telescopes. One key role for these telescopes, as described in the proposal, is wide-field imaging, in both the optical and infrared, in support of Gemini observations. The US Gemini Program will sponsor a workshop, probably in the spring of 1997, to identify Gemini support requirements independent of the NOAO proposal for 2.4-m telescopes. This workshop will probably be followed by an international meeting of the Gemini partners to assess requirements for Gemini support. Any re-submission of a proposal for additional nighttime telescopes at NOAO would be made only after this community assessment is completed.

The review panel was composed of very distinguished scientists, many with considerable experience in the management of complex facilities. Their advice to all of us engaged in the enterprise of operating national observatories---NOAO, AURA, and the NSF---provides a road map for strengthening the programs that we offer to the user community.

Goetz K. Oertel, Sidney C. Wolff

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NOAO Educational Outreach

Announcing: Project ASTRO-Tucson

Greetings from Project ASTRO's latest expansion site in Tucson, Arizona! Project ASTRO, developed by the Astronomical Society of the Pacific, is an innovative classroom outreach program that forms ongoing partnerships between educators and astronomers. NOAO is the lead institution for the expansion of Project ASTRO into the Tucson area, adding a half-time Project Coordinator to our Educational Outreach office. The Project ASTRO-Tucson local organizing committee is in the midst of selecting and matching ASTRO partners and preparing for the initial training workshop scheduled for 22 and 23 November.

The local organizing committee includes representatives from the University of Arizona's Steward Observatory, Flandrau Science Center, and Lunar and Planetary Lab; the Tucson Amateur Astronomy Association (TAAA); the Sahuaro Girl Scout Council; the Tucson Unified School District; and NOAO. We plan to integrate resources from all these organizations into Project ASTRO-Tucson, from star parties to telescope refurbishing services to classroom outreach programs that prepare students for star parties and observatory tours. We'd further like to link partners electronically, to facilitate communication and support the integration of educational technology in local classrooms. Our activities are described on-line through the K-12 Educational Outreach Activities link off the NOAO Home Page, http://www.noao.edu or accessed directly at URL http://www.noao.edu/education/astrotucson.html.

Correction: Case Western Reserve University Burrell Schmidt

In my September 1996, NOAO Newsletter article about an in-class activity based on the motion of Comet Hyakutake, I incorrectly identified the CWRU Burrell Schmidt telescope on Kitt Peak. The correct acknowledgment should indicate the images were taken with the "Case Western Reserve University Burrell Schmidt Telescope located on Kitt Peak."

Suzanne Jacoby, NOAO Education Officer
& Project ASTRO-Tucson Program Director

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NOAO Preprint Series

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

720 Chaboyer, B., Demarque, P., Kernan, P.J., Drauss, L.M., *Sarajedini, A. "An Accurate Relative Age Estimator for Globular Clusters"

721 *Lauer, T.R., Tremaine, S., Ajhar, E.A., Bender, R., Dressler, A., Faber, S.M., Gebhardt, K., Grillmair, C.J., Kormendy, J., Richstone, D. "Hubble Space Telescope Observations of the Double Nucleus of NGC 4486B"

722 *Vaughnn, D. "Identification and Analyses of Phosphorescent Materials for Use in Optical Systems and Instrumentation"

723 *Vaughnn, D. "The Electrostatic Application of Black Flocking for Reducing Grazing Incidence Reflections"

724 Fowler, A.M., Gatley, I., McIntyre, P., Vrba, F.J., Hoffman, A. "ALADDIN, the 1024 1024 InSb Array: Design, Description , and Results"

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

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

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Other NOAO Papers

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

*Abt, H.A., "HD 105262, A Newly-Discovered HR 4049 Star with a Large Proper Motion"

*Abt, H.A., "How Long Are Astronomical Papers Remembered?"

*Altrock, R.C. "An `Extended Solar Cycle' as Observed in Fe XIV"

Bechtold, J., Yee, H.K.C., Elston, R., Ellingson, E. "H" Imaging of the Candidate ProtoGalaxy MS1512cB58"

*Beckers, J.M. "Comments on the Next Generation of Ground-Based Solar Telescopes"

*Brault, J.W. "New Approach to High-Precision Fourier Transform Spectrometer Design"

*Braun, D.C., Fan, Y., Lindsey, C.A., Jefferies, S.M. "Diagnostics of Subsurface Radial Outflow from a Sunspot"

Briley, M.M., Smith V.V., Suntzeff, N.B., Lambert, D.L., Bell, R.A., Hesser, J.E. "Sodium Abundance Variations on the Main Sequence of the Globular Cluster 47 Tucanae"

Clocchiatti, A., Wheeler, J.C. "On the Light Curves of Stripped Envelope SNe"

Clocchiatti, A., Wheeler, J.C., Phillips, M.M., Suntzeff, N.B., Cristiani, S., Phillips, A., Harkness, R.P., Dopita, M.A., Beuermann, K., Rosa, M., Grosbol, P., Lindblad, P.O. "SN 1983V in NGC 1365 and the Nature of Stripped Envelope-Core Collapse Supernovae"

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Ibata, R., Wyse, R., Gilmore, G., Irwin, M., Suntzeff, N.B. "The Kinematics, Orbit, and Survival of the Sagittarius Dwarf Spheroidal Galaxy"

Kaspi, S., *Smith, P.S., Maoz, D., Hetzer, H., Jannuzi, B.T., "Measurement of the Broad Line Region Size in Two Bright Quasars"

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*Lindsey, C.A., Braun, D.C., Jefferies, S.M., Woodard, M.J., Fan, Y., Gu, Y., Redfield, S. "Doppler Acoustic Diagnostics of Subsurface Solar Magnetic Structure"

*Livingston, W.C., Wallace, L., Gray, D., Huang, Y., Meunier, N., Solanki, S.K., White, O.R., Wang, Y., "Long-Term Trends in Solar Indices"

*Penn, M.J., Allen, C.L. "He I 1083 nm Oscillations and Downflows Near the North Solar Pole"

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Seldin, J.H., Paxman, R.G., *Keller, C.U. "Time Series Restoration from Ground-Based Solar Observations"

Stenflo, J.O., *Keller, C.U. "The Second Solar Spectrum: a New Window for Diagnostics of the Sun"

*Zirker, J.B., Martin, S.F., Harvey, K.L., Gaizauskas, V. "Global Magnetic Patterns of Chirality"

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

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Community Input Sought for SOAR Science and Operations

The SOAR consortium has set up two working groups on Science and Operations for which NOAO, as a partner, is seeking user input. The Science Working Group has the following charge:

1) Develop the scientific requirements for SOAR in a quantitative fashion, particularly in the delivered image quality.

2) Undertake engineering studies with the goal of completion by January, 1997, including the initial project plan, model and costs.

3) Within these engineering studies, explore in particular the scientific and engineering benefits and associated savings or additional costs of a thinner (10cm) primary mirror and of an off-axis design.

4) On the basis of the engineering studies and external impartial review, formulate a recommendation for the technical approach to the telescope to present to the partnership.

The members of this committee are Gerald Cecil (UNC, Chair), Jack Baldwin (CTIO/NOAO), Jeff Kuhn (MSU), and Joao Steiner (Brazil).

We plan to discuss the status of the SOAR project and NOAO user requirements at the NOAO Users' committee on 13-14 December. The members of the NOAO Users' Committee are:

*Suzanne Hawley (MSU) Chair, slh@pillan.pa.msu.edu

Bob Mathieu, (Wisconsin), Chair, KPNO subcommittee, mathieu@madraf.astro.wisc.edu

*Michael Strauss (Princeton), strauss@astro.princeton.edu

*Charles Bailyn (Yale), bailyn@astro.yale.edu

*Stephen Schechtman (Carnegie), shec@ociw.edu

*Kristen Sellgren (OSU), sellgren@cannon.mps.ohio-state.edu

*Patricio Ortiz (U. de Chile), ortiz@das.uchile.cl

Martha Haynes (Cornell), haynes@astrosun.TN.CORNELL.EDU

Verne Smith (Texas), verne@astro.as.utexas.edu

John Bally (Colorado), bally@janos.colorado.edu

Mark Dickinson (STScI), med@stsci.edu

David Koo (UCSC), koo@lick.UCSC.EDU

*Member of CTIO subcommittee

Please contact Suzanne Hawley and me immediately if you wish to participate in formulating the NOAO user science requirements for the SOAR telescope. Fairly irrevocable decisions will be taken early in the new year. NOAO's opening position is to attempt to make the telescope and instrument package for SOAR complementary with the telescope and instrumentation capabilities of Gemini and the Blanco 4-m. The goal is to, whenever appropriate, share instrumentation, access and infrastructure between these three powerful telescopes to increase the power of each and to avoid expensive duplication of instrumentation. To achieve these aims, we put considerable weight on SOAR for excellent image quality in the optical and near IR, goals which are shared by the partnership. We expect to specialize the Blanco 4-m towards wider-field applications and to exchange telescope time between the SOAR and Blanco telescopes on a science-demand basis, where 1 night on SOAR = 1 night on the Blanco. This will allow our user community to have access to even more time on SOAR, provided users from the other SOAR partners apply to make corresponding use of the capabilities of the Blanco 4-m and its instrumentation (e.g. a large mosaic CCD camera and a multifiber spectrograph).

The Operations Working Group consists of Sergio Oliveira Kepler (Brazil), Malcolm Smith (CTIO), Sue Simkin (MSU) and Chuck Evans (UNC). Its charge is to:

1) Explore and recommend the level of operational costs and support for (a) commissioning; and (b) operational phases of the project.

2) Define the anticipated operating period and costs and methods by which we may compensate for inflation as it affects all partners.

3) Explore the cost/benefit trades of queue scheduling, the optimum number of simultaneously active instruments during a night and during a year, the mix of support for facility class and non-facility class instruments, the data bandwidth that will be adequate for remote observing, and the compatibility of SOAR instruments and equipment with Gemini/CTIO protocols.

4) Study the costs and benefits of building SOAR atop Cerro Pachon vs. Cerro Tololo and make a recommendation.

NOAO users who wish to be involved in addressing these operational concerns should, again, contact Suzanne Hawley and myself immediately. A decision on siting the telescope has to be made by the next meeting of the SOAR consortium, early in the new year.

Malcolm Smith

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The 8K Mosaic: CTIO Perspective on a Joint Venture

The 8K X 8K CCD Mosaic has been developed jointly by NOAO staff in La Serena and Tucson. It will be shared between Kitt Peak and Cerro Tololo, and is scheduled to come to Tololo in late 1998. Work will start soon on a Mosaic Clone so that each observatory will have its own large format imager, primarily for use on the 4-m Mayall and Blanco telescopes.

This project has involved large scale cooperation between two geographically separated divisions of NOAO. It has provided valuable experience in an age when instrumentation projects are growing to such a size that intercontinental collaborations are increasingly likely. For the last 18 months, this project has had the dubious privilege of being the most resource intensive instrumentation effort at CTIO. Eighteen of CTIO's technical and scientific staff have worked on the project at some time, with Roger Smith managing. An additional EE was contracted to work full time on production and testing.

The project was divided between the North and South American teams at the interface between the dewar and CCD controllers. The Instrumentation Projects Group (IPG) in Tucson procured detectors and produced the cryostat, detector mount, filter, and shutter mechanisms, while CTIO produced the CCD controllers and associated software. The IPG simultaneously carried the additional burden of building an atmospheric dispersion corrector for the Mayall 4-m telescope. The Blanco Telescope's ADC pre-dates this project; however, the prime focus pedestal will require strengthening to support the weight of the Mosaic Imager. The IRAF team is working on real time display software, an extended image format, and quick look reduction tools to replace the interim tools written by Steve Heathcote.

The Mosaic schedule required that most subsystems be developed in parallel. Our particular problem was that the Mosaic dewar and controller were being assembled in separate hemispheres and could not be tested together until shortly before the first telescope run. Instead of producing one big controller, we chose to segment the focal plane into 4 quadrants and operate each with a nearly standard quad-readout Arcon. This allowed us to test each controller with a standard lab dewar containing a pair of 2K X 4K CCDs similar to those used in the final Mosaic, and it avoided re-engineering the enclosure, backplane and supplies. The spares, a complete Arcon, do double duty as a lab system.

The decision to use multiple standard Arcons allowed us to run four systems in separate labs simultaneously and thus to harness the additional manpower required to meet the deadline. We concurrently needed to develop upgrades to the software, and to the Video, ADC and Voltage-Temperature-Telemetry cards, while also testing 50 boards, modules, or enclosures.

The transputer network, communication packet format, and command handlers already in use lent themselves to the expansion needed to handle the mosaic. The transputers nearest the Sun workstation were connected in a ring to support broadcast of commands from a single link. However, for data transfer the controllers operated independently (over separate links to the Sun) to maximize throughput and postpone the data bottleneck as much as possible.

Electronic mail, networking and teleconferencing were essential to our collaboration; but these were no substitute for staff travel and direct interaction for understanding personalities and developing a real team spirit. At least five nationalities were represented on the team. After the preliminary telescope tests on the 0.9-m telescope in May it became clear that the system integration time had been too little and too soon. We successfully reorganized, cancelling some intermediate telescope tests in favor of more lab work, and were back on schedule for the 4-m run in September. Aside from successfully commissioning the controllers, we have gained more experience in planning and managing time-critical production and development projects. Above all we now go forward with a sense of camaraderie and mutual respect for our colleagues down North.

Roger Smith, Dan Smith, Alistair Walker

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New Operating Arrangements for Yale 1-m on Tololo

In the June 1996 Newsletter, we announced that AURA had been " *encouraged to find other means to keep in operation those productive telescopes NSF can no longer afford to support*." In an accompanying article, Charles Bailyn (Yale) outlined provisional plans to set up a consortium to "privatize" the operation of the 1m Yale telescope for unique kinds of synoptic observing on Cerro Tololo.

An international consortium, consisting of Yale (30% contribution), the University of Lisbon (Portugal; 30%), Ohio State University (30%), and NOAO (10%) has been formed and is working on a memorandum of understanding. Under existing agreements Chile will receive 10% of the telescope time as the host country. So it is expected that NOAO users will retain access to about 9% of the total telescope time, once the telescope is brought back into operation sometime in early 1998.

The 1m will be withdrawn from service on 1 February 1997. Plans are in progress for refurbishment of the telescope, which is expected to begin in March 1997. Yale will contribute most to this activity, which is likely to include the installation of a new telescope control system, as well as improvements to the focusing system and tube ventilation. Portugal will provide most of the funds for operations over a three-year period. Ohio State is constructing a new IR/optical imager for the telescope. By means of a dichroic, the instrument will image the same area of the sky simultaneously onto an optical CCD and an IR array. The consortium intends to provide synoptic observing capabilities in which the community can participate.

Further details of the new consortium's plans will be worked out at a meeting to be held in New Haven in late October.

Malcolm Smith

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NOAO Newsletter - Cerro Tololo Inter-American Observatory - December 1996 - Number 48

Observing Request Statistics: February - July 1997

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4-m Telescope: 145 nights

    Requests        Nights Requested
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Dark	Bright	Dark	Bright	Instrument	Nights	%
8	5	29	16	Argus	45	10.4
0	4	0	16	COB	16	3.7
3	1	9	1	CF/CCD	10	2.3
29	7	89	24	CS/CCD	113	26.1
1	15	4	57	Ech/CCD	61	14.1
0	2	0	5	CIRIM	5	1.2
0	15	0	46	IR/IRS	46	10.6
7	1	19	3	PF/CCD	22	5.1
15	2	62	4	BTC	66	15.2
3	2	12	5	RF-P	17	3.9
0	11	0	32	Visitor	32	7.4
--	--	---	---		---	----
66	65	224	209		433	100.0

	Now	Last Semester	Semester Before Last
No. of requests	131	133	102
No. of nights requested	433	471	354
Oversubscription	2.99	4.13	2.95
Average request	3.31	3.54	3.47

1.5-m Telescope: 158 nights

Requests		Nights Requested				
Dark	Bright	Dark	Bright	Instrument	Nights	%
5	1	39	7	ASCAP	46	20.9
13	0	59	0	CF/CCD	59	26.8
5	0	20	0	CS/CCD	20	9.1
0	2	0	9	Ech/CCD	9	4.1
0	14	0	62	CIRIM	62	28.2
1	2	5	7	RF-P	12	5.5
1	1	7	5	Visitor	12	5.5
--	--	---	--		---	-----
25	20	130	90		220	100.0

	Now	Last Semester	Semester Before Last
No. of requests	45	55	57
No. of nights requested	220	270	265
Oversubscription	1.39	1.66	1.65
Average request	4.89	4.91	4.65

0.9-m Telescope: 171 nights

Requests		Nights Requested				
Dark	Bright	Dark	Bright	Instrument	Nights	%
20	11	123	136	CF/CCD	259	100.0

	Now	Last Semester	Semester Before Last
No. of requests	31	27	26
No. of nights requested	259	221	203
Oversubscription	1.51	1.31	1.17
Average request	8.35	8.19	7.81

Schmidt Telescope: 139 nights

CF/CCD	2	requests for	7	nights	4.9
NF/CCD	14	requests for	135	nights	95.1
	--		---		----
	16	requests for	142	nights	100.0

	Now	Last Semester	Semester Before Last
No. of requests	16	17	9
No. of nights requested	142	156	125
Oversubscription	1.02	1.11	1.07
Average request	8.88	9.18	13.89

ESO 3.6 m Telescope: 12 nights

TIMMI	1 request for	6 nights	54.5
EFOSC1	1 request for	5 nights	45.5
	-	--	-----
	2 requests for	11 nights	100.0

	Now	Last Semester
No. of requests	2	4
No. of nights requested	11	9
Oversubscription	0.92	0.75
Average request	5.50	2.25

Mark Phillips, Ximena Herreros

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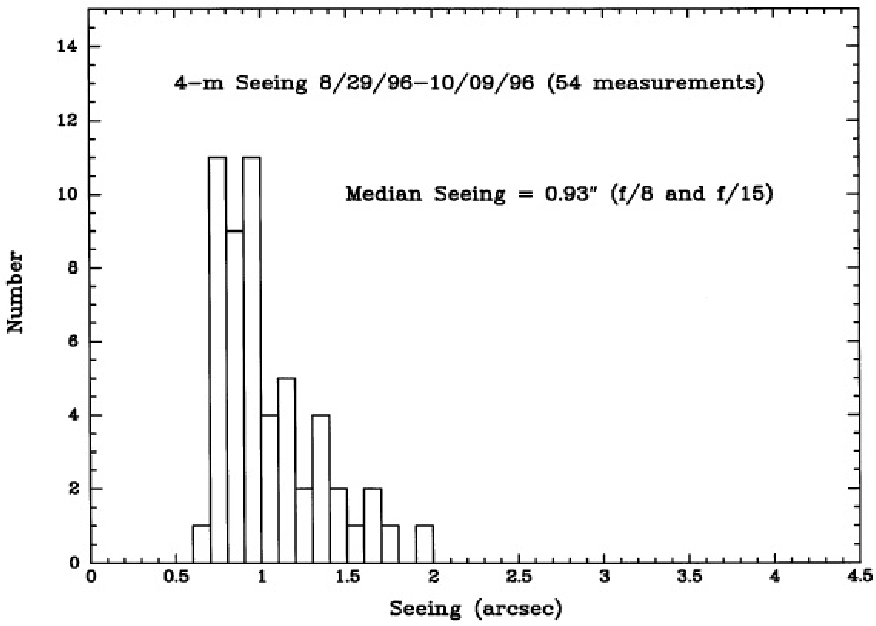
NOAO Newsletter - Kitt Peak National Observatory - December 1996 - Number 48

4-m Achieves Subarcsecond Median Seeing!

The superb performance of WIYN has demonstrated that the site seeing at Kitt Peak is usually subarcsecond. The WIYN median seeing is 0.8", with best images of 0.3-0.4". This provided a major incentive to do what we can to improve the delivered image quality at the Mayall 4-m.

Our most significant changes to date have been implementing a cooling system for the primary mirror, adjusting the edge supports for the primary mirror, and a "holistic" recollimation of the telescope after the primary was realuminized.



Caption: Histogram of the measured seeing at the 4-m telescope (both f/8 and f/15) over the period 29 August-9 October 1996. The median value of the 54 measurements is 0.93".

The edge supports keep the primary mirror centered as the telescope moves around the sky; work last summer revealed that these were badly out of adjustment, but access required the removal of the mirror cell. While the primary was being realuminized, the system was completely refurbished. Upon reinstallation of the primary, the system was adjusted and pronounced to be in excellent shape.

Chuck Claver led the recollimation effort, with the aid of Khairy Abdel-Gawad, Tony Abraham, Larry Reddell, and Bill Schoening. Chuck decided to approach this *ab initio*, beginning by defining a reference axis coincident with the guider bearing, taken as being on the primary mirror's mechanical axis. Next, each secondary was translated to this axis and tilted so that their optical axes coincided with the reference axis. At least this was the plan---in execution, it turned out that the f/15 had neither the translation nor tilt required to bring it entirely on-axis; the engineering staff is looking into ways to correct the problem. The new prime focus pedestal built for the larger corrector needed for Mosaic was also brought onto this same axis. Finally, wave-front curvature measurements were used to remove residual on-axis coma by tilting the primary mirror slightly. When this was all done, the first seeing measurements obtained at f/8 were 0.8", compared to WIYN's 0.7" taken the same night. Over the course of the next few nights, the 4-m's images matched or beat WIYN's! Fortunately, the thermal environment just happened to be pretty good at that time, with the primary mirror temperature a degree or two colder than outside the dome.

Six weeks have passed, and our median seeing is 0.93" for both f/8 and f/15, with little difference noted between them. During this same time span, WIYN achieved a median of 0.74". For comparison, the median seeing from 25 March (when we began our measurements) to shutdown on 11 July was 1.10". While not all bad seeing can be attributed to local conditions, it is clear that on every night when the primary mirror was 2°C warmer than ambient, the seeing was worse than 1.4".

What's planned for the future? As the nights grow colder, we expect the thermal environment to degrade, with plenty of nights with the primary warmer than the ambient and unmixed air in the dome contributing to image degradation. Our top priority is to get our mirror cooling system working more efficiently. We are also in the advanced stages of planning for ventilating the 4-m dome. Third on the list is implementing an air extraction system, similar to that in use at the CTIO 4-m, to mix the air near the primary during observing.

On a personal note: this article is being written on the day following a three-night 4-m run for a project I (Massey) have been trying to finish for the past three years at Kitt Peak, obtaining classification spectra of V = 18-19.5 OB stars in nearby galaxies. Last year the seeing was 3" for much of the time, and I left the mountain more discouraged than had it been snowing. This year, my seeing varied from 1.1" to 0.7", and was typically 0.8-0.9", and I walked away with beautiful spectra of all the stars I had intended---the improved seeing made the difference in this project being possible or not. So, while we can't guarantee that **your** seeing will be as fine, one has to be heartened by what we are currently achieving.

Phil Massey, Chuck Claver

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CCD Mosaic Imager Progress

Since the September *Newsletter* deadline, the CCD Mosaic Imager has had first light at the Mayall 4-m telescope. The run was a success: many aspects of the Mosaic were tested, and a number of areas for further work were identified and prioritized. We are happy to report that there was significant progress since the 0.9-m testing runs in early June. For example, the ARCON hardware and software has advanced markedly from that time. In addition, the Mosaic's large pneumatic shutter is operating well now. Dome-flat tests indicate that it has better than 1% accuracy in a 1-second exposure.

The new 4-m corrector also underwent its first tests. Although the new corrector includes optics for atmospheric dispersion compensation, we did not have time to test their performance. We hope to verify the operation of the ADCs during the next engineering run. Overall, the corrector performed quite well, producing subarcsecond images (when atmospheric conditions allowed) over the entire Mosaic field (diagonal of 50'). The wide field also provides the optical feed for a pair of guide TV cameras; these were tested successfully as well. Since we did not have ample time to evaluate the properties of the new corrector (e.g., UV and blue performance), we will continue to use the old doublet corrector for PFCCD imaging runs until we have demonstrated that the new corrector is a suitable replacement.

We have measured preliminary count rates for the Mosaic at the 4-m, which will likely be of use to proposers considering the use of Mosaic. The count rates in e-/second of a 20th magnitude star measured through a 4" diameter aperture, are:

B	V	R	I
63	156	217	187

Further Mosaic testing is planned at the 4-m in November and January, and at the 0.9-m in October and January.

We have now received the dedicated Mosaic computer, a Sun UltraSparc2 with 40 GB of disk storage, 512 MB of RAM, and two 20inch monitors. Integration with the Mosaic has begun.

In our last *Newsletter* article (No. 47, page 27), we described how interested users could request access to Mosaic in the spring semester, provided that it becomes ready for users in that time frame. The first method, allowing users to request T2KB at the 4-m or T2KA at the 0.9-m with a contingent "upgrade" to Mosaic, was selected by seven proposals (four for 4-m time and three for 0.9-m time). The second method, Mosaic expressions of interest, resulted in 11 requests (eight of which asked for 4-m time and four of which asked for 0.9-m time, with one proposal asking for both telescopes). We are reviewing these requests and comparing the project's progress with the scientific needs of the requests. We will contact proposers for further information as required. It is our sincere hope that we will be able to provide one or more Mosaic blocks for a subset of these proposals.

The Loral CCDs, which we are using initially in the CCD Mosaic Imager, have a number of serious shortcomings. They are thick, and so they peak at only about 40% QE and have little sensitivity in the blue. They have numerous bad columns, both dark and bright, and regions of overall poor charge transfer efficiency. Because of a processing error in the CCD fabrication, they cannot be run at temperatures colder than -60°C, causing a significant dark count.

It is our plan to replace these CCDs with chips of better quality. We have placed a large order with Scientific Imaging Technologies, Inc. (SITe) for 2K X 4K CCDs (same format and pixel size as the existing CCDs). Eight of these CCDs will be used in the CCD Mosaic Imager. These SITe chips will be thinned for high QE, even in the U band. They should have lower noise and better cosmetic quality than the Loral CCDs. They will be flat so as not to degrade the image quality by departing from the flat focal plane. We expect delivery of these CCDs by late in 1997, and the existing chips will then be replaced as soon as feasible.

For updates on the progress of the Mosaic project, check out the Mosaic Web page at http://www.noao.edu/kpno/mosaic/mosaic.html.

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

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Fall 1996 Progress Report for the WIYN Queue Observing Experiment

Good progress has been made on a number of fall 1996 WIYN Queue observing projects after a predictably slow start because of a robust summer monsoon. Only 16% of the available dark time could be used during the six August nights allocated to the WIYN Queue. In contrast, only 30% of the allocated October time has been lost to a combination of weather, technical problems, and the use of one Queue night for Director's Discretionary time. As a result, and keeping in mind that some programs have no targets available until later in the semester, data have been obtained for six of eleven "high priority" programs. In addition, six of sixteen 2hr Queue programs (three high priority; three "best effort") have been serviced. Five of these programs are considered to be complete. Unfortunately, sustained seeing of 0.8" or less has been rare during NOAO nights so far this fall and not as much progress has been made on projects demanding excellent seeing as we would have hoped.

At this writing there are 30 nights remaining in the fall 1996 allocation, giving a total of about 340 possible observing hours (232 dark; 108 bright). Roughly 350 hours of observing still need to be executed, so the substantial (100 hr.) weather buffer incorporated into the schedule has already disappeared before the midpoint of the semester!

As advertised in past Newsletter articles, investigators and other interested parties may follow the progress of the WIYN Queue observing at our Web site (http://www.noao.edu/wiyn/obsprog). The Web site is generally updated within a day after a Queue observing run. Please feel free to contact us if you find any inaccuracies in the Web pages or need to resolve any issue raised by the material posted.

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

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Electronic Proposals in Full Swing at KPNO

Thanks to the hard work and help of our users, Kitt Peak received more than 98% of proposals for the spring 1997 observing semester in electronic form. Only four proposals were not submitted via electronic mail (you know who you are!). A few more investigators tried to submit paper versions, but kindly provided us with their LaTeX versions with only a small amount of arm-twisting. We are grateful for everyone's cooperation because this is the first semester that we are trying automatic entry of proposal information into our new database program.

Once the proposals are received at KPNO, the LaTeX files are parsed into proper pieces of information for importation into the database. The telescopes and instruments you request are recognized by the parsing program and stored as well. When the data are imported, the database program checks for acceptability (is that instrument available on the requested telescope?) and the Kitt Peak Support Office staff compare each data entry to a printed copy of the proposal to assure that the data are correct. Since we are trying this for the first time, we are still finding glitches, but the process is rapidly becoming smoother. Based on what we are learning this cycle, we will make additional small changes to the LaTeX template for the next proposal cycle. Be sure to use the most current version of the proposal template each semester.

Now is a good time to help us improve the process, as well. If you have suggestions for ways to simplify the job of preparing and submitting proposals to KPNO, please contact any of us. We are looking at the feasibility of a Web-based submission process as an alternative to email in the near future.

Caty Pilachowski, Pat Patterson, Jeannette Barnes,
Dave Bell, Christa Brown, Judy Prosser

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NOAO Newsletter - Kitt Peak National Observatory - December 1996 - Number 48

First Light for the Ohio State/NOAO Imaging Spectrograph!

The announcement in the previous Newsletter of the availability on Kitt Peak telescopes of a near-infrared imaging spectrograph developed by Ohio State University has generated a significant response from the community. A total of 13 proposals requesting 81 nights was received for the shared-risk observing time that will be scheduled for the spring 1997 semester.

The initial engineering run of this instrument took place 18-20 September on the 2.1-m telescope. Thanks to the efforts of numerous people from both Ohio State and NOAO, the complex logistics of interfacing the instrument mechanically and electronically were worked out well in advance of the run so that the actual installation and setup went quite smoothly. A summary of the results of the engineering run can be found at the Web site http://www-astronomy.mps.ohio-state.edu/~isl/tifkam.html . The instrument is presently (late October) being used for an engineering run at MDM, and will have another such run at the KPNO 2.1-m in late November. The Web site noted above will be updated as more information on the instrument performance is obtained.

As we noted in the last Newsletter article, the original name of this instrument (MOSAIC) is the same as that of the NOAO large-format CCD imager. The alternative designation suggested in the article (OSU-IRIS) is unfortunately close to that of the existing Ohio State instrument OSIRIS. The Web page therefore utilizes the unambiguous name TIFKAM; the four-letter acronym which will appear on the KPNO schedule is yet to be determined.

Dick Joyce

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REU Data Wranglers Spend a Productive Summer at KPNO

Six self-named "Data Wranglers" spent the 1996 summer working at KPNO as part of the NSF funded Research Experiences for Undergraduates program. The program involves students in active research programs being carried out by staff members of the observatory as well as a lecture series and observing runs using telescopes on Kitt Peak. The 1996 students and brief descriptions of their projects are listed below. Applications for the 1997 program will be due 14 February 1997 with invitations for participation being made on 1 March 1997. Please contact Buell Jannuzi (bjannuzi@noao.edu) for more information.

1996 KPNO REU Summer Research Assistants

Ross Beyer (University of Illinois), worked with Michael Belton, Elizabeth Alvarez, and members of the Galileo Solid State Imaging Team to help the public dissemination of the early results from the Galileo Space craft mission to Jupiter. Ross also worked on several research projects, including a study of the terrain units of Uruk Sulcus, Ganymede.

Vanessa I. Harvey (University of Nevada, Las Vegas), worked with Nigel Sharp to produce multi-band images of the Fornax Cluster and M31 by scanning high quality photographic plates of these objects and then processing the resulting images.

Sean P. McGinnis (Case Western Reserve University), worked with Ata Sarajedini to estimate the metallicity of NGC 147, a dwarf elliptical satellite of M 31.

Cailin Nelson (Dartmouth College), worked with Todd Boroson to develop a simulator for the queue scheduling on a nightly basis of the Gemini 8m telescopes.

Sunny Snaith (Agnes Scott College), worked with Jeanette Barnes and members of the IRAF group to develop IRAF tutorials.

Megan J. Vogelaar (Vassar College), worked with Nigel Sharp and Dave DeYoung on a study of the Herbig-Haro Objects 106/107.

Buell Jannuzi

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Status of Laboratory Measuring Equipment to be Reviewed

The Observatory has several large laboratory instruments, most of which are designed for measuring photographic plate material. They are now seldom used, yet require various types of support to keep in working order. Below is a list of these laboratory plate measuring instruments that require electronic/software maintenance and manpower for user orientation when requested for use. In view of diminishing resources for the continuing support of this equipment, their status will be reviewed internally and recommendations will be made to the Director for the level of continuing availability. Possible alternatives to fully supported access are block scheduling, a minimal support and maintenance mode, or retirement. If the possible unavailability of any of this equipment will affect your research or that of the community, please make your views known to Richard Green (rgreen@noao.edu) by 15 January 1997. Your input will be key in the subsequent decision process.

```
                    Measuring Engine List

          Dual-Axis Grant Measuring Engine
          PDS Microphotometer/"Monet" CCD digitizing attachment
          Single-Axis Grant Measuring Engine (optimized for spectrograms)
          Blink Comparators (Gaertner and KPNO instruments)
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Cuffey Iris Photometer
Cary 14 Spectrophotometer (circa 1960)
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Jim DeVeny, Richard Green

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Kitt Peak Telescope Requests

After each deadline for telescope requests passes, we examine the results for changing patterns in the proposals received. Requests for the spring semester of 1997 were higher than those for the fall 1996 semester for nearly every telescope, except for 4-m bright time, and the change at the 2.1-m was particularly dramatic. At this telescope, we are offering the Phoenix high resolution IR spectrometer for the first time, and we received requests for 100 nights---thereby more than doubling the oversubscription of bright time at this telescope! This example is an illustration of how demand increases when new instrumental capabilities become available.

A complete analysis of the proposals will be given in the next *Newsletter* after the TAC meets, but the following table estimates the oversubscription rates in terms of number of nights requested for fall 1996 and spring 1997. Note especially the high oversubscription rate for the Schmidt. This rate is directly traceable to the small number of dark nights (only 39) available on this shared telescope. When the CCD 8K X 8K mosaic imager is re-deployed with good CCDs, which are now on order, both the 0.9-m and the 4-m can be used for wide-field optical imaging and will help to address the shortfall in this capability.

Oversubscription Rates At Kitt Peak

Telescope	Nights Requested/Nights Available: Fall 1996	Night Requested/Nights Available: Spring 1997
4-m Bright	1.75	1.30
4-m Dark	2.10	2.57
WIYN Bright	0.80	0.75
WIYN Dark	1.80	2.90
2.1-m Bright	1.21	2.69
2.1-m Dark	0.95	1.15
Coude Feed	0.88	0.91
0.9-m Bright	0.76	1.03
0.9-m Dark	1.30	1.50
Schmidt	1.90	2.90

Sidney C.Wolff

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From the NSO Director's Office

As of 1 October, I resumed my function as NSO Director, with Doug Rabin returning to full-time research. Doug did an outstanding job in his position as Acting NSO Director this year, allowing me to focus all my efforts on the definition study of a large solar telescope. All of us at NSO thank Doug for undertaking this challenging task this year and for carrying it out very well. Doug expects to complete the Near Infrared Magnetograph NIM-2 for the McMath-Pierce Facility this year, making it available as a user facility in 1997, as described later in this Newsletter.

The feasibility study of the large solar telescope (CLEAR) has made substantial progress in this year. Much of the engineering of the telescope has been completed. However, because of competition for the best of NOAO's engineering talent from the Gemini and WIYN projects, the manpower was insufficient to complete the telescope and building design. This design is proceeding, and I expect it to be well enough along in six months to allow a good cost evaluation, followed by the completion of the Phase B study. Simultaneously a 1/6 scale mock-up of CLEAR will be build to test, and hopefully validate, the ideas for seeing and dust control that are critical for the satisfactory functioning of CLEAR. This mock-up will be mounted on the side of the Sac Peak spar. Other mini-studies on the management of super-polished surfaces and on other CLEAR related topics are under way. As of October 1 the full seeing site survey for CLEAR is under way with Seykora seeing monitors running daily at the Mauna Loa, Big Bear, Sac Peak and La Palma solar observatories. Pending final arrangements, it is anticipated that monitors will also be installed on Mauna Kea and Haleakala.

The SOLIS proposal received a very good evaluation by the NSF Site Visit Committee last July. That committee was also charged with reviewing the NOAO renewal proposal to NSF that included, besides SOLIS, two nighttime facilities. As a result, we hope that NSF funding will be made available for its construction in time for its completion by the maximum of solar activity expected in the year 2000. Together with GONG, the RISE/PSPT, and the observing facilities on the SoHO satellite, it will provide the most comprehensive data base ever of the physical properties of the Sun, extending for the first time from the deep solar interior to the distant regions of the outer solar corona and the inner solar wind. Its availability over a solar cycle will doubtless lead to much improved models of the solar activity cycle, including better knowledge of astrophysical dynamo mechanisms and magneto-convection.

Notwithstanding limited available manpower resources, good progress is being made on NIM-2, on the image quality improvement program at the Sac Peak Vacuum Tower Telescope and on the KPVT Telescope Control System. Individual images taken in the 430 nm G-Band at the VTT now approach the diffraction limit of that telescope. Removal of the residual telescope aberrations is expected to improve the isoplanatic patch size, the duration and the frequency of occurrence of the good images.

The AURA Observatory Visiting Committee will be at NSO from 8 to 11 December, visiting first Sac Peak for two days and then the Tucson/Kitt Peak division of NSO. Much of our activities in the coming month will focus on the preparation for this visit. The National Academy, through its Space Studies Board, will start its review of ground-based solar astronomy probably early next year. It is expected to have a major effect on the future of NSO as well as on that of other ground-based solar facilities in the USA that are equally threatened by funding reductions and related deterioration.

Inside NSO, activities have started on preparations for the 1997 NSO/SP workshop. The preliminary topic for this workshop was selected to be "The Sun at all Time Scales." Jack Harvey and K. Balasubramaniam are the organizers of this workshop, with the help of Doug Rabin. Stay tuned for more specifics on the date and with a better definition of the topic of the workshop. The workshop will be held in the conference room of the then newly completed Visitor Center at Sac Peak.

Jacques Beckers

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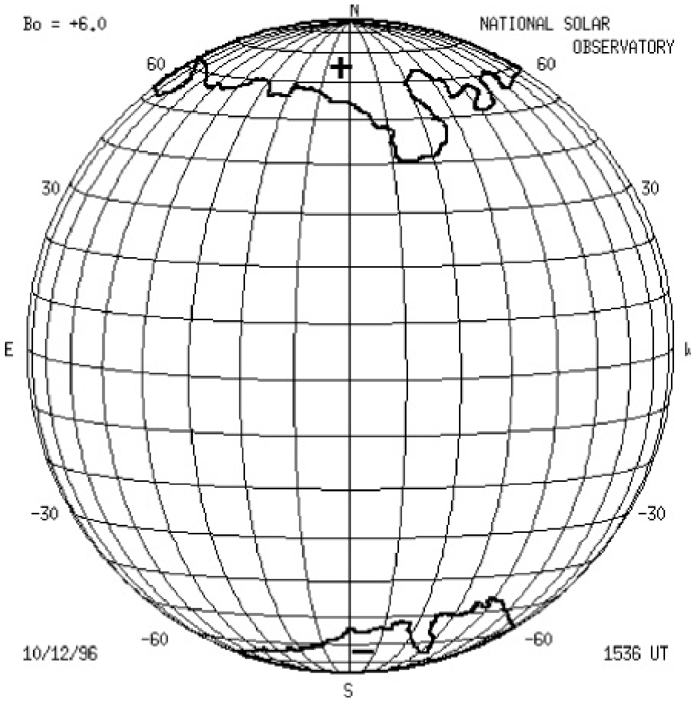
New NSO Coronal Hole Maps

Karen Harvey (Solar Physics Research Corporation) and Frank Recely (NOAA/SEC) are developing an IDL program to determine the boundaries of coronal holes, using the NSO/KP full-disk He I 1083 nm spectroheliograms and magnetograms. This program will provide a more precise map of the coronal hole boundaries and will be available on the internet more quickly than the method currently in use. It also will provide information on the magnetic fields, size, and location of coronal holes

The products of this program will be 1) a "gif" image of the map of coronal hole boundaries drawn on a Stonyhurst disk; the image size matches the low-resolution NSO He I 1083 nm images; 2) a "fits" image of the coronal map matching the size of the high-resolution full-disk He I 1083 nm spectroheliogram; 3) for each coronal hole, measures of the total magnetic flux, the net magnetic flux, the mean total and net flux density, area in cm^2 and as a fraction of the visible disk, the type of hole (polar, isolated, extension, transient), the heliographic location, and the identification certainty, will be contained in the fits header; and 4) a file listing the coronal hole boundaries in heliographic latitude and longitude at an increment of 3 to 5 degrees. These images and data will be available to the solar community on the NSO anonymous ftp archive. An example of the coronal hole map for 12 October 1996 is shown in the accompanying figure; some of the parameters for the two polar coronal holes on this day are shown in the table below.



Within the next month, we plan to implement this program and produce daily coronal hole maps using current NSO/KP observations. Our plan is then to redo the coronal hole maps for the interval extending from late 1991 (the Yohkoh period) and eventually to complete the maps for the entire NSO/KP full-disk archive period.

Coronal Hole Information Table:

Basic Info For Coronal Hole Data Base

Date = 96/10/12, 15:36:53 UT
X-Center = 225.831 X-Radius = 208.741
Y-Center = 227.190 Y-Radius = 210.423
Carr Longitude = 39.830
Carr Rotation = 914.898289
Bzero = 6.014527
Semi-Diameter = 16.029527

Parameters: Coronal Hole 1

Polarity = negative
Type = Polar
Certainty = Certain
Location = S65 E00
N/S and E/W Extent = S56/S90 E90/W90
Area = 49240.603 X 10^{-6} hemisphere
Area = 14.987 10^{20} cm^2
TOTAL Magnetic Flux = 44.888 10^{20} Mx
NET Magnetic Flux = -37.077 10^{20} Mx
Mean He I 1083 EW = 28.583 m
Mean TOT Flux Den = 2.995 Mx/cm^2
Mean NET Flux Den = -2.474 Mx/cm^2

Parameters: Coronal Hole 2

Polarity = positive
Type = Polar
Certainty = Certain
Location = N65 E00
N/S and E/W Extent = N90/N40 E90/W90
Area = 90445.618 X 10^{-6} hemisphere
Area = 27.528 10^{20} cm^2
TOTAL Magnetic Flux = 111.929 10^{20} Mx
NET Magnetic Flux = 10.271 10^{20} Mx
Mean He I 1083 EW = 30.501 m
Mean TOT Flux Den = 4.066 Mx/cm^2
Mean NET Flux Den = 0.373 Mx/cm^2

Karen Harvey

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NSO/Tucson Visiting Scientist

Dr. Debi Prasad is a scientific visitor at NSO/Tucson from October 13th through January 13th. Dr. Prasad is on sabbatical from the Udaipur Solar Observatory and will be working with Harry Jones and Matt Penn on obtaining and interpreting solar observations of the He I 1083.0 nm line. His e-mail address while at NSO is dprasad@noao.edu.

Harrison Jones

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NIM-2

NSO is developing a next-generation Near Infrared Magnetograph, NIM-2. NIM-2 is an imaging Stokes polarimeter that employs the Zeeman-sensitive Fe I lines at 1564.9 and 1565.3 nm. Spectral selection is accomplished with a rapidly tunable Fabry-Perot etalon from Queensgate Instruments (70 mm diameter) in series with a tilt-tuned interference filter (1 nm FWHM). Voltage-tuned liquid crystal retarders from Meadowlark Optics are used for the polarization analysis. The initial detector is the 256 X 256 InSb array used in the spectrograph-based NIM-1 (which will continue to be available). The target detector is a 512 X 512 or larger InSb array from the Aladdin collaboration in which NOAO is a partner. The NIM electronics have been upgraded to provide frame rates up to 10 Hz. NIM-2 will take images in a 0.5 nm band around the iron lines with a spectral resolving power approaching 10^5 and a 2 X 2 arcmin field of view.

During two engineering runs in July and August, the NIM-2 components were assembled and tested. While a good bit of tuning will be needed to achieve optimum performance, the instrument has yielded the first magnetograms. Spectral resolution, currently about 0.02 nm, is expected to improve after fine adjustment of the optical system. An improved liquid crystal variable retarder (5 ms switching time) has recently been delivered. The new device should significantly improve polarization sensitivity over the first-generation instrument. We anticipate that NIM-2 will be commissioned and available to the scientific community in the first half of 1997.

Dave Jaksha, Christoph Keller, Doug Rabin

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17th NSO/SP Summer Workshop: SOLERS22

Continuing its tradition of bringing the international community together annually at Sacramento Peak to review and discuss the most recent results in various topics in solar physics, this year NSO hosted the "Solar Electromagnetic

Radiation Study for Solar Cycle 22" (SOLERS22) 1996 Workshop during the week of June 17. This workshop was a fine match for NSO's workshop series because it considered both basic physical processes on the Sun and their terrestrial consequences, and because NSO leads the Precision Solar Photometric Telescopes (PSPT) component of the NSF-sponsored Radiative Inputs from the Sun to Earth (RISE) program.

SOLERS22 has been organized under the auspices of the Solar-Terrestrial Energy Program (STEP) Working Group on "The Sun as a Source of Energy and Disturbances". STEP is sponsored by the Scientific Committee on Solar Terrestrial Physics (SCOSTEP) of the International Council of Scientific Unions (ICSU).

The main goals of SOLERS22 are to monitor, study, model, and interpret the observed changes in the solar electromagnetic radiation, both bolometric and in spectral bands from X-ray to infrared and radio. Since the Sun is a representative of one class of stars showing cyclic variability, the study of the variability of solar-type stars is also an important interest of SOLERS22. Understanding and predicting solar variability, especially on long time scales, is of extraordinary practical importance because the solar radiative output is one of the major natural driving forces of the terrestrial atmosphere and climate system. Therefore, SOLERS22 is also concerned about the climate impact of solar variability.

More than 100 scientists from many countries attended this year's meeting. Variations in solar and stellar irradiances and the climate impact of solar variability were discussed in detail. The contributed papers will be refereed and published in *Solar Physics*. The Workshop Proceedings will be edited by Judit Pap, Claus FrÃ¶hlich, and Roger Ulrich and published by Kluwer Academic Publishers.

Results presented during the Workshop demonstrate that considerable progress has been made since the SOLERS22 Workshop held in 1991. Several new measurements of solar irradiance have been performed from space, from the Upper Atmosphere Research Satellite (UARS), the ATLAS and EURECA missions, and more recently from the SOHO mission. These space-borne observations of the solar radiation have confirmed that solar total and spectral irradiances have indeed changed in parallel with the solar magnetic activity cycle. In addition to space observations, considerable efforts have been made in improving the ground-based observations of solar activity. Since the satellite-based irradiance monitoring experiments observe the Sun as a star, high quality, spatially resolved images are necessary to reveal and interpret the causes of the observed irradiance changes. In addition to the ground-based observations of solar variability, several experiments on the SOHO mission provide high resolution solar images to study solar variability on time scales from minutes to years. Results presented at the SOLERS22 1996 Workshop have demonstrated that considerable efforts have been put forward to improve irradiance models using the results of image decomposition techniques and new statistical methods. Coupling the studies of changes in solar irradiance and the frequency of solar oscillations, as well as the solar radius, have provided an additional tool for probing the solar interior and to study the physical causes of irradiance changes.

Since the current STEP project and its activities will expire in December 1997, the Workshop participants discussed the future of SOLERS22. SOLERS22 members and Workshop participants agreed that the near-term SOLERS22 effort will concentrate on the following: 1) producing a reference solar spectrum from X-ray to far infrared for solar minimum between cycles 21 and 22; 2) gathering information about the solar cycle dependence of spectral irradiance changes; and 3) improving physical models of solar irradiance variability by incorporating the results gained from image analysis, radius measurements, and studying the frequency changes of p-mode oscillations. A better understanding of the physical causes of irradiance changes will certainly lead to improvement of the reliability of climate models. Based on the discussions during the SOLERS22 1996 Workshop, a continuation of SOLERS22 in the post-STEP era, during the period 1998-2002, has been proposed to SCOSTEP.

The Workshop was sponsored by the Air Force Office of Scientific Research (AFOSR)/ European Office of Aerospace Research and Development; AFOSR/Asian Office of Scientific Research and Development; Jet Propulsion Laboratory, California Institute of Technology; National Aeronautics and Space Administration; National Optical Astronomy Observatories, National Solar Observatory; Scientific Committee on Solar-Terrestrial Physics (SCOSTEP); Solar-Terrestrial Energy Program (STEP); and University of California, Los Angeles.

The Scientific Organizing Committee consisted of R.P. Cebula, R.F. Donnelly, F. Farnik, C. FrÃ¶hlich (Co-Chair), D. Gillotay, K. Harvey, D.F. Heath, J. Kuhn, A. Mecherikunnel, L. November (Co-Chair), H. Ogawa, J.M. Pap (Chair), G.J. Rottman, P.C. Simon, G. Thuillier, W.K. Tobiska, C.H. Wehrli, T.N. Woods. The Local Organizing Committee consisted of R. Altrock, R. Coleman, R. Elrod, R. Hunter (Chair), R. Kariyappa, J. Kuhn, L. November.

Judit Pap, Claus FrÃ¶hlich, Dick Altrock

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Kitt Peak Vacuum Telescope Upgrade

Reporting the status of a project reminds one of the tortoise and the hare story. The Kitt Peak Vacuum telescope upgrade project is the tortoise and the desire to be finished is the hare. As in the story however, the tortoise is progressing nicely. Ed Bell, Tom Roussey, and Russ Cole have completed the new #4 mirror control system and have done preliminary testing in the lab. The final performance characteristics will not be known until the mirror and control system are installed in the telescope, but the performance appears to be very good and should provide much better image stability than the current installation. Along with the #4 mirror upgrade, Jerry Duffek is investigating the possibility of upgrading the #3 mirror mechanical assembly to improve the focus capability.

Jan Schwitters is making good progress in the conversion of the "Magtool" software. The new Graphical User Interface will be written in the Tool Command Language (TCL). Writing the user interface in TCL will allow the interface to be platform independent and executed from various locations. Jan reports that the conversion is going more smoothly than expected, but requires more code than expected.

The telescope control hardware upgrade is also progressing nicely. We have ordered and received all new stepper motor drive amplifiers to replace the current obsolete ones. In anticipation of replacing the existing Telescope Control Program (TCP) "forth" computer and CAMAC crate, new VME crates, Motorola `162 processor boards, vxWorks targets and "smart" stepper indexer controllers have been ordered and received. The control chain is currently being tested in the lab. We have also ordered and received the fiber optic components necessary for the control system upgrade. The components consist of fiber cable, LIUs (Light-guide Interface Units), RS232 to fiber converters, fiber crimp connectors and serial port multiplexers. Still on the list of items to specify and order are replacements for the anemometer, new encoders for the #1 and #2 mirrors, GPS time code receiver, and replacement motor controllers.

Ed Stover and Dave Jaksha are in the process of defining and prototyping a new hand paddle controller for use in the Vacuum Telescope and elsewhere. One programmable hand paddle will be used for all the telescope and spectrograph functions, and thus some thought needs to go into defining the layout. Procurement is complete and testing started on some switches with small integrated displays, along with a controller board that drives the displays, an LCD readout, and interfaces to a host computer (the new TCP). Preliminary results look very good. The displays look very nice and seem to be rugged. Integration of the breadboard with the vxWorks control computer will start soon.

Lonnie Cole

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NSO Telescope/Instrument Combinations

```
Vacuum Tower Telescope (SP):
      Echelle Spectrograph
      Universal Spectrograph
      Horizontal Spectrograph
      Universal Birefringent Filter
      Fabry-Perot Filter System
      Advanced Stokes Polarimeter
      SlitJaw 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):
      H-alpha Flare Monitor
      WhiteLight 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)

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

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

Razdow (KP):
      H-alpha patrol instrument
```

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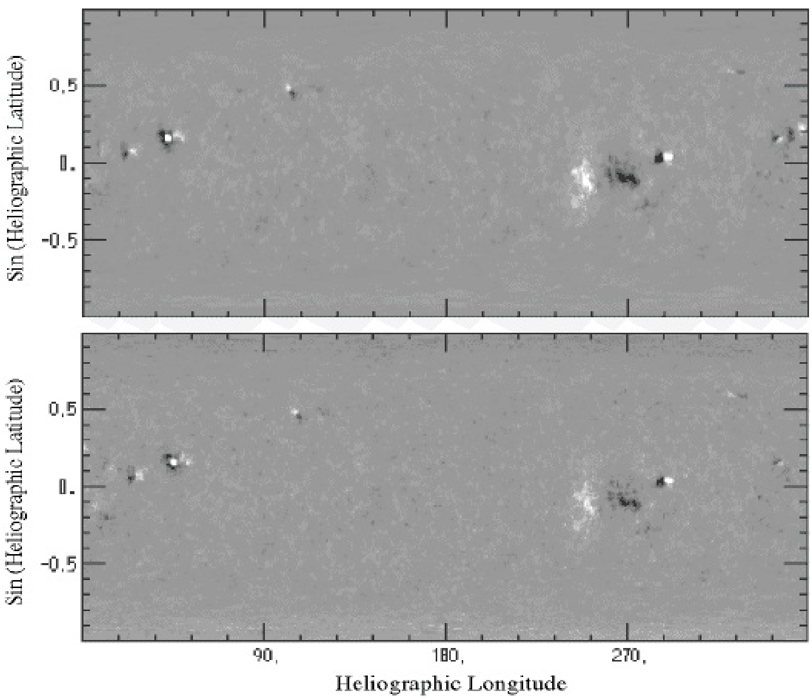
Global Oscillation Network Group

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



Caption: A comparison of synoptic magnetic field maps constructed for Carrington rotation 1910 using GONG data (top) and Kitt Peak Vacuum Telescope data (bottom). The noise level in these maps is similar. Note the presence of a small bipolar region in the GONG map near heliographic longitude 360 and sin latitude 0.2 that is not present in the KPVT image. This region had a short lifetime, and was not present during the 1 hour per day that the KPVT data is collected. Since the GONG network obtains a magnetogram every 20 minutes around the clock, it can detect these short-lived regions.

Overview

With a year of full network operations behind us, we are pleased to report that the instruments are still working! The network has virtually eliminated artifacts in the spectra, the pipeline is keeping up with the flow of data, and the science teams are hard at work improving the algorithms in light of the resolution and signal to noise that we are achieving---not to speak of making scientific sense of it all. Only about 2% of the possible images from any given site are being lost to instrumental problems, an order of magnitude less than lost to weather. The network duty cycle is averaging 90%, and for some months it is as high as 95%.

Data has been flowing out to the community at a rate of about 60 gigabytes per month during the recent past; a total in excess of 437 gigabytes has been delivered so far. In light of the knowledge gained from the analysis of the first year's data, we are about to undertake a reprocessing of this data with improved algorithms at the same time that we process the new data.

The scientific community continues to pursue its collaborative analysis of the major issues, and several team papers are in the works. With the well-attended IAU Symposium honoring Philippe Delache ("Sounding Solar and Stellar Interiors"), which was held in Nice during early October, individual publication of results from GONG data has begun as well.

Overall, we have gained an enormous amount of experience in all aspects of the project during this year. We can now confidently look to the future, and consider in detail plans to continue the operations of the instrument for a full solar cycle with a new, larger format camera.

Data Management and Analysis

During the past quarter, month-long (36-day) time series and power spectra were produced for GONG months 11 and 12 (ending 960711) with fill factors of 0.94 and 0.82. The fill factor for month 11 was even higher than we had hoped for from the experience of the site survey. On the other hand, the fill factor for month 12 was significantly lower. Both resulted from global weather patterns. Eight-month and nine-month (the concatenation of GONG months 4 through 12) time series and power spectra for l's less than or equal to 45 were produced.

For month 12, the delay between data acquisition and completion of the month-long power spectra was about 17 weeks (previously the process delay has been about 13 weeks). This increase was caused by vacations, participation in the AAS and GONG meetings in Madison, and various software activities. We expect the processing delay to decline somewhat (one or two weeks) in the future.

The correction to the camera rotator angle now consists of the results from the reduction of drift scan data acquired during instrument maintenance visits that occur periodically (every six to nine months) at each site, and the intercomparison of contemporaneous velocity images from all the sites. Typically, the drift scan data are reduced six to nine weeks after a maintenance visit. The intercomparison of contributing contemporaneous images is similar to the multi-site merge, in that data from all sites must be available before proceeding. In addition, to suppress noise in the results derived from the intercomparison and to span gaps in the data, the multi-site contributions are needed for a period of about two weeks beyond the date for which refined rotator correction angles are being derived. This algorithm provides more consistent and more accurate camera rotator corrections than could be obtained from the drift scan results alone. Routine use of this approach began with GONG month 12.

The subsystem that receives the raw data cartridges from the observing sites processed 100 cartridges (96 during the previous quarter) containing 614 (643) site-days from the seven instruments. 310 (439) site-days were processed through the site-dependent data reduction stages. The difference of 304 site-days is attributed to bad weather at the network sites, 104 site- days from the engineering test unit in Tucson (which are reduced only when requested by the instrument team) and data acquisition problems at the Teide site, which were corrected late in the quarter.

During the past quarter, the Data Storage and Distribution System (DSDS) serviced 27 (72 during the previous quarter) data distribution requests for 307,204 (455,842) files totaling 95.2 (189.6) Gigabytes of data. The average delay between receipt of a request and shipping the media containing the data products was about 1.5 days. The DSDS performed 2,494 (2,937) data cartridge transactions (library check-ins and check-outs) in response to requests from the data reduction pipeline and other internal operations. The copying of new data product cartridges, the delivery of these copies to the off-site storage facility, and the testing of old media in both the DSDS library and in the off- site storage facility continued as expected.

The DMAC Users' Committee met in Boulder during August and in October via a conference call. Recent and proposed changes to the pipeline and a reprocessing campaign were discussed, as well as a community effort to evaluate the algorithm to estimate mode frequencies. The project has also formed an in-house team to focus on the peak-finding task. This team will thoroughly test and improve the current algorithm and will investigate at least four alternative approaches to smoothing the spectrum and estimating the mode parameters: wavelet denoising, multi-taper spectral analysis, homomorphic deconvolution, and multi-dimensional spectral fitting.

Despite the low-sensitivity and high noise level of individual GONG magnetograms, the large volume of data available for averaging produces a Carrington map with surprisingly high quality. The project has begun routinely producing synoptic maps as an archived data product, and samples of the synoptic maps will be available on the WWW in the near future.

During the quarter several operational changes were made to improve the efficiency of the data reduction pipeline. The project integrated functions into the calibration stage that were performed by the next reduction stage that refines the determination of the geometry of the solar disk and estimates the modulation transfer function (GEOMPIPE). This change is expected to save about 400 cartridges annually and will reduce by one-half the time spent performing GEOMPIPE functions. Previously, concatenating month time series into year time series and producing the power spectra were separate data reduction stages. These steps were merged into one, and the production of phase spectra (the principal part of the arctangent of the real and imaginary parts of the Fourier transform of the time series) was discontinued. These changes will eliminate unnecessary cartridge operations and accelerate processing. The data reduction stages that merge the site-day time series into network-day time series, that concatenate the site-day time series into month time series, and that produce the power spectra from the month time series were also combined into one data reduction stage.

The project is working toward a reprocessing campaign that will begin after November but before April. This will apply the software updates that occurred during the past year to all the network data, and will result in a more consistent and homogeneous data set. Additional changes to the routine data reduction are also being evaluated. These include correcting the scale of the velocity images by fitting the spatially averaged velocity to the observer motion, compensating the registration of the velocity images for the difference between synoptic and sidereal heliographic coordinates, changing the spatial window function from an aperture with constant range of heliographic latitude and longitude to an aperture with constant area on the observed solar disk, several methods of scaling the mode coefficient amplitudes, and changes to the temporal gap-filling and apodization. The reprocessing will start with the most recent data and work backward to build up the longest continuous time series as rapidly as possible.

Operations

Reality caught up with GONG operations over the last three months just as we were closing the books on our first year of full-network operations. We had previously reported that any given site was only losing about 0.4% of the possible images due to instrumental problems. That number has now increased to about 2%. This is still well within the acceptable range, and in line with the down time recorded by the (far simpler) site survey instruments during their use. Though hardly good news, we take comfort in noting that the down time due to broken instruments is now comparable to the self-inflicted gaps caused by our preventive maintenance schedule, allowing us to feel somewhat relieved about that strategy.

The big jump in instrumental down time was caused by events at two sites that caused one instrument to fail intermittently over a six to seven week period, and another to be down hard for over two weeks. The full network is once again running at 100%, and we're now solidly into the "lessons-learned" phase of the experience.

Event number one occurred at El Teide on Tenerife. This particular instrument had suffered the most from Exabyte problems, likely foreshadowing the failure that was to follow. The specific trouble began in July while we had a preventive maintenance team at the site. None of the four tape drives in the rack could be accessed, although the individual drives passed the diagnostic tests and appeared to be healthy. The team struggled for several days trying to get the tape system to work, with apparent success shortly before they were scheduled to depart. Three days later, however, the problem recurred and the bits began spilling onto the floor. A few days later, we had a backup system in place that utilized the two additional Exabyte drives associated with the work station. Problems persisted at the site however (some related to Exabytes and some not). The system wasn't back to normal until the entire data chassis, accompanying modules, and cables had been replaced, along with both dual Exabyte chassis. This involved a great deal of shipping between Tucson and La Laguna, and no small effort on the part of the on-site staff at El Teide. Our thanks go out to them for bearing with us through this period. We don't have all the pieces of the original system back in Tucson yet, so we are not confident that we understand everything about this chain of failures. We were able to simulate the symptoms at the Tucson prototype, but it requires that the power supplies in both dual Exabyte chassis be intermittently weak. Another theory is that the SCSI bus in the Teide system was noisy or in some other way dysfunctional. We'll trade in some plane tickets for a SCSI bus analyzer to allow us to better diagnose both this type of problem and other chronic SCSI noise problems we have been trying to chase down since before the instruments were shipped.

The second event occurred in India as that part of the world was emerging from the annual summer monsoon. A failure of the air conditioning system caused the shelter temperature to increase to nearly 40°C, resulting eventually in the breakdown of the CCD camera's electronics. This would normally have been an emergency event, but we had already purchased tickets for a scheduled maintenance trip two weeks hence. We decided that we could hardly improve on that plan given the complexity of travel, and that we would have to "take our lumps" on the down time until the team could arrive. With the help of the staff at Udaipur Solar Observatory, we were able to get the instrument in a state that allowed us to run remote diagnostics on the data system from Tucson prior to anyone getting on an airplane. The team left town confident that they had packed the right spares to bring the system back to life, and in fact were able to bring the instrument to an operational state within a few days of arrival. Steps were also taken during the maintenance trip to correct the air conditioning problems that originally precipitated the crisis. There are two air conditioners in the GONG shelters. Typically one is operational---should it fail a second unit will turn on as the temperature exceeds a prescribed limit. In this case, both air conditioners drew too much current on startup, resulting in two tripped circuit breakers. To address this, a "hard start" kit was installed in both operational units on the advice of the manufacturer, and a regulating transformer was installed in the power line in an attempt to better condition the power supplied to the units. Current in excess of the ratings are still sometimes being drawn on startup, however, and it will likely be necessary to make additional modifications before we can declare this problem to be fixed.

Another general review of the items in the service log has been carried out now that we have a year's worth of data to digest. The one item that continues to get the most negative attention is the Exabyte drives. They represent the only piece of hardware in the system for which it makes any sense to compute a mean-time-between-failures value. During our first year we have seen the system abandon the primary tape bank and automatically switch to the secondary bank 32 times. In other words, the operations group can expect to see this event somewhere in the network every eleven days or so. Given that this is going on at six independent sites, and that each bank consists of two drives (the failure of either of which constitutes a "bank failure") the mean time between "mishaps" for a given drive is about 136 days. It should be noted, however, that of these 32 bank swaps, only eight actually required a drive replacement and factory repairs. The balance were corrected by a media change, bus reset, or power-on reset of the drive. The sum of all problems relating to the taping of data is also the biggest contributor to lost images, accounting for 45% of all instrumental down time. To address this, we have converted some travel funds to purchase enough dual Exabyte drives to keep a spare on hand in each shelter.

To Be Continued...

Beyond network operations, data analysis, and support of the community, we are continuing to work to identify a new camera, data caching hardware, and data recording system that can accommodate the future needs of the community in light of new and refined scientific goals, as well as improving technical capabilities during a full eleven-year observing run. The data pipeline hardware and reduction strategies will also have to be modified to handle up to a factor of 16 more data. For example, we will be experimenting with schemes to perform preliminary reduction of the images at the instrument---either in real time or at night---in order to "compress" the data for transport to Tucson in an affordable, reliable way. "Routine" operations are still in the future.

John Leibacher

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Workshop on Future Instrumentation for Gemini Telescopes

As announced in the last Newsletter, the USGP is beginning to plan for the ongoing Gemini instrumentation program. In the steady-state of Gemini operations, approximately $3.5 million per year will be available for new instruments and facility upgrades; one-half of that will be spent in the US. Each of the Gemini partner countries has been asked to identify its interests and priorities for future instrumentation. As a start to that process, the USGP held a workshop in Tucson in early August. About 25 astronomers from universities, research institutions, NOAO, and Gemini were invited to discuss the science drivers for Gemini capabilities. Representatives from most of the other large telescopes and telescope projects were there to put the discussion in the context of the total suite of facilities available to US astronomers. Input from the community at large was also received prior to the meeting via the World-Wide Web.

As preparation for the discussion, the group heard presentations on Gemini capabilities and its initial instrument complement as well as the instrumentation programs for the Keck, MMT-upgrade, Magellan, Hobby-Eberly, VLT, and Subaru telescopes. Short presentations were made on new technologies that might lead to instruments that could open up new research areas.

A general discussion of the philosophical principles for defining future instruments followed. Six considerations were agreed upon:

- Focus on combination of scientific issues and instrumentation. Remember that capabilities are more than the instruments alone.
- Emphasize Gemini's best attributes. Require performance that preserves Gemini's outstanding features.
- Duplicate capabilities can be justified by potential for scientific returns.
- Telescopes have to be effective in worse than median conditions.
- Bring US technology into Gemini; open new paths to facilitate this.
- Consider Gemini in the context of other large telescopes.

The general discussion of future Gemini capabilities was structured by dividing the participants into four groups, each charged to consider a (very broad) scientific area. The groups were:

1) Star Formation, Stellar Physics, and the ISM (chaired by Steve Strom),

2) Problems in Nearby Galaxies (chaired by Jay Gallagher),

3) Structure and Evolution out to z = 1 (chaired by Richard Elston),

4) Cosmology (chaired by Buell Jannuzi).

Each group was charged with developing a list of problems that they saw as important and addressable over the next ten years. For each problem, they were asked to list the required observations, the instrumental capabilities needed to make those observations, and some sort of benchmark for the capability.

The top problems identified by the four groups were:

1) The origin and early evolution of the stellar mass spectrum,

2) An understanding of the kinematics and structures of the nearest AGNs,

3) The local manifestations of large scale structure,

4) When (and where) did the progenitors of z = 1 ellipticals form their first significant population of stars?

These top problems give just a flavor of the discussions at the workshop; a large range of science and instrumental capabilities made it onto the four lists. Merging the four lists produced the following list of desired future instrumental capabilities for Gemini. Note that the order represents some measure of the overall importance of the capability, although the sequence in which instruments are built may be determined by other factors.

1) *Laser Guide Star Adaptive Optics:* A large fraction of the high priority programs require fairly high Strehl (> 0.5) AO at 2μm over a small field (< 10"). Many of the objects are faint, requiring a laser beacon. It is recognized that this type of AO is far from being viable as a user facility, and that it is risky to base a large fraction of the science to be done on an undemonstrated capability. However, it was judged that within the constraints of the 3.5' IR field and the 10' optical field of Gemini, by far the most interesting and important science would capitalize on the diffraction-limited near-IR images of an 8-meter telescope. Thus, the recommended strategy is to pursue LGS AO (though not to fund development of major subsystems that are being worked on by other programs), and to concentrate early efforts within the ongoing instrumentation program on those instruments and upgrades that do not require AO.

2) *Near-IR imager for Gemini-South:* Several of the highest priority programs require near-IR imaging from both north and south sites. In general, the imaging applications tend toward AO, and so multiple pixel scales (from 0.01" or 0.02" to 0.1"-0.2"/pixel) would be effective.

3) *Narrow-field multi-slit Near-IR Spectrograph:* Those programs attempting to study distant galaxies or star forming regions in detail require a near-IR spectrograph optimized for use with the AO system outlined above. Some of these require multi-slits, some require a single slit, and some (most) require an integral field unit with spatial elements appropriate for the diffraction-limited 2m images. Resolutions from 2000 to 10,000 are needed.

4) *Wide-field multi-slit near-IR spectrograph:* Many of the programs aimed at studying galaxies at high redshift require cryogenic multi-slit spectrographs. Those that wish to measure integrated properties require a few dozen slits over a field of several tens of arcminutes. The GMOS 1.5m upgrade is seen as an interim solution, but a true cryogenic instrument will be necessary ultimately to address these problems. Resolution of several thousand is needed.

5) *Ultra-high resolution optical spectrograph:* Studies aimed at the next step in stellar physics were recognized as potentially yielding very important information and being well suited to Gemini. In addition, an ultra-high resolution (R ~ 500,000) spectrograph would open up new areas in studies of the interstellar medium. This would be a bench mounted (and probably fiber-fed) system in order to ensure high stability.

6) *Integral Field Units for the existing spectrographs:* Many of the programs require integral field spectroscopy, and some are in the spatial regime attainable with the initial instruments, GNIRS and GMOS. IFUs for these instruments having spatial scales of 0.1" or less could be used to attack some of these problems.

7) *High-dispersion near-IR spectrograph:* Two of the high priority programs require high-resolution near-IR spectra, one for studies of the abundances in distant absorption systems of QSOs and one for kinematic studies of circumstellar material. The proposed sharing of the NOAO instrument Phoenix would be cost-effective way of providing this capability.

8) *Coronagraphic feeds:* A number of the projects require blocking the light from a relatively bright object to study the faint or low-surface-brightness emission nearby. There are both imaging and spectroscopic applications that require a coronagraphic front-end; all of these are aimed at use with adaptive optics.

9) *H-band extension for GMOS:* Despite the fact that a multi-slit IR spectrograph with a cryogenic focal plane was seen as essential for a number of important programs, the possibility of extending the sensitivity of GMOS to 1.5m by replacing the CCD array with a HgCdTe array is a good first step.

The workshop was deemed a success by all the participants, and the international Gemini project is organizing an international version with a structure quite similar to the US workshop to be held in England in January 1997. This *Newsletter* article is a condensation of the final report of the workshop, " *Future Instrumentation for the Gemini 8-Meter Telescopes; The US Perspective*," which is available from the USGP.

Participants in the workshop were:

Sam Barden (KPNO/NOAO)
Eric Becklin (UCLA)
Todd Boroson (USGP/NOAO)
Richard Elston (CTIO/NOAO)
Craig Foltz (MMT)
Christ Ftaclas (Michigan Technological)
Jay Gallagher (Wisconsin)
Fred Gillett (Gemini)
Richard Green (NOAO)
Lee Hartmann (Harvard)
Suzanne Hawley (Michigan State)
Buell Jannuzi (KPNO/NOAO)
Bob Joseph (Hawaii)
Pat McCarthy (OCIW)
Joe Miller (Santa Cruz)
Matt Mountain (Gemini)
Gerry Neugebauer (Caltech)
Phil Puxley (Gemini)
Larry Ramsey (Penn State)
Steve Ridgway (KPNO/NOAO)
Dave Silva (USGP/NOAO)
Steve Strom (Massachusetts)
John Tonry (MIT)
Mark Trueblood (USGP/NOAO)
Alistair Walker (CTIO)
Sidney Wolff (NOAO)

Todd Boroson

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ADASS Conference Update

The Sixth Annual Conference on Astronomical Data Analysis Software and Systems (ADASS) was held 22-26 September 1996 at the Omni Charlottesville Hotel in Charlottesville, Virginia. The Conference was hosted by the National Radio Astronomy Observatory. Sponsors for the meeting included:

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Associated Universities, Inc.
European Southern Observatory
Infrared Processing and Analysis Center
National Aeronautics and Space Administration
National Center for Supercomputing Applications
National Optical Astronomy Observatories
National Radio Astronomy Observatory
National Research Council of Canada
National Science Foundation
Smithsonian Astrophysical Observatory
Space Telescope Science Institute
University of Virginia
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Corporate sponsors included:

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GE Fanuc Automation
Sun Microsystems, Inc.
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The meeting was a busy one with 8 invited talks, 31 contributed talks, 79 poster papers, and 12 computer demos. There were also 11 BOFs (Birds-of-a-Feather sessions that ran for 1 hours, often in parallel with one another). A reception was held Sunday evening in the atrium of the Omni Hotel. The Conference banquet was held at Ash Lawn-Highland just south of Charlottesville in the foothills of the Blue Ridge Mountains (Ash Lawn-Highland was President James Monroe's 535-acre estate). A tour to the NRAO's Green Bank Facility was offered on Sunday prior to the reception. The Conference was also preceded by a Java Tutorial presented on Sunday by a representative from Sun Microsystems. An IRAF Developer's Workshop followed the Conference on Thursday. There were 248 participants at the Conference, including 83 attendees representing 18 countries from outside the US. For a more detailed ADASS '96 program see the

URL http://www.cv.nrao.edu/adass/.

The Conference Proceedings for ADASS VI will be edited by Gareth Hunt (and others) from NRAO. It will be published as part of the Astronomical Society of the Pacific Conference Series, as in past years. An online version of the Proceedings is planned.

The Proceedings for ADASS '95 is now available, and the online version can be viewed at http://iraf.noao.edu/iraf/web/ADASS/adass_proc/adass_95/cover.html or at the IRAF mirror site at http://star-www.rl.ac.uk/iraf/web/ADASS/adass_proc/adass_95/cover.html .

Plans for ADASS '97, to be held in Garching/Munich, Germany, are now underway. The Conference will be hosted by the Space Telescope European Coordinating Facility / European Southern Observatory. The tentative dates are 14-17 September 1997. For up-to-date information about ADASS '97 see the home page at http://ecf.hq.eso.org/adass/adass97.html.

Jeannette Barnes

IRAF Update

X11IRAF, which was initially released only for the major IRAF development platforms, was made available for all the remaining IRAF platforms (except VMS) in September. This means that the X11IRAF utilities Xgterm, Ximtool, and Xtapemon are now available for SunOS, Solaris, DEC Alpha OSF1, SGI IRIX, Linux (all supported with earlier releases), IBM AIX, Dec Ultrix, and HP/AUX (new releases). The binaries for these platforms can be found in the IRAF anonymous FTP archive on iraf.noao.edu in the */pub/v2103-beta* directory.

The September release was only to round out the X11IRAF platform support and did not include any substantive feature enhancements. This was a side benefit of a new version of X11IRAF, which is still under development. The upcoming release will include a major new version of Ximtool, will add man pages for all X11IRAF utilities, and will include more complete and portable Imake-based build procedures to make it easier for users to build the package on new platforms. When this version is released the distribution directory will move from */pub* to */iraf/x11iraf* so keep an eye on this directory for the new software. We will post an announcement to the *adass.iraf.announce* newsgroup when this new version of X11IRAF becomes available. If you are a registered IRAF user and we have your current email address you will be notified of its release through this newsgroup mailing list. Progress and announcements for the X11IRAF project can also be monitored through its Web page at http://iraf.noao.edu/projects/x11iraf.

As mentioned in the last Newsletter all registered IRAF users were added to the mailing list associated with the *adass.iraf.announce* newsgroup. This went very well and subsequently a number of people even subscribed to additional ADASS newsgroup mailing lists. Not surprisingly the first postings to the full list revealed that about 10% of our IRAF subscribers email addresses (100-200 addresses) were out of date or otherwise invalid, and the bad addresses had to be removed. If you are a registered IRAF user and your email address has changed please feel free to re-register (which will auto-subscribe you) or contact us at iraf@noao.edu to update your subscription information. You may also subscribe to additional newsgroup mailing lists through our online registration or ADASS newsgroup Web pages on http://iraf.noao.edu.

Along with other system projects such as X11IRAF, various V2.11 release-related development work, and Open IRAF, the data handling system for the NOAO mosaic continues to be our current major IRAF systems project. The focus for this past quarter was on the data processing subsystem. This is exciting as it will have a message-based, distributed, heterogeneous architecture of the sort emphasized by Open IRAF, and will introduce new technology in IRAF for characterizing CCD data using pixel masks and uncertainty modeling. A write-up detailing what this will consist of is in preparation. See the discussion below for further information, or contact Doug Tody or Frank Valdes for the details.

If you are looking for IRAF-related software that is not part of the main IRAF distribution, there are two directories in our anonymous FTP archive on iraf.noao.edu that you may want to look through. The */iraf/extern* directory contains add-on or layered software packages from the NOAO/IRAF group---these are often beta releases of new software packages that will eventually migrate into the main IRAF system at a later date. The other directory is the */contrib* directory. This is a directory containing user contributed software from outside the IRAF group. There is a wide range of software available in the */contrib* directory and you can browse the current contents through our Web page at http://iraf.noao.edu/contrib. Any user wishing to contribute software here is welcome to do so, all we ask is that you include a "readme" file for each package explaining what it is and whom to contact. Dropping a note to iraf@noao.edu will also allow us to include the package in the general description of the directory and the Web pages.

Mike Fitzpatrick has been working hard for the past few months on the X11IRAF and Ximtool enhancements and continues to be the primary contact for IRAF technical support. Nelson Zarate has been working on improvements to the FITS image kernel and on the OpenVMS IRAF port, an early version of which is in use at STScI for the HST pipeline. A beta test, shared image based distribution of the FITS image kernel is available in the IRAF archives for experimenting with the new image kernel on selected platforms.

Lindsey Davis is continuing to work on the new IRAF astrometry package. As part of that work she has completed initial development and testing of a library of digital image centering routines, and is investigating methods and user interfaces for local and remote catalog access.

Frank Valdes is working on the design of the data format and data reduction software for the NOAO CCD Mosaic. The design of the data processing software is nearly complete, and we hope to have portions of the new mosaic reduction software (plus parts of the messaging system for data capture) working by December. The ADASS conference provided an important opportunity to discuss this work with other interested parties. Frank is also part of a team taking data with the KPNO CoudÃ© Feed telescope to create a high resolution (approximately one Angstrom resolution) library of stellar spectra covering the spectral types, luminosity classes, and metallicities. This library will be made available to the community. He was at the telescope this quarter taking data for this project. This work allows him to have personal research experience with the IRAF CCD and spectroscopy software he develops and supports.

Rob Seaman is working on the FINDER package update. FINDER is an internal NOAO package for overlaying the HST guide star coordinates on a displayed image, interactively measuring the stellar X,Y coordinates from the image display and then passing the resulting equatorial and pixel coordinates to a plate solver. This is normally used for generating target coordinates for multi-object spectrograph observing runs. The updated package will add Lindsey Davis's new CCMAP plate solver task as another option to the Starlink ASTROM program that was previously used. A new task DSSFINDER will allow overlaying GSC sources on the STScI Digital Sky Survey scans with minimal user input, permitting the plate solution to be recomputed as a standard IRAF world coordinate system. Various smaller improvements have been implemented. Rob continues to support CCD data acquisition at KPNO and the NOAO/IRAF Save the Bits archive in a variety of ways. An update of Save the Bits to support recordable CDR as an archival format is in progress.

The annual Astronomical Data Analysis Software and Systems Conference (ADASS) was held in Charlottesville, Virginia in late September, and all the IRAF group members attended. Papers on current IRAF projects were presented at the meeting:

Lindsey Davis, "A Library of Digital Image Centering Routines for IRAF"

Mike Fitzpatrick, "Automatic Mirroring of the IRAF FTP and WWW Archives"

Rob Seaman, "Asteroseismology - Data Acquisition and Reduction for a SONG"

Rob Seaman, "WIYN Data Distribution and Archiving"

Doug Tody, "The Data Handling System for the NOAO Mosaic"

Frank Valdes, "Data Format for the NOAO Mosaic"

Frank Valdes, "IRAF CCD Reduction Software for the NOAO Mosaic"

An important part of ADASS are the many Birds-of-a-Feather (BOF) sessions that are held during the meeting---parallel sessions on special topics that run about 1 hours. The IRAF BOF is a regular feature of the ADASS, attended by a variety of IRAF users and programmers. This year's IRAF BOF was chaired by Bob Hanisch and had about 60 enthusiastic attendees. Several very interesting invited and "focus" talks were presented by IRAF users and developers from sites around the world. A highlight of the BOF was a talk by Pat Wallace on Starlink and Starlink-IRAF collaboration in the UK. This was followed by a talk by Doug Tody outlining system developments and plans for IRAF over the next few years. A short question and answer period wrapped up the evening.

An IRAF Developer's Workshop was held on the day following the ADASS Conference. This workshop provides an opportunity for groups that are doing IRAF development outside the IRAF Group to get together with the IRAF group members and discuss programming issues. About 45 developers attended the IDW.

We do not plan to have a computer demo at the AAS meeting in Toronto this year, but we do plan to have a table with handouts and a poster display as part of the NOAO presentation, so please drop by. We value the discussions with our users at the AAS meetings, but this year time and money are at a premium and we decided that we should stay in Tucson and try to get some work done! If time and money permit perhaps we will see you in Washington in January 1998.

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

Doug Tody, Jeannette Barnes

NOAO FTP Archives

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

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

ftp ftp.sunspot.noao.edu (146.5.2.16), cd pub
   Directory containing SP software and data products---coronal maps, active
   region lists, sunspot numbers, SP Workshop paper templates, information on
   international meetings, SP observing schedules, NSO observing proposal
   templates, Radiative Inputs of the Sun to the Earth (RISE) Newsletters and
   SP newsletters (The Sunspotter).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The following numbers are available for the machines mentioned above:

```
argo.tuc.noao.edu    = 140.252.1.21
ctios1.ctio.noao.edu = 139.229.2.1
ftp.gemini.edu       = 140.252.15.71
ftp.noao.edu         = 140.252.1.24
ftp.sunspot.noao.edu = 146.5.2.16
gemini.tuc.noao.edu  = 140.252.1.11
helios.tuc.noao.edu  = 140.252.8.105
iraf.noao.edu        = 140.252.1.1
orion.tuc.noao.edu   = 140.252.1.22
```

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

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

Jeannette Barnes

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Division Editors

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Production Staff

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