NOAO Newsletter - March 1999 - Number 57

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NOAO Highlights!

Director's Office

SCience OPErations

Cerro Tololo Inter-American Observatory

Kitt Peak National Observatory

National Solar Observatory

Global Oscillation Network Group

US Gemini Program

- Gemini North Nears First Light
- USGP Instrumentation Program

Central Computer Services

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Newsletter Editorial and Production Staff

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Comments concerning this Newsletter are welcome and will be forwarded to the appropriate editors.
Newsletter Posted: 25 Feb 1999

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Intracluster Light in Coma

Michael Gregg (Davis) and Michael West (St. Mary's) used the Burrell Schmidt 0.6-m Telescope to obtain deep multi-color images of the Coma galaxy cluster, with the goal of exploring the nature of its "intracluster light." It was Zwicky who first noted "an extended mass of luminous intergalactic matter of very low surface brightness" in the core of the Coma. The origin of this vast sea of stars is uncertain. Perhaps it formed outside the confines of any galaxy from primordial material left over from Coma's birth; alternatively, the intracluster light may be the accumulated debris from a Hubble time of galaxy-galaxy or galaxy-cluster tidal interactions that spilled stars into intergalactic space.

Caption: *The Coma cluster of galaxies imaged with the Burrell Schmidt.*

Inspection of a 75 minute R-band image obtained by Gregg and West reveals three large, low surface brightness (LSB) features (Numbers 1-3 in Figure 1). All are much larger and more prominent than the slim arc of tidal debris in the Coma cluster recently reported by Trentham and Mobasher (Number 4 in Figure 1). The most striking LSB feature is a plume of stars (Figure 2) extending at least 4.5' in the halo of NGC4874. To better analyze the LSB features, Gregg and West digitally "cleaned" portions of the images to remove superposed galaxies and stars; before and after images of LSB-1 are shown in Figure 2. At a distance of 100 Mpc, it is 130 kpc long, four times the diameter of the Milky Way. The mean R-band surface brightness is m_R = 25.7 mag/arcmin^2 and the integrated apparent magnitude is R = 15.60.1. About 0.6 mag fainter than the plume, LSB-2 is a circular pool of diffuse light about 40 kpc in diameter, adjacent to a small subgroup of galaxies. (Figure 3). Only a little fainter, LSB-3 has a chaotic appearance (Figure 3); a bridge of light connects this object to the outskirts of the Coma member galaxy NGC4911, where there is additional low surface brightness material (inset, Figure 3). NGC4911 and LSB-3 happen to fall along a bright ridge in the X-ray distribution in Coma; LSB-3 may have originated during the same dynamical interaction that has brightened the X-ray emission. The colors of these LSB objects are consistent with those of early type galaxies, but the errors of 0.2mag leave open the possibility that the material contains young stars.

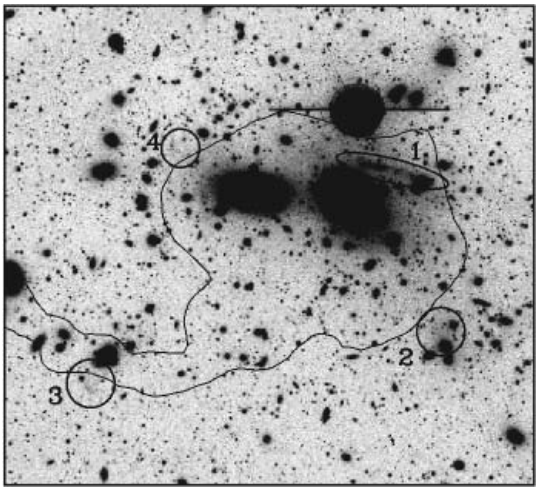

Figure 1: *R-band image of the Coma cluster core showing the locations and approximate sizes of the low surface brightness features (heavy solid circles labeled 1-4) discussed here. The image is 37' 33'; north is up, east to the left. The thin solid line is one X-ray contour from ROSAT observations showing the extended ridge which includes LSB-3.*

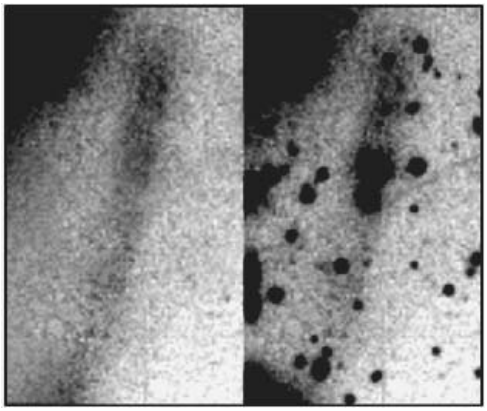

Figure 2: *The plume feature before and after removing foreground objects.*

The four LSB objects are most easily understood as transient features generated by galaxy-galaxy or galaxy-cluster tidal interactions. They provide strong evidence of ongoing galaxy destruction in the Coma cluster. The crossing time in the cluster core is short, 1 to 2 billion years, so they will soon disperse, augmenting the population of intergalactic stars and perhaps globular clusters; evidence of such components are now being detected in nearer clusters such as Virgo. If we are viewing Coma at a typical epoch, then the presence of it *at least* four large transient star piles indicates that a substantial amount of material could have been liberated from galaxies over the cluster's lifetime. Integrated over 10 to 20 billion years, the material added to the intracluster light could amount to m_R ~22, roughly 20% of the luminosity of NGC4874. As the interaction rate was almost certainly higher in the past, perhaps the intracluster light can be completely accounted for through gradual accumulation over a Hubble time. The LSB objects now in Coma provide a vivid snapshot of this process in action.

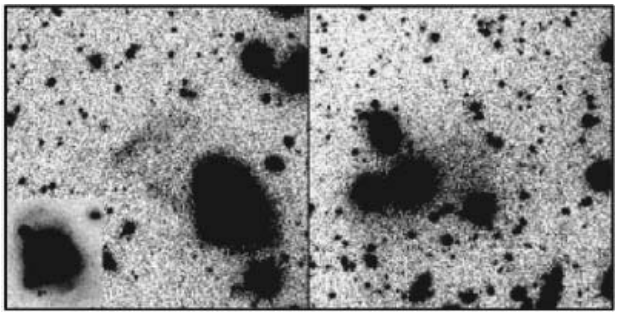

Figure 3: *LSB Objects LSB-2 (upper) and LSB-3 after removing foreground stars and galaxies. Each image is 400 arcsec^2. The bright object to the northwest of feature LSB-3 is NGC4911, a face-on spiral. The inset in the lower right is a lower contrast display of NGC4911 showing the low surface brightness material encircling its disk and linking it to LSB-3.*

Less spectacular gravitational encounters should be much more common; Gregg and West have embarked on a follow-up project using the KPNO Mosaic imager on the 0.9-m telescope to search for smaller bits of tidal debris.

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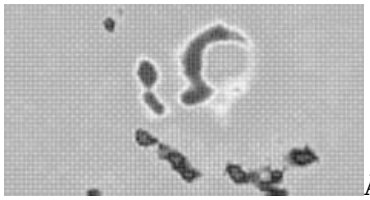
Mapping Sunspot Magnetic Fields at 12 m

The McMath-Pierce telescope and Celeste cryogenic spectrometer have produced the first mid-infrared (12 m) magnetograms in a sunspot. The field is measured by recording spectra of a magnesium (MgI) line at 12.3 m wavelength. This 12 m line exhibits the largest Zeeman splitting of any line which is currently observable, and its resolved splitting gives a direct measure of the magnetic field strength. Celeste is a high-resolution liquid-helium-cooled grating spectrometer built by NASA Goddard Space Flight Center. Individual measurements record the MgI spectrum at each point along a 2.4' slit. An infrared polarimeter placed at the spectrometer input creates a Stokes-V profile of the line at each position. Data cubes (two-dimensions spatial, one-dimension spectral) are created by stepping the slit across the region being imaged. The image dimensions are approximately 0.9' by 2.4'.

The magnetic field image illustrated is a slice of the data cube at a wavelength where only spectral components corresponding to fields of 1700 Gauss contribute. The maximum field in the sunspot umbra was 2200 gauss; however, the umbra appears dark in the image due to a much weaker line intensity. The morphology of the field can be studied by examining the variation with field strength using a series of these slices of the data cube. In some regions, more than one field strength is present, and these separate fields can be resolved in the spectrum due to the great Zeeman sensitivity of the line.

This research is part of an ongoing NASA-sponsored project to measure the magnetic structure above the photosphere using the infrared MgI line. The unique infrared capability and large aperture of the McMath-Pierce telescope makes this work possible. This investigation is a collaboration between Goddard Space Flight Center (D. Jennings, D. Deming, G. McCabe, and T. Moran) and the Universidad de Monterrey, Mexico (P. Sada).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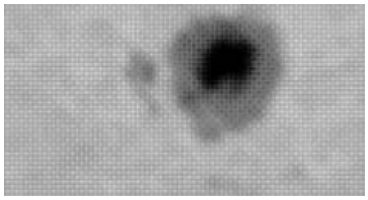

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Transfer of 1.3-m Telescope: Request for Proposals

The National Optical Astronomy Observatories, on behalf of the National Science Foundation, is soliciting applications for the continued operation of the 1.3-m telescope, which is currently located on Kitt Peak. In 1997, NOAO discontinued operating the telescope because of budget constraints and is now soliciting applications by institutions that are prepared to assume the full responsibility - technical, scientific, and financial - for operation. Applications will be reviewed by an independent panel of astronomers. Factors to be considered in the evaluation include: 1) quality and significance of the proposed scientific programs; 2) educational impact of the proposed use; 3) plans for instrumenting the telescope; 4) plans for public outreach; and 5) technical and financial resources available to ensure that the proposed program will be implemented successfully. Proposals for continued operation on Kitt Peak, transfer to another site, or for a long-term use agreement for a specific program will all be accepted for review. Proposers will be expected to provide funding for the entire cost of operation and, if appropriate, for transporting the telescope to another location.

Letters of intent to submit a proposal should be sent to Sidney Wolff and are due by 30 May. Requests for additional information about the telescope and its performance should be directed to Bruce Bohannan. The proposals themselves will be due 15 July.

Specifications for the telescope and estimated costs of operation or removal are available through the .

Sidney C. Wolff

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A New Director for NSO

Following an international search, ***Steve Keil*** has been named Director of the National Solar Observatory and Associate Director of NOAO. The choice was based on Steve's comprehensive and balanced view of NSO's role in solar physics and his plans and optimism for the future. He has substantial management experience and a demonstrated track record in developing financial support for solar research. Of all the candidates, he had the best understanding of what would be required to obtain community and staff consensus on the specifications for an Advanced Solar Telescope (AST) and to prepare a strong proposal for it. He is very aware of the "customers" for solar data and has innovative ideas about how to make data sets available that meet the needs of the different communities that require groundbased observations. Steve has a wide range of experience. His own research interests have recently emphasized high resolution observations of granulation, but he has also worked in a variety of other areas including solar activity, space weather, and several spacecraft experiments. He has been especially effective working with students.

Steve is well known to the NSO community since he has been resident at Sacramento Peak for many years, where he has headed the Air Force group of solar researchers. I am very pleased that he has agreed to lead the NSO program as it moves forward toward the AST, continues with the development of adaptive optics, and completes SOLIS and the upgrade of the GONG cameras. He will assume his new position on 1 April 1999.

Sidney C. Wolff

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Administrative Changes in Chile

The advent of Gemini South has required a reorganization in structure in Chile. Malcolm Smith is now Director of CTIO *and* Head of the AURA Observatory in Chile, which includes both CTIO and Gemini. In his new role, Malcolm serves as the interface between all AURA-operated facilities and the Chilean government, the union of AURA employees in Chile, and all other official organizations in Chile. There is also a new unit in Chile called the AURA Observatory Support Services, which will provide administrative and logistical services to all of the facilities operating on AURA property in Chile. Management of the scientific programs at each facility will continue to be the responsibility of the director of that facility.

These new responsibilities are taking an increasing fraction of Malcolm's time. Therefore, we have decided that it is necessary to appoint an Assistant Director of CTIO, who will be responsible for scientific oversight of both the mountain operations and of the engineering programs of CTIO. The position of Assistant Director was formerly filled by Mark Phillips. We intend to make a new appointment to this position from the current CTIO staff, and consultations with the staff about who might best fulfill the role of Assistant Director are ongoing. I invite any members of the community who have suggestions or comments about this appointment to send them to me.

Sidney C. Wolff

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Acknowledgment of the Use of NOAO Facilities

I am often struck when I attend meetings of the AAS by just how many of the research results depend at least in part on data from NOAO facilities. I am equally struck, however, by how rarely use of these facilities is acknowledged.

I can cite two recent examples. The first is a cover story in *Nature* that was based in large part on data obtained at KPNO. I was just about to send copies to the NSF astronomy division so that they could show the article to their colleagues in the Foundation when I realized that the required footnote acknowledging the use of NSF facilities was missing. As a result, I never called attention to what could have been very good publicity for NSF-funded astronomy. As another example, two recent review talks at the AAS were based in substantial part on discoveries at CTIO. Prior to the talk, I gave 50-50 odds that CTIO would not even be mentioned. My odds were just right. One talk mentioned CTIO; the other did not.

In this era of increased competition for funds, it is important that the staff in the funding agencies, our colleagues, and the general public be more aware of the contribution that both NSF and the national facilities make to advances in astronomy. It is also a legal requirement imposed by NSF that their support of the facilities used be acknowledged in published papers.

So here is the reminder. Visiting astronomers must, according to our cooperative agreement with the NSF, include the following footnote to the observer's name on the title page:

"Based on observations obtained at Cerro Tololo Inter-American Observatory (or whatever the appropriate observatory actually is) a division of the National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc. under cooperative agreement with the National Science Foundation."

We also suggest that you try to give credit to the NSF in press releases. Since press releases are always rewritten, and pedestrian details about who runs the observatory are often dropped, we suggest that in the body of the text you write something like the following:

"....have discovered.....using observations from the National Science Foundation's (NSF) Mayall 4-meter Telescope at Kitt Peak National Observatory, near Tucson, Arizona."

For images, an accompanying statement below the image that simply says "National Optical Astronomy Observatories/National Science Foundation" or even "NOAO/NSF" is sufficient. More details about acknowledgements of images can be found on the NOAO web pages in the Image Gallery section.

Other suggestions for press releases are contained in the "yes" letters sent to successful proposers. We are also ready to work with your university on joint press releases. Contact Suzanne Jacoby if you have ideas for a press release.

Sidney C. Wolff

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A Riddle

Question: When is a budget increase not an increase?

Answer: When it comes with strings attached.

If you have seen the operating plan for the NSF for FY 1999, you will have noted that the budgets of the centers and the grants programs within the astronomy division have increased by 4-5 percent, including the budget for NOAO. However, NOAO is also required to spend $1.425M on the construction of SOLIS, a facility for synoptic observations of the Sun. The net effect is a $200K decrease relative to last year in the budget for operating all other aspects of the NOAO program. If we allow for imposed increases in health care costs and for a 3 percent salary increase (all surveys show that our salaries, especially for technical and scientific staff, are much further behind our comparison groups than 3 percent), then the budget for this year falls short of maintaining last year's level of services by $1M. Since the increase requested for FY 2000 in the President's submission to Congress is 2.9 percent, we can expect no significant relief next year.

If the NOAO budget had merely kept pace with inflation since 1984, the year that the observatories were combined into a single organization, the budget would be $8.5M higher. What that means is that on average the budget has been reduced by an average of $570,000 every single year for 15 years. And we have managed to add GONG, WIYN, and support for US activities related to Gemini to the suite of programs that we carry out.

The percentage decrease is comparable or slightly smaller in the grants program and in the budgets for the other centers. Since NOAO represents about of the NSF astronomy budget, what this means is that, had astronomy funding simply maintained its purchasing power, the funding would be about $30M/year higher. *That would be sufficient to fund nearly every NSF initiative that we have considered as a community,* whether it is enhancing support for theory or increasing support for instrumentation. Indeed one might have expected that the enormous opportunities in astronomy should have led to *increased* support for the field as a whole, rather than the substantial decrease that has actually occurred.

Given my understanding of the budgets, I do not believe that NOAO management can identify a plan that will both reduce the budget to the level of funding that will likely be available in FY 2000 and be acceptable either to ourselves or to the user community. It is my conviction that the time has come to restructure NOAO in fundamental ways, and I plan to propose such restructuring to AURA within the next two months. The community will be kept fully informed in a timely way about restructuring plans.

Sidney C. Wolff

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GNIRS

As you are aware, the delivery of the Gemini Near Infrared Spectrograph by NOAO will be substantially overbudget and will be delivered late. In addition to the inadequacy of management oversight, which failed to detect the fact that the formal reports on project status were not correct, we have discovered substantial problems with the original mechanical design. We are, accordingly, in the process of repackaging the instrument. The optical, electronics, and software designs were sound and will be retained. More details about why the management failures occurred can be found on the NOAO web site.

We do not expect the redesigned instrument to cost more or take longer than it would have taken to complete the original design, and the original design would not have met specifications. It is my understanding that the international Gemini project staff is much happier with the changed design.

Because most of the problems with this project were caused by NOAO staff, NOAO will cover the additional costs of completing the instrument. The total cost to NOAO will be approximately $3M, with $1M having already been committed and the remaining $2M to be committed in nearly equal installments over the next four fiscal years.

Much concern has been expressed about the impact on other NOAO programs of this $3M commitment to Gemini. The increased cost of the GNIRS will have negligible impact on the observatory relative to the impact of the pattern of persistent and systematic reduction in the purchasing power of the funding provided to NOAO by the NSF. Compare $3M for the GNIRS with the impact of the reduction in the purchasing power of the NOAO budget over the past 15 years, which at an average of $4.25M per year integrated over each of the past 15 years (see) amounts to a total of nearly $64M in 1998 dollars in instruments that were never built and projects that were never started. At least the $3M for the GNIRS will ultimately provide a first rate instrument to the users of Gemini.

Sidney C. Wolff

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NOAO Preprint Series

The following preprints were submitted during the period 1 December 1998 to 28 February 1999. Please direct all requests for copies of preprints to the NOAO author marked.

822 *Lauer, T.R., "Combining Undersampled Dithered Images"

823 *Suntzeff, N.B., et al., "Optical Light Curve of the type Ia Supernova 1998bu in M96 and the Supernova Calibration of the Hubble Constant"

824 *Armandroff, T.E., Da Costa, G.S., "The Andromeda Dwarf Spheroidal Galaxies"

825 *Keller, C.U., "Optimum Apodization for Speckle Imaging of Extended Sources"

826 *Keller, C.U., "An Advanced Solar Telescope: I. Science Goals"

827 Bell, E.F., *Hill, F., Harvey, J.W., "Estimation of Seeing Quality Using Low-Resolution Solar Image Data"

828 *Jacoby, G.H., Ciardullo, R., "Chemical Abundances of Planetary Nebulae in the Bulge and Disk of M31"

829 *Pilachowski, C.A., Barden, S.C., "Future Prospects for Spectroscopy with Large and Small Telescopes"

830 *Brown, C.L., "A VBA Desktop Database for Proposal Processing at National Optical Astronomy Observatories"

831 *Howard, R.F., Gupta, S.S., Sivaraman, K.R., "Measurement of Kodaikanal White-Light Images. II. Rotation Comparison and Merging with Mount Wilson Data"

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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.

Blum, R.D., Damineli, A., Conti, P.S. "The Stellar Content of Obscured Galactic Giant HII Reginos I.: W43"

Garnavich, P.M., Jha, S., Challis, P., Clocchiatti, A., Diercks, A., Filippenko, A.V., Gilliland, R.L., Hogan, C.J., Kirshner, R.P., Leibundgut, B., Phillips, M.M., Reiss, D., Riess, A.G., Schmidt, B.P., Schommer, R.A., Smith, R.C., Spyromilio, J., Stubbs, C., Suntzeff, N.B., Tonry, J., Carroll, S.M. "Supernova Limits on the Cosmic Equation of State"

Hines, D.C., Schmidt, G.D., Wills, B.J., *Smith, P.S., Sowinski, L.G., "The Misdirected Central Engine of the Hyperluminous Infrared Galaxy and QSO-2 IRAS P09104+4109"

Micela, G., Sciortino, S., Harnden, F.R., Kashyap, V., Rosner, R., Prosser, C.F., Damiani, F., Stauffer, J., Caillault, J.-P., "Deep ROSAT HRI Observations of the Pleiades"

Olsen, K.A.G. "Star Formation Histories from HST Color-Magnitude Diagrams of Six Fields of the LMC"

Riess, A.G., Filippenko, A.V., Challis, P., Clocchiatti, A., Diercks, A., Garnavich, P.M., Gilliland, R.L., Hogan, C.J., Jha, S.,

Kirshner, R.P., Leibundgut, B., Phillips, M.M., Reiss, D., Schmidt, B.P., Schommer, R.A., Smith, R.C., Spyromilio, J., Stubbs, C., Suntzeff, N.B., Tonry, J. "Observational Evidence from Supernovae for an Acceleration Universe and a Cosmological Constant"

Suntzeff, N.B., Phillips, M.M.,Covarrubias, R., Navarrete, M.,Perez, J.J., Guerra, A., Acevedo, M.T., Doyle, L.R. Harrison,T., Kane, S., Long, K.S., Maza, J., Miller, S., Patti, A.E., Claria, J.J., Ahumada, A.V., Pritzl, B., Winkler, P.F. "Optical Light Curve of the Type Ia Supernova 1998bu in M96 and the Supernova Calibration of the Hubble Constant"

Wang, J., Heckman, T.M., Lehnert, M.D., "On the Structure and Morphology of the `Diffuse Ionized Medium' in Star-Forming Galaxies"

Williams, R.M., Chu, Y.-H., Dickel, J.R., Smith, R.C., Milne, D.K., Winkler, P.F. "Supernova Remnants in the Magellanic Clouds II: SNR Breakouts from N11L and N86"

Pat Breyfogle, John Cornett,
Suzan Ecker, Mary Guerrierri,
Elaine Mac-Auliffe, Shirley Phipps

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NOAO Educational Outreach

The NOAO Educational Outreach Department is responsible for Information Requests, Scientific Press and Media Relations, and Educational Outreach Programs.

Our NSF-funded Teacher Enhancement Program, *The Use of Astronomy in Research Based Science Education (RBSE)*, is a cornerstone of the department, providing a research experience to middle and high school teachers from around the country and helping them facilitate classroom research projects. Over four weeks this summer, the third annual RBSE workshop will take place in Tucson and on Kitt Peak. Teachers and mentors are being recruited now; see the application form for more information at: http://www.noao.edu/outreach/rbse/.

Two grant proposals were recently submitted to strengthen the RBSE program by NOAO Outreach Astronomer and Kitt Peak Staff Scientist, Travis Rector:

- *Internet Tools for Research Based Science Education* was submitted to the STScI/NASA IDEAS Grant Program and has been funded. This effort will develop freely available software tools capable of astronomical analysis needed by educational programs such as RBSE for modest computing facilities commonly found in middle and high school classrooms.
- A second proposal, *Research Based Science Education with the HST*, was submitted to STScI as a HST Cycle 8 Education/Public Outreach supplement. This effort consolidates eight NOAO-affiliated HST observing programs and integrates their research into the RBSE Teacher Enhancement framework.

Since 1996, NOAO has been the lead institution for the expansion of the ASP's Project ASTRO into the Tucson area. Our three years of funding wind down this fall, but not before a fourth training workshop takes place in September, bringing the number of teachers and astronomers trained through this expansion to over 150.

We are exploring methods of keeping key elements of Project ASTRO alive in NOAO Educational Outreach, particularly the worthwhile training of area astronomers and teachers interested in partnering for classroom inquiry of astronomy and science. To that end, an education supplement was submitted with a NASA Technology Development proposal (K. Hinkle, PI) for the *Evaluation of Coarsely Ruled Gratings*. This effort would fund four astronomers and two high school teachers to participate in the next Project ASTRO-Tucson workshop and enhance their classroom teaching of spectroscopy and the nature of light.

Images from the NOAO collection are frequently requested by textbook authors and others for reproduction and

publication. Thanks to the efforts of Nigel Sharp, Jeannette Barnes, and Dave Bell, the NOAO Image Gallery is now available on the Web at URL http://www.noao.edu/image_gallery. There you will find images at a variety of resolutions and conditions for their use.

The tenth NOAO press release of 1998, *Science Selects NSF-Supported Research on the Accelerating Universe as the Top Advance in Science for 1998*, was distributed and made available at http://www.noao.edu/outreach/press/. We are increasing efforts to help users of NOAO facilities distribute their science discoveries and images to the media and public. For more information, please see Sidney Wolff's article elsewhere in this Newsletter.

Suzanne Jacoby, NOAO Educational Outreach

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NOAO Nighttime Proposals Due for 1999B

Proposals for observing time for the 1999B observing semester (August 1999-January 2000) at Cerro Tololo Inter-American Observatory and Kitt Peak National Observatory are due in March 1999. The deadline for Survey Proposals is Monday evening 15 March Midnight MST. Regular or standard proposals are due Wednesday evening 31 March Midnight MST.

Proposal materials and information are available on our Web page at http://www.noao.edu/noaoprop/ (see accompanying articles in this section of the Newsletter for changes to the proposal form and other important proposal information). Proposal materials are no longer available by FTP. *Investigators are requested to use the Web form to initiate all new proposals.* Although the Web form is the starting point for all proposals we do provide two options for submission (note that paper submissions are no longer an option).

- **Web submissions.** The Web form may be used to complete and then submit proposals. The information provided on the Web form is formatted and submitted as a LaTeX file, including figures that are "attached" to the Web proposal as Encapsulated PostScript files.
- **E-mail submissions.** If you prefer to prepare your proposal locally as a LaTeX file and then submit it by e-mail, that option is still available. Using the Web form investigators are requested to fill out the general information, investigator information, and run information pages.

  After these pages have been completed the "Email LaTeX File" button on the bottom of these pages may be pressed to return a "customized" LaTeX template for completion and submission by e-mail. Follow the instructions in the LaTeX template for submitting proposals and figures.

There are several addresses available to help with proposal preparation and submission:

http://www.noao.edu/noaoprop/
Web proposal materials and information

noaoprop-help@noao.edu
Help from a person for proposal preparation

noaoprop-letter@noao.edu
Address for thesis and visitor instrument letters

noaoprop-submit@noao.edu
Address for submitting LaTeX proposals by e-mail

ctio@noao.edu
CTIO-specific questions related to an observing run

kpno@noao.edu
KPNO-specific questions related to an observing run

Once again we would like to thank the astronomical community for their continued cooperation in using the electronic submission process.

The NOAO Proposal Team

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Changes to the NOAO Proposal Form and Process

With observing proposals for the MMT, HET, and Gemini not far away, we are modifying the NOAO proposal form and process to better accommodate these new facilities. We list here a summary of the major changes to the proposal form and process. Also see other articles in this section of the Newsletter.

- **No more paper submissions.** With this observing period NOAO officially announces that we will no longer accept paper submissions. This new policy should have "zero" impact since we have had no paper submissions in the past two semesters. Details about the submission processes are outlined in accompanying articles.
- **One title, one proposal.** A single observing proposal may now request up to six observing runs at any of the NOAO facilities. For example, a single proposal may include requests for time on the WIYN and the 4-m at Cerro Tololo.
- **Web access to form.** All proposals must be started through the NOAO Web-based proposal form available at http://www.noao.edu/noaoprop/. Specific fields on the general information, investigator information, and runs requested pages must be completed before a customized LaTeX template, based on the run information specified, will be returned to you by pressing the "Email LaTeX File" button on the form. This returned LaTeX template may be edited and submitted by e-mail, if that is the submission option you choose.
- **Select proposal type.** NOAO now supports two types of proposal forms - standard and survey. Although the forms are similar there are some differences so be sure to select the proper proposal type on the proposal form home page before beginning a new proposal - for most investigators this will be "standard." Select "survey" only if you submitted a letter of intent prior to 29 January.
- **Science category selection.** On the general information page investigators are asked to select a science category keyword that best matches their proposal (see the accompanying article in this section). The panel selection will be assigned automatically when the proposal is submitted.
- **CoI information.** We no longer require detailed address information for co-investigators - just full name, affiliation, e-mail address, and status.
- **Run information expanded.** Up to six observing runs may be specified with each proposal. For each run, up to twelve instrument configuration parameters may be specified. You are also asked to complete a technical description for each run describing the observations to be made during that run (this information was previously included in the experimental design section). Run information is still summarized on the front page of the printed copy but the expanded information is printed later in the form.
- **Optimal/acceptable dates change.** Each run can now have one range of optimal and one range of acceptable month ranges associated with it, e.g, Sep-Dec. We have expanded the "scheduling constraints and non-usable dates" line to four lines to accommodate additional comments that may be needed based on these range changes.
- **Figure option enhanced.** If you use the attachment option on the Web form for figures, you will notice that each figure and caption can now include one or two figure files - if two figure files are submitted for a figure they will be placed side-by-side - in LaTeX terms we are accepting "plottwo"s. An option is available for rotating each of the figures in a plottwo figure environment.
- **Target tables move.** Target tables are now tied to each run and will appear in the printed copy along with the run details. Target tables are required for all WIYN and YALO runs, but are optional for other instruments and telescopes.
- **Spectroscopic ETC available.** Investigators now have a spectroscopic and an imaging exposure time calculator to assist them in preparing proposals. See the accompanying article in this section.
- **Instrument lists update.** As always, investigators should check the telescope/instruments lists for any changes. Many of these will be documented in this Newsletter in either the CTIO or KPNO sections.

There are other minor changes to the form so please read all the documentation provided on the side-bar of the before preparing your proposal for 99B. If you have any questions about the proposal process or form please send e-mail to noaoprop-help@noao.edu.

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NOAO Newsletter - SCOPE - March 1999 - Number 57

Survey Proposals A New Opportunity

Letters of intent for NOAO's new Survey Program have been received for the upcoming first deadline for proposals, 15 March 1999. The Survey Program makes available up to 20% of the time on all NOAO telescopes for proposals to carry out surveys. Surveys are defined as significant (up to five years in duration) observational programs that

- address novel, well-focused scientific goals;
- enable scientific programs requiring large, statistically complete, and homogeneous data;
- provide a basis for planning more detailed follow-up studies;
- enable extensive archival research; and
- represent a significant enhancement over existing surveys.

Survey proposals will be written using a Web-based form similar to that for standard proposals, but with several important differences. The scientific justification section will be expanded to include other potential uses of the survey data (in addition to that proposed as the goal of the proposing team) as well as benefits in other areas such as educational outreach and return of expertise to the community. The experimental design section will be modified to include a management plan, including an explanation of how the data will be reduced and archived, and a description of how the data will be made available to the community. Detailed instructions are available through the Web-based form. Note that survey proposals will only be accepted from investigators who submitted a letter of intent.

Survey proposals will be reviewed and ranked first by a panel separate from those evaluating the standard proposals. A joint TAC will subsequently consider the allocation of time to survey proposals. New proposals will be solicited annually. PI's of ongoing surveys are expected to submit progress reports for review by the Survey panel until the survey is completed. We will also attempt to keep the community informed about the progress of ongoing surveys through Newsletter articles, Web pages, and AAS meetings.

Todd Boroson

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Selecting a Science Category Rather Than a TAC

One of the changes to the 1999B proposal process for telescope time is the addition of subject categories to the proposal form. Investigators will be asked to select from a list of subjects the one science category which best matches their proposal. Based on the selection of science category, the submitted proposal will be assigned to one of the TAC panels for review and evaluation. As part of the revisions that NOAO is making to the proposal process, the science categories include a list of broad subjects in solar system, galactic, and extragalactic astronomy. A choice of "Other" in each area is also possible for programs that do not fit any of the science categories available.

When you begin your proposal on the Web, please select the science category from the pull-down menu that best

describes your scientific program. A more complete description of each category is available in the on-line documentation.

The NOAO Proposal Team

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Exposure Time Calculators

NOAO, in a collaborative effort with CTIO and KPNO, now supports two exposure time calculators for assisting investigators in preparing their observing proposals. Both are IRAF tasks available through a Web-interface.

- During the last observing proposal period the ccdtime interface at http://www.noao.edu/scope/ccdtime/ was used by most investigators (based on the number of hits) to estimate exposure times for CCD and IR imaging requests.
- A new tool called *spectime* for computing exposure times for all spectroscopic instruments at NOAO is available at http://www.noao.edu/scope/spectime/. Spectime, written by Frank Valdes, is an IRAF adaptation of the exposure time calculator which has been available for some of the spectroscopic instruments at CTIO for the last few years.

All proposers are encouraged to use these tools for estimating the number of nights for each run on the front page of the proposal form and for their technical justifications on the run details pages.

Many scientific staff members have contributed input into these tasks including comments, suggestions, testing, calibration files, etc., and we are grateful for their involvement.

Kitt Peak maintains two additional tools as an aid to investigators to identify imaging or spectroscopic needs and exposure times:

http://www.noao.edu/kpno/imaging/imaging.html
identify a telescope/instrument configuration from input requirements;

http://www.noao.edu/kpno/spectroscopy/spect.html
predict a telescope/spectrograph combination based on input parameters.

Also see the CTIO home page (http://www.ctio.noao.edu/) and KPNO home page (http://www.noao.edu/kpno/) for additional information.

Todd Boroson, Jeannette Barnes

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Changes to the TAC Process

As part of our effort to develop an integrated process for getting telescope time to undertake complete scientific programs, the way in which proposals are evaluated is changing. Starting with the upcoming deadline for the 1999B semester, proposals for all NOAO telescopes will be reviewed in a single set of meetings. Dave De Young, who has chaired the KPNO TAC for many years, will oversee the new process. For the current cycle, the facilities include KPNO and CTIO, but the national access time on the MMT and the HET will be added in over the next year and the US time on

Gemini shortly after that. The concept, which has been endorsed by the NOAO Users' Committee, the AURA Observatories Council, and the AURA Observatories Visiting Committee, is to divide proposals among discipline-based panels rather than site-specific TACs. Merged ranked lists are generated for each telescope using a simple numerical algorithm and these lists are reviewed by a "merging TAC" with representation from all the panels. The final, TAC-approved, ranked lists are then submitted to the site directors and telescope schedulers.

Initially, there will be four different disciplines: galactic, extragalactic, solar system, and surveys. There will be two separate panels of each of the galactic and extragalactic types, making a total of six panels. The split between the two galactic panels or the two extragalactic panels will be based on a combination of subject matter and telescope. The goal, however, is not to narrow the range of subject reviewed by any single galactic or extragalactic panel, but to ensure that all proposals to do the same or similar science are reviewed by the same panel.

In order for the sequence of panel and merging TAC meetings to be practical, we will schedule them to occur within a single week, roughly four weeks after the proposal deadline. We hope that this will allow us to streamline the process and minimize duplicate effort. As additional telescopes are added, we will add more panels, with the intent of limiting the number of proposals that each panel reads to about 100.

The goal of these changes is to encourage proposers to think about and present their work in a more complete scientific context. Proposals that require facilities in both northern and southern hemispheres will be allowed, and we will try to understand the relationships between smaller and larger telescopes. Of course, we will continue to assess the success of this method of reviewing observing proposals and further modify it if necessary.

Todd Boroson

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A New NOAO-Chile Partnership

With so many new facilities under construction in Chile that provide access to telescope time for Chilean astronomers, our southern colleagues are establishing a new procedure for applications for telescope time. Chilean astronomers will apply for time through a new national TAC rather than directly to the individual facilities. NOAO has agreed to assist by providing access to the NOAO Web Proposal Form for Chilean national proposals for time at CTIO. Proposals received in Tucson will be checked for completeness and for LaTeX usage before being forward on to the Chilean National TAC. NOAO is pleased to be able to provide this assistance.

Todd Boroson

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Approved Proposal Abstracts Now Available on the Web

Starting with the 1999A observing proposals (February-July 1999), abstracts of approved proposals are now being posted on the Web. The links to the abstracts are available on the CTIO and KPNO telescope schedule Web pages (available from the NOAO home page), either from the monthly telescope schedules or from the approved proposal list for each semester. Plans are to continue these postings for subsequent semesters.

Jeannette Barnes

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South Pole Observing is Cool

The astronomical community will receive approximately 30% of the time on the SPIREX/Abu facility during the next austral winter (March-October 1999). Because of the cold, dry, stable conditions at the site, this facility provides exceptional performance in the L and M bands. The response to NOAO's call for proposals for observing time at the South Pole surpassed our expectations. We received 45 proposals requesting approximately 4,086 hours of observing time, representing an oversubscription ratio of about six. All of the proposals were successfully submitted via the NOAO Web form. Eight of the proposals, or 17% of the total, were requests for thesis observations.

On 15 January 1999, a qualified group of scientists gathered in Tucson to undertake the daunting task of ranking these proposals. The panel consisted of James Jackson (Boston), William Latter (IPAC), John MacKenty (STSci), Michael Merrill (NOAO), and Michael Meyer (Steward). Tod Lauer (NOAO) chaired the meeting.

We wish everyone successful programs.

Todd Boroson

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Journals Available

An unbound set of *The Astrophysical Journal*, volumes 219 to 263 is available for ***free*** from the NOAO Library (shipping charges to be paid by recipient). Contact me at library@noao.edu if you are interested.

Mary Guerrieri

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Mosaic II Imager at CTIO

A clone of the 8K Mosaic Imager presently in use at the KPNO Mayall and 0.9-m telescopes will be commissioned at the Blanco prime focus during 1999. This new facility instrument replaces the Big Throughput Camera, previously available

through a collaboration with Tony Tyson and Gary Bernstein.

The dewar (with engineering grade devices) and filter assembly have already been received at CTIO. The eight SITe 2K 4K CCDs for Mosaic II are being tested in the Tucson CCD Lab during early 1999. After assembly of the science-grade focal plane, the CCDs will be taken to CTIO and installed in the dewar, to be followed by full system tests. Concurrently, we will modify the prime focus area, strengthening the pedestal and enlarging the cage doors. Mosaic II is scheduled to be put on the 4-m for engineering tests on 12 July. It is planned to be available for general visitor use for Semester 1999B, with the caveat that we intend to restrict access during August when we plan a second engineering run.

Since Mosaic II is a clone of Mosaic I, much of the extensive documentation available for the latter is directly relevant.You can find this at: http://www.noao.edu/kpno/mosaic/manual or via a link from the CTIO Optical Instruments page http://www.ctio.noao.edu/instruments/optical_instruments.html.

Information on aspects that are different between the two installations (e.g. filters available) will be found via the CTIO address, and we will continue to add more information, such as CCD properties, as it becomes available.

Mosaic II will not be offered at any telescope apart from the 4-m prime focus. Mosaic II offers a finer pixel scale than the BTC, and there has been little demand and no scheduled use of Cass focus CCD imaging in recent semesters. Hence we will no longer offer CCD imaging at Cass focus. The Mosaic II at prime focus will be the only optical imager scheduled at the Blanco 4-m.

Alistair Walker (awalker@noao.edu)

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Hydra CTIO On the Air and Science Ready

Hydra CTIO was installed on the Blanco Telescope on 7 and 8 January for the last scheduled engineering run before it goes into service on a shared-risk basis in March 1999. The instrument performed very well, with no significant problems. The positioning was excellent. The user interface was reliable and straightforward to use. The new bench spectrograph, corrector and comparison lamp system behaved well. The fibers appear to be quite uniform and efficient. The FOPS guider is working nicely. The basic process of commissioning Hydra is essentially over and the instrument is ready for scientific use.

There remain a number of pending issues to be resolved, the most important of which are the need to change to a better camera/CCD detector system and the installation of the small fibers. We expect both of these to be completed by the end of the coming semester. Other problems will doubtless appear as people start to use the instrument, but by and large Hydra is ready for use, right on schedule.

Even though Hydra isn't completely finished, this is a good opportunity to give well-deserved kudos to all the members of the team who have participated in this project and give my personal thanks to everyone who has put their energy into building Hydra CTIO, especially to Sam Barden. The progress and success of this project is due in no small part to Sam's coming to Chile for three months, with his family, and devoting himself tirelessly to the commissioning process.

Much credit also belongs to Rolando Cantarutti, who kept the project on track by his willingness to go to Tucson for several months, completely immersing himself in Hydra.

Thanks also go to Gary Muller, Tom Roussey, and Dave Dryden for coming to Chile and doing an excellent job of installing Hydra and showing the CTIO staff how to use and maintain it, as well as for their work in building it in the first place.

I can't write this without also emphasizing the contribution of Fabian Callao who devoted a tremendous amount of energy and time beyond the call of duty to the job of getting the fibers installed and polished. His efforts will show in the quality of the science Hydra will produce. Gracias, Fabian!

And we must all remember the contribution of our late colleague, Lee Groves, who worked hard on the software as long as his health permitted and left a significant part of himself in it.

Thanks Sam and Rolo! And thanks also to Fabian, Gary, Tom and Dave as well as Rodolfo Cardemil, Jeff Lewis, Andres Montane, Hugo Ochoa, Gabriel Perez, Rich Reed, Nelson Saavedra, German Schumacher and anyone else who I should give credit to but have forgotten.

This project has been an outstanding example of how cooperation and collaboration between NOAO North and South

can and ought to function. The two hemispheres functioned as a team, working towards a common goal. That's how it should work and it looks like it did!

Tom Ingerson (tingerson@noao.edu)

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Update On the Return of OSIRIS

CTIO and The Ohio State University are upgrading the Ohio State Infrared Imager and Spectrometer (OSIRIS) with a 1024 format HgCdTe array. It will be made available as a facility instrument for Semester 1999B.

The science grade array from Rockwell is now (January 1999) in the instrument and being tested in preparation for scheduled engineering runs in February and March. Look for information regarding OSIRIS performance on the CTIO infrared instruments web pages in March. Observers with scheduled time at CTIO in 1999A with the IRS or CIRIM will be given the opportunity to observe with OSIRIS where appropriate. We expect that OSIRIS will be the instrument of choice for IR imaging and spectroscopy for 1999B and subsequent semesters.

A brief summary of OSIRIS capabilities follows. Please see the September 1998 NOAO Newsletter (No. 55) for more details. OSIRIS provides two imaging scales. On the 4-m, this will maximize efficiency with the f/14 tip-tilt system under differing conditions. A 0.15" pixel scale will take advantage of Cerro Tololo's best corrected seeing, while a 0.4" pixel scale will allow productive observations even when the site seeing is not at its best. The square field of view will be approximately 70" on a side at the fine scale on the 4-m; the field of view at the coarser scale will be about 3.5 3.5'. The corresponding fields on the 1.5-m will be 2.7' 2.7' at 0.4" pixel and 10.3' at 1.1"/pix. The filter set includes JHK and narrowband filters.

In addition to 1-2.5 m imaging, OSIRIS provides spectroscopic capability in the same dewar. The new pixel scale will result in resolution 2900 spectroscopy covering each of the J, H, or K bands in one grating setting. This mode uses the fine pixel scale and the slit will be approximately 3 pixels wide (0.45" on the 4-m). In addition, a cross dispersed mode will cover J, H, and K bands simultaneously at resolution 1200. The XD mode will use the 0.4"/pix scale with a slit about 1.2" wide. The IRS spectrometer will remain available for IR spectroscopy at higher resolution and/or wavelengths longer than the K band.

If you have questions regarding OSIRIS, please contact Bob Blum, Patrice Bouchet, Brooke Gregory, or Ron Probst at CTIO (rblum@noao.edu, pbouchet@noao. edu, bgregory@noao.edu, rprobst@noao.edu).

Bob Blum (rblum@noao.edu)

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Changes to Proposal Process for CTIO Proposals

As part of an NOAO-wide effort to reorient the proposal process to an emphasis on scientific programs, rather than sites and telescopes, there will be significant changes to the submission and review procedures for Semester 1999B. These are discussed in detail in a series of articles in the SCOPE section of this Newsletter; this note serves as a pointer to them. Please see the SCOPE section for more information.

Ron Probst (rprobst@noao.edu)

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The 1999 CTIO Summer Student Programs

Once again, summer in La Serena means a beach full of tourists and the Recinto full of summer students in astronomy and engineering.

A total of 19 well-qualified applicants competed for the four available positions in the 1999 Cerro Tololo Inter-American Observatory Research Experiences for Undergraduates (REU) Program. This NSF-sponsored program is open to undergraduate students in astronomy and physics from US institutions. Our site director is Don Hoard. The 1999 REU students are:

Alicia Soderberg (Bates). Alicia will be working with Nick Suntzeff on a project to analyze observations of SN 1987A.

Jeremy Buss (Wisconsin, Oshkosh). Jeremy will be working with Knut Olsen, attempting to understand the elliptical bubble HII region "Hubble II" in NGC 6822.

Jenny Greene (Yale). Jenny will be working with Stefanie Wachter to determine the orbital period of the low mass X-ray binary LMC X-2, using data from the YALO telescope.

Jessica Kim-Quijano (Towson). Jessica will be working with Don Hoard to determine the orbital period of the unusual double-lined cataclysmic variable Phe 1.

More information about the CTIO REU Program can be found on our web page at http://www.ctio.noao.edu/REU/reu.html.

This year we have started a new program for advanced Chilean astronomy students, the CTIO Practica de Investigacion en Astronomia (PIA) program. This program is open to all Chilean astronomy students in their last year of undergraduate or first two years of graduate school. We have one participant this year:

Ricardo Demarco (Pontificia Universidad Catolica de Chile). Ricardo will be working with Nick Suntzeff and Bob Schommer on a cosmology-related project.

We also have two Chilean engineering students working in the Engineering section for their practicas ("real world" work experiences which form part of their educational curriculum):

Mario Caceres, an EE student (U. Federico Santa Maria). Mario is working with Roger Smith on monitoring nocturnal clouds, OH emission and light pollution with CCDs and wide angle lenses.

Cecil Acevedo, an EE student (UFSM). Cecil is working with Marco Bonati to develop a GUI which will monitor and log engineering telemetry data from all Arcon CCD systems in use over the local network.

In addition to research and work experiences, the CTIO summer programs provide an opportunity for cultural enrichment. We encourage this by housing all the US and Chilean students together in Casa 13, with the responsibility of doing their own shopping, cooking, and housekeeping great vocabulary builders in both languages! They'll be there until around 20 March, when the REU program officially ends.

Malcolm Smith (msmith@noao.edu),
Don Hoard (dhoard@noao.edu),
Ricardo Schmidt (rschmidt@noao.edu),
Roger Smith (rsmith@noao.edu)

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Driver's License Requirements for CTIO

Due to the distance between our dormitory and dining facilities and the telescopes, observers at CTIO are issued vehicles for their use while on the summit. Our venerable fleet of Volkswagen Beetles has recently been replaced by new cars with automatic transmissions (no more frantic searches for first gear on that uphill curve!).

Visiting investigators will need to bring a current driver's license, valid in their home country, to be permitted to drive on the mountain top private CTIO roads. CTIO vehicles may not be driven off the summit or to Cerro Pachon by observers.

Chilean law requires that foreign drivers also have an international driver's license if they are to use public roads. In the US, this can be obtained through local American Automobile Association offices for a modest fee.

Enrique Figueroa (efigueroa@noao.edu),
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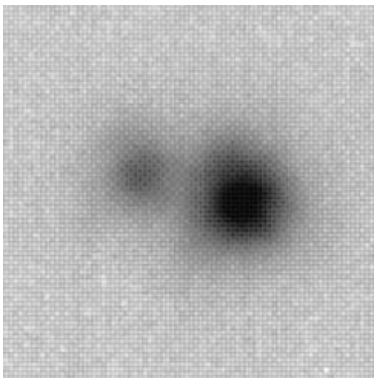
Imaging at WIYN Achieves New Standards

Recent improvements in imaging performance at WIYN coupled with periods of superb atmospheric conditions have set new standards for delivered image quality. This was particularly evident during a recent Yale observing run where during four nights (UT 4-7 Jan 1999) Yale astronomers measured the delivered image quality to be better than 0.6" FWHM 65% of the time during the entire run, with periods as good as 0.3". This demonstrates the quality of the site, the potential of WIYN, and drives our ambition to make the best utilization of imaging performance. As an example of the superb imaging performance of WIYN, the image shown below is of the binary star Ho 532 taken with the Rochester Institute of Technology fast readout CCD. Elliott Horch (RIT) and John Lee (Yale) obtained this 2.4s exposure at a central wavelength of 8532 on UT 5 Jan 1999. The magnitudes of the two stars are 9.28 and 11.63, and the separation between them is 0.66". The 30 milli-arcsecond/pixel plate scale of the RIT CCD yields a delivered image quality of 0.32" FWHM.

The WIYN organization is committed to enhance the scientific performance of the observatory. Through a long-term commitment of increased technical support, significant progress has been made on many technical efforts to improve imaging performance. Following is a brief summary of some of the more significant improvements accomplished over the past few years:

1) At WIYN, wavefront curvature analysis is used to measure the optical aberrations of the telescope. The wavefront Zernicke representation of the telescope's optics are converted to forces applied to the primary mirror, and to tilt and focus corrections that are applied to the secondary mirror to remove the measured aberrations. The process used to obtain the wavefront curvature measurements has been recently streamlined to tune out nightly optical aberrations more efficiently. This upgrade involved incorporating a dedicated small format CCD camera instead of the large format Science CCD Imager to reduce overhead involved with wavefront measurements. Experience with the new system revealed that subtle "tuning" of the wavefront process was necessary to achieve optimum performance.



Caption: *Ho 532 (Image credit: Elliott Horch (RIT) , John Lee (Yale))*

The software client responsible for interpreting the wavefront Zernicke representation to force and tilt corrections was initially tuned primarily by empirical means. The client thus is particularly sensitive to the physical manner in which the wavefront images are obtained. In particular, the results of the wavefront analysis are dependent on the extra-focal distance at which the wavefront images are obtained. By recreating the conditions of the original wavefront process, we have substantially improved the reliability and repeatability of each wavefront measurement, and of the WIYN active support system.

2) The control of secondary mirror motions, thus active focus and collimation, has been improved through better communication between the telescope subsystems. We have incorporated a two-way communication between the control system and the serial subsystems, such as secondary control, so that commands are now acknowledged and verified. This improvement has eliminated problems where commands were being dropped when a burst of commands was issued to a subsystem. For example, during telescope slews, a burst of secondary motion commands maintains active collimation of the secondary mirror. The improved reliability of the secondary motion commands being successfully completed results in a more stable collimation of the telescope during the course of the night.

3) One of the more significant contributors to degraded imaging performance is focus stability. The optical configuration at WIYN makes the focus sensitive to less than 10 m of motion at the secondary mirror (our method of focusing). This, coupled with the fact that the focus of the telescope is influenced by many factors, such as thermal changes in the telescope structure, active collimation, and thermal conditioning of the primary mirror, itself makes for complex interaction between physical conditions and focus. Improvements to the focus stability have been realized through several means. The implementation of a software client to arbitrate secondary motion commands allows for prioritization and better control of secondary motions. A thermal feedback for the truss structure has been incorporated to allow temperature-dependent focus changes to be modeled and corrected within the secondary control. The algorithm used for temperature corrections has been refined as experience has been gained.

Currently, the most significant contributor to focus instability is the primary mirror thermal system. As the thermal system servos compensate for changing ambient conditions, the temperature of the air cooling the primary mirror changes on short timescales, causing rapid defocus in the primary mirror. Efforts are currently aimed at understanding the effects of thermal conditioning of the mirror on focus with hopes that the interaction is predictable and can be modeled.

4) We have learned from empirical data that rapid cooling of the mirror introduces optical aberrations, primarily astigmatism. This introduced instability in the optical performance of the telescope during the course of a night (sometimes on short time-scales), especially when ambient air temperature fluctuated rapidly. We found that the twelve heat exchangers within the mirror cell used to condition the air behind the primary mirror required critical balancing to assure that the mirror was immersed in uniform temperature air. Recent efforts have improved this heat exchange balance from ~1C variance among the heat exchangers to ~0.1C variance.

This effort has dramatically improved the stability of astigmatism in the telescope during the course of a typical observing night, allowing the "open loop" active corrections to maintain better optical performance, and has helped to reduce the fluctuations in focus. In addition, it has allowed us to obtain a stable set of data for building the active optics look-up tables. In the past, thermal variations introduced unacceptable variations in astigmatism during the course of obtaining the elevation-dependent data for the look-up tables. We now have look-up tables that produce no worse than 165 nm of wavefront RMS error from an elevation range of 20 to zenith (WIYN's goal is 200 nm wavefront error or less).

5) The most important attribute of an Alt/Az telescope to track open loop is its ability to point. Recent developments in our understanding of the behavior of the elevation axis and the correct implementation of the control system refraction code have resulted in all-sky pointing as accurate as 3" RMS. Open loop tracking has thus been vastly improved, which in turn results in better unguided imaging performance. Future work to characterize the harmonic character of the elevation and azimuth axes could reduce the pointing residuals even further.

6) The vacuum support system for the secondary mirror has been reconfigured and tuned to provide a more stable vacuum flow to the mirror. As a result, elevation-dependent trefoil aberrations in the wavefront have been essentially eliminated with very little elevation-dependent variation.

Several additional enhancements are planned for the future at WIYN to further improve the imaging performance. For example, a nearly-complete project will implement a focus sensor at the imaging port to measure gradual changes in focus caused by the telescope and to provide closed-loop corrections for focus variations. Projects are also underway to implement rotational guiding at the imaging port and to characterize and eliminate a 24 Hz vibration in the top-end of the telescope that under certain conditions can distort images by as much as 0.15".

The delivered image quality being realized at WIYN opens the doors to many interesting science projects that require excellent seeing over a reasonably wide field (a few arcmin). The improvement in seeing brings very significant improvement in the signal-to-noise for faint point-like sources, and higher contrast in looking for structure in resolved sources. The science projects that this improvement enables are too numerous to list comprehensively, but among them are the study of star-forming regions, stellar populations and variable star surveys in nearby galaxies, the study of super star clusters, monitoring of supernovae at high redshift, galaxy structure (at 0.4" seeing galaxies at all redshifts are resolved at the few kiloparsec scale), and the survey and photometry of gravitational lenses.

One of the most important goals of the WIYN Consortium is to exploit the good seeing conditions at WIYN maximally. The tip-tilt camera being developed for WIYN will help to further enhance the scientific potential of WIYN under good seeing conditions. The queued observations taken in the NOAO fraction of WIYN time are set up to utilize the best seeing conditions for the programs that require it, thus optimizing the use of this resource. Programs like these along with the improvements to the optical stability of WIYN are a sure step towards achieving this goal.

Dave Sawyer, Charles Corson, Abi Saha

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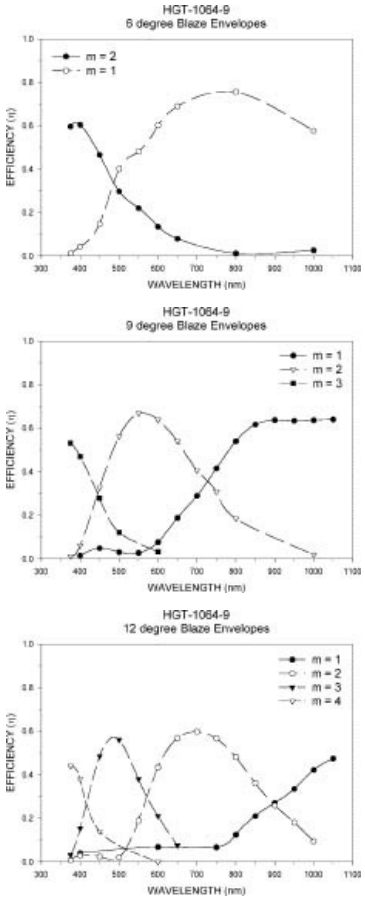
Volume Phase Holographic Grating Evaluation - Progress Report

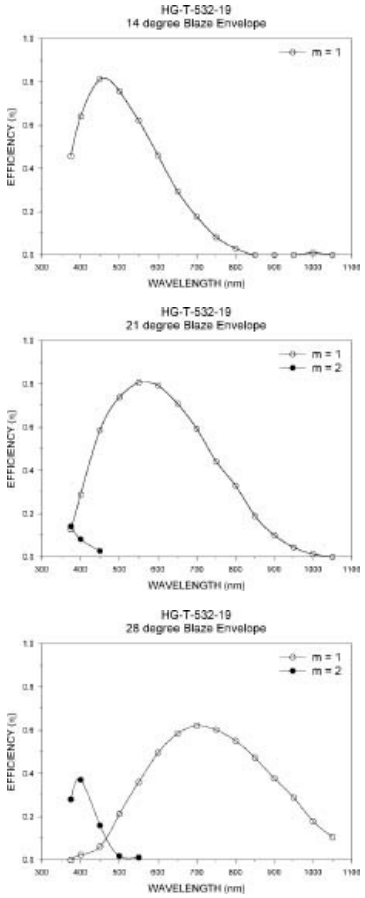
In the June 1998 issue of the NOAO Newsletter, we discussed our effort to evaluate the technology of volume-phase holographic (VPH) gratings which is being funded by the NSF. Much work has been accomplished over the past nine months on this project. To aid in this effort, we have hired Joel Williams (University of Arizona senior, majoring in Optical Sciences), as a laboratory assistant to carry out the grating measurements.

Of the eight NSF gratings to be fabricated, seven have either been fabricated or are in process at present (January 1999). Two have been fully evaluated: the 300 l/mm grating optimized for peak efficiency at 1064 nm, and the 1200 l/mm grating optimized for peak efficiency at 532 nm. Production of the final grating, a 300 l/mm, high-order diffraction grating, is on hold as we learn about the performance of the other gratings. Our understanding of those gratings will give us better insight to the design of this remaining grating.

The figures shown here give "blaze" profiles for the first two gratings in unpolarized light at different grating angles. The 300 l/mm grating (referred to as HG-T-1064-9) shows excellent efficiency in first and second orders of diffraction similar to that shown by the 600 l/mm grating discussed in the June 1998 article. It also shows good 3rd and 4th order efficiencies when appropriately tuned. The 1200 l/mm grating (HG-T-532-19) shows much higher efficiency than can be obtained with a comparable 1200 l/mm surface relief grating (which typically achieves only about 50% peak efficiency). The difference is due primarily to the less significant impact of polarization angle on diffraction efficiency for the VPH grating compared to the surface grating.



Caption: *Measured Efficiency curves for the 300 l/mm VPH grating (HGT-1064-9) at grating angles of 6, 9, and 12 degrees.*



Caption: *Measured Efficiency curves for the 1200 l/mm VPH grating (HGT-532-19) at grating angles of 14, 21, and 28 degrees.*

In other efforts, the VPH grism installed into the LDSS++ instrument at the Anglo-Australian Observatory was a great success, even though the grism was mistakenly fabricated at the incorrect line frequency. Please see the November 1998 AAO Newsletter at http://www.aao.gov.au/library/news.html for further details. Design studies are also underway at the AAO, SOAR, and NOAO for a variety of instruments, which would utilize this interesting technology. In addition, there is growing interest in the cryogenic behavior of these gratings for operation in the near-infrared spectral region. We intend to conduct some cryogenic testing in the near future.

Various results from the NSF grant will be presented at the *"Imaging the Universe in Three Dimensions"* conference at the end of March 1999; at the AAS summer meeting in Chicago; at the SPIE Annual Meeting in Denver in July 1999; and at the August 1999, Congress of the International Commission for Optics meeting in San Francisco. A variety of publications will also be generated.

Sam Barden

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NOAO Newsletter - Kitt Peak National Observatory - March 1999 - Number 57

Changes to KPNO Observing Policies

As you read in the article from Sidney Wolff, the NSF has allocated a reduced operations budget to NOAO this year. The exact level for KPNO has not yet been decided at the time of writing this article. The KPNO budget will, however, be below the zero-based model for running three telescopes. We are currently running five telescopes plus supporting NSO activities on Kitt Peak. We must therefore reluctantly make some reductions in availability of observing facilities. Our memorable Web posting suggested that we would close telescopes altogether. I will try to avoid that alternative by some radical approaches to availability, which will be described in more detail in the next Newsletter.

Here are guidelines for observing proposals for Semester 1999B:

- KPNO facility instruments will be scheduled in blocks for a minimum of two weeks on all telescopes.
- The Mayall 4-m and 0.9-m telescopes will be scheduled for runs of no less than 4 nights.
- The 2.1-m and Coud Feed telescopes will typically be scheduled for runs no less than 7 nights. (If your science program requires fewer than the minimum number of nights, go ahead and propose! We make every effort to schedule highly ranked proposals, and we do need some flexibility.)
- The 0.9-m will be scheduled for the CCD Mosaic Imager only, as demand for the instrument on the 4-m permits.

We are investigating the possibility of using T2KA on the 2.1-m for imaging, and have some optimism for its availability for the coming semester. In the technical section of your proposal, please let the TAC know about the difference in scope of the project or time required with T1KA versus T2KA.

These changes represent an attempt to minimize the losses of high quality scientific results based on KPNO facilities, while coping with a subcritical budget allocation. A guiding principle is to maintain proposal-driven access to unique observing capabilities on the smaller aperture telescopes. The 0.9-m telescope + CCD Mosaic provide unique wide-field capability; the grasp of the single-chip imager can be duplicated elsewhere with some compromise, even at the 2.1-m. The Coud Feed enables very high dispersion spectroscopy, particularly with Camera 6. The 2.1-m plus Phoenix, SQIID, and eventually Flamingos offers a powerful vehicle for near-IR observing. Even restricted access to such capabilities will continue to produce forefront science.

As one of many additional impacts, we were unable to offer a new postdoctoral position for this coming year, despite the high quality of the applicants. As always, I am open to your comments, which I intend to share with the NSF.

Richard Green

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Phoenix to be at Kitt Peak in 1999B!

Future Phoenix Plans

Plans for sharing Phoenix between Gemini, CTIO, and Kitt Peak were discussed at recent meetings of the KPNO/CTIO Users Committee and the Instrument Planning Advisory Committee (IPAC). At the Users Committee meeting a consensus of committee members and NOAO staff was that Phoenix should be deployed to a site for a minimum duration of two years.

NOAO would like to offer Phoenix on the Gemini South telescope starting in 2001 and share it with SOAR in a campaign mode with large blocks of continuous availability on each telescope. Gemini use requires that Phoenix be out of service for one semester for Gemini-related modifications as well as shipment and check out in the Southern Hemisphere. Unfortunately, we have to determine where Phoenix will be during the next two semesters before we have concluded discussions with Gemini.

We have therefore decided to make the optimistic assumption that Gemini will accept our proposal that Phoenix be used on Gemini South. The schedule for Phoenix then will be:

1999A	Current semester; out of service (see below)
1999B	Offered on Kitt Peak
2000A	Offered on Kitt Peak
2000B	Out of service for Gemini modifications and shipment
2001-2002	Offered on Gemini South and SOAR

Current Engineering Work

Phoenix was shipped to Tucson in mid-January following nine weeks of scheduled use on the Kitt Peak 4-m and 2.1-m telescopes during the 1998B semester. During February and March 1999, new motors and motor drivers are being installed on the outside of the dewar. The motor drivers will be controlled through Ethernet connections to the Sun instrument control computer. This control configuration will allow much more flexibility in the computer control of individual mechanisms. Users will see an impressive speed up of the mechanisms as well as accurate status reports on each mechanism. The collimator is also being disassembled and the primary collimator mirror will be remounted and realigned. The mounting of the collimator primary is the major suspect in causing the collimator aberrations. It is expected that the motor control and optical realignment phase of the work will take eight weeks. A test run has been scheduled on the 2.1-m telescope in April.

Progress reports on the engineering work will be posted on the Phoenix Web Page
http://www.noao.edu/kpno/phoenix/phoenix.html .

Ken Hinkle

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KPNO Visiting Student Program

To enable graduate students to gain hands-on experience with astronomical instrumentation and observation, KPNO offers extended visits to Kitt Peak. This year we will fund travel and lodging expenses for up to three students to spend a month working with NOAO scientists and engineers. Students interested in this program should submit a proposal to Richard Green (KPNO Director), by 1 May 1999 for visits beginning July 1999.

A diverse range of opportunities is possible, including observing and data analysis, instrument calibration, and technical

and engineering projects. Participation in the program may lead to continuing scientific and technical collaborations.

The proposal should state what your interests are and why this extended visit would be beneficial to your training as an astronomer. Applicants will be selected based on their proposals and the match between student interests and available scientific and engineering supervisors.

Lodging and meals on Kitt Peak will be provided for students in the program. Please e-mail kpno@noao.edu for further details.

Bruce Bohannan, Dave Sawyer, Richard Green

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NOAO Newsletter - National Solar Observatory - March 1999 - Number 57

From the NSO Director's Office

The conclusion of the search for the new NSO Director and the recommendations of the "Parker Committee" are key developments in the history of the Observatory. It is with great enthusiasm that the NSO staff is looking forward to the tenure of Stephen L. Keil as the new NSO Director, beginning 1 April. The NSO appreciates the dedicated efforts of the Director Search Committee, chaired by John H. Thomas (University of Rochester), in conducting the difficult task that culminated in a final selection from among a slate of extremely well-qualified candidates. Congratulations, Steve!

The NRC/NAS study on *Ground-Based Solar Research: An Assessment and Strategy for the Future*, or the "Parker Committee," has published its report. It is available on the WWW at http://www.nas.edu/ssb/ssb.html, or by contacting the Space Studies Board via e-mail at ssb@nas.edu to request a copy. Features of the report that are of direct relevance to the NSO include prioritized recommendations regarding the completion and operation of the new SOLIS facility; the upgrade and operation of GONG over a whole solar cycle; and the development, construction and operation of a 3-m to 4-m Advanced Solar Telescope (AST).

While a detailed response to the specific recommendations of the Parker Committee report is being formulated, the staff of the NSO is nevertheless encouraged by these recommendations to carry on its national mandate for research in solar physics and the development of advanced solar instrumentation. We note that the SOLIS project is proceeding as is the GONG upgrade (GONG+). The latest developments in AO experiments at Sac Peak are extremely promising and represent important steps toward establishing the technical feasibility of a large-aperture, diffraction limited AST operating at visible and infrared wavelengths (see the AO update by Thomas Rimmele herein). In addition to new telescopes and instrumentation, the NSO is pioneering new ways to deliver ground-based solar data to the scientific and educational communities through its Digital Library. All of these initiatives along with the infrared program and RISE/PSPT appear prominently in the new-format, long-range plan of the NOAO.

Further major activities in the NSO include the NSF management review of SOLIS during February, to be followed by the SOLIS Design Review in April. The ISOON Critical Design Review was concluded in January with a recommendation that the NSO proceed with the production phase. We are also delighted that three NSO scientists, Jack Harvey, Christoph Keller, and Thomas Rimmele, are members of one of the three selected US teams to develop instruments and science programs for the joint Japanese-US-UK solar satellite project known as Solar-B.

Looking forward to upcoming scientific events in the NSO, we call your attention to the GONG workshop in Tucson on 22-24 March and the PROM workshop (on solar prominences) during 8-10 April at NSO/Tucson. On 26 March the NSO and the NOAO Director's Office will sponsor a one-day meeting to celebrate the scientific career of our recently-retired colleague, Robert Howard (first director of NSO).

Mark Giampapa (NSO/Tucson),
Thomas Rimmele (NSO/Sac Peak)
Deputy Directors

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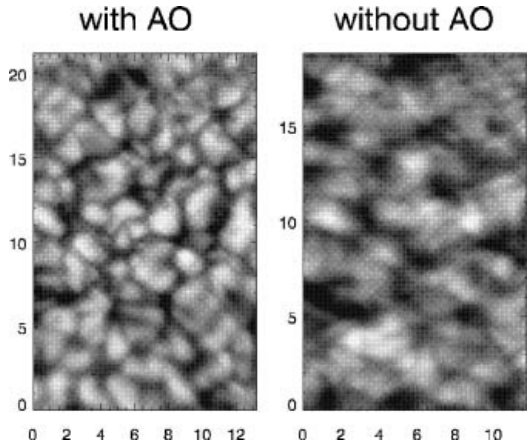
First Images from NSO's Solar Adaptive Optics System on the Internet

As reported in the previous NOAO Newsletter (December 1998) and in *Solar News* (February 15, 1999 issue), the NSO solar adaptive optics program at NSO/Sac Peak has achieved a major milestone by closing the servo loop with solar granulation and small pores as the wavefront sensing target at the R.B. Dunn Solar Telescope (DST) in early November 1998. This is the first time adaptive optics has been shown to work with solar granulation as the wavefront sensing target. First images and movies from the November 1998 engineering run and a brief description of the solar AO system, which is based on a 24 subaperture correlating Shack-Hartmann wavefront sensor, are now available on the internet (www.sunspot.noao.edu/AOWEB).

The accompanying figure shows simultaneous corrected and un-corrected images of granulation taken at 500 nm. The images were recorded using two synchronized video cameras and a split-screen electronics. The image scale and the field-of-view for the two images are slightly different (axes are labeled in arcsec). The images were digitized from videotape using a frame grabber. Despite the poor reproduction of the video images, it is obvious that the image correction performed by the AO system is substantial. The correction is slightly better in the center of the field of view, giving an indication of the size of the isoplanatic patch. However, a substantial improvement in image quality can be seen over the entire FOV. This indicates that a substantial amount of local turbulence close to the telescope and possibly aberrations in the telescope optics were present during these observations. A detailed performance evaluation of the solar AO system was conducted during a second engineering run in mid-February 1999, during which an attempt was made to collect the first science data.



T. Rimmele, R. Radick, R. Dunn, K. Richards

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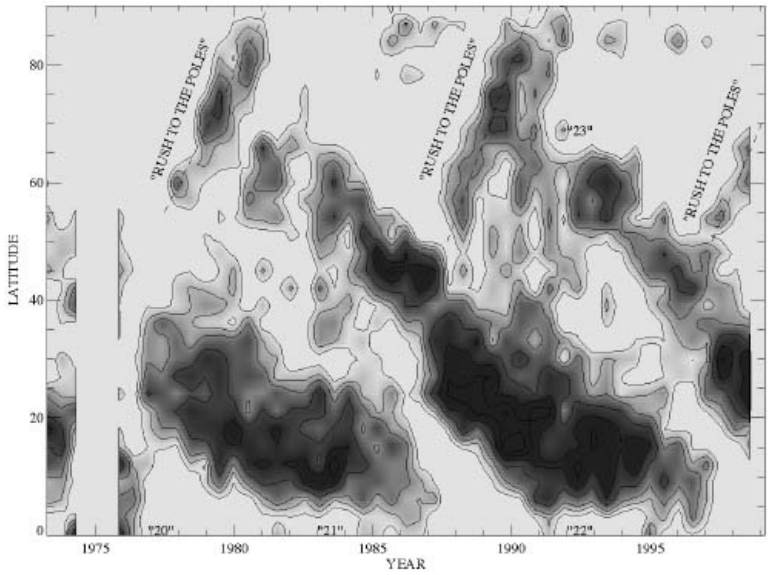
NOAO Newsletter - National Solar Observatory - March 1999 - Number 57

New Method for Determining the Time and Amplitude of Solar Maximum

Long-term maxima of solar activity occur on the average approximately every 11 years. However, the exact timing is a matter of disagreement among solar scientists and of some importance to satellite operators, space-system designers, etc. Most predictions are based on physical conditions occurring at or before the minimum of activity preceding the maximum in question. However, a perhaps more reliable indicator of the timing of the maximum occurs early in the rise phase of the solar cycle. This graph shows that coronal Fe XIV emission features observed with the NSO/SP Evans Solar Facility 40-cm coronagraph appear near 55 latitude in approximately 1978 and 1988 and begin to move towards the poles at a rate of 9 to 12 of latitude per year. This motion is maintained for a period of 3 or 4 years, at which time the emission features disappear at the poles. This phenomenon has been referred to as the "Rush to the Poles." The maximum of solar activity has been found to occur approximately 14 months before the features reach the poles. In

early 1997, emission features appeared near 55 latitude, and they are moving towards the poles. This then is the *Rush to the Poles* that heralds the next solar maximum. Based on observations up through October 1998, these features will reach the poles in approximately October 2000, which results in a prediction for solar maximum of between June and August 1999, substantially earlier than many other predictions. A maximum smoothed sunspot number of approximately 160 is predicted following Bray and Loughhead (Sunspots, 1965, pp. 240ff).



Dick Altrock, Todd Brown, Joe Elrod,
John Cornett, Tim Henry

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NOAO Newsletter - National Solar Observatory - March 1999 - Number 57

Selected US Teams for Solar-B Project Include NSO Scientists

In December 1998, NASA announced selection of three US teams to develop instruments and science programs for the forthcoming joint Japanese-US-UK solar satellite project presently called Solar-B. Three NSO scientists are members of one of the selected teams: J. Harvey, C. Keller, and T. Rimmele. The satellite, to be launched in February 2004, is a project of Japan's Institute of Space and Aeronautical Sciences (ISAS) following their very successful Yohkoh mission. Major participation from the US and UK is part of both missions. The primary scientific goal of Solar-B is to explore the coupling of energy transfer throughout the solar atmosphere. This mission will, for the first time, realize a decades-long dream of solar astronomers to take advantage of space to provide high angular resolution images of the sun with sustained quality approaching the best resolution snapshots that have been obtained on the ground. The instrument, which includes NSO participation, will be built by Lockheed-Martin's Advanced Technology Center with Alan Title as US Principal Investigator. The instrument is a Focal Plane Instrument Package located at the focal plane of a 50-cm aperture telescope. Other US members of the Lockheed team are the High Altitude Observatory (which has major responsibility for the spectrograph part of the instrument), the Center for Astrophysics, Goddard Space Flight Center, New Jersey Institute of Technology, Stanford University, and the University of Chicago.

Jack Harvey

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Solar Data Delivery for the Digital Age

As public use of the Internet continues to explode, NSO is developing new ways to deliver data to both scientific users and the general public. In particular, NSO has enhanced its ability to provide data products by installing a set of robotic juke-boxes containing 300 CD-ROM discs. This system now houses the entire set of daily solar images from the KPVT, the entire set of spectra from the FTS and a growing portion of the SP/ESF spectroheliograms. The holdings of this Digital Library are searchable via a web-based interface to a relational database. Since the Library is open 24 hours a day, 7 days a week, users can obtain data at their convenience and NSO scientific staff resources are released for application to other tasks. The "front door" of the library can be found at the URL http://www.nso.noao.edu/diglib/.

Frank Hill

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NOAO Newsletter - National Solar Observatory - March 1999 - Number 57

NSO Observing Proposals

The current deadline for submitting observing proposals to the National Solar Observatory is 15 April 1999 for the third quarter of 1999. Forms, information and a Users' Manual are available from the NSO Telescope Allocation Committee at P.O. Box 62, Sunspot, NM 88349 for Sacramento Peak facilities (sp@sunspot.noao.edu) or P.O. Box 26732, Tucson, AZ 85726 for Kitt Peak facilities (nso@noao.edu). A TeX or PostScript template and instruction sheet can be emailed at your request; obtained by anonymous ftp from ftp.sunspot.noao.edu (cd pub/observing_templates) or ftp.noao.edu (cd nso/nsoforms); or downloaded from WWW at http://www.nso.noao.edu/. A Windows-based observing-request form is also available at the WWW site.

Dick Altrock

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Global Oscillation Network Group

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

The 1999 GONG annual meeting (GONG '99) will be held in Tucson, 22-24 March. We expect this meeting to provide a forum for discussion of work in progress to understand the physics of modes of moderate and high spherical harmonic degree, the data analysis methods needed to extract the appropriate description of their properties, and the physics of the solar interior that can be derived from them. We address scientific issues posed by both the ground-based and space-borne experiments. In view of GONG's 11-year observing, and strong support from the National Academy of

Sciences' Study of Ground-Based Solar Research (Parker Committee) for the 1024^2 camera upgrade, the GONG Science Teams will work on the refinement of the high-resolution data processing that GONG+ should start providing in mid-2000.

Operations

The network of GONG telescopes has again demonstrated a great degree of reliability during the last quarter of 1998, with the vast majority of down time due to the scheduled preventive maintenance (PM) shutdowns: Udaipur (8 days in October), Learmonth (10 days in October), and Big Bear (8 days in November). For the first time, a single, two-person PM team made back-to-back visits to Udaipur and Learmonth (26 consecutive days), and although certain advantages were realized (e.g. minimized jet-lag), this will not likely be a common practice.

The Mauna Loa instrument was inoperative for approximately seven hours, due to a power outage which affected the entire observatory. The UPS kept the equipment running for an hour or so, but was unable to handle the prolonged blackout. Once the power was restored, the system resumed operational status. Various other system glitches and reboots were responsible for about three hours worth of lost images network-wide.

The mirror-fogging problem, which occurs primarily at Big Bear after a cold, damp night, has not been particularly bothersome so far this winter. This season has been much drier than previous winters; however, we would like to believe that the more frequent replacement of desiccant cartridges is helping solve the problem. The Big Bear staff are now replacing the desiccant when conditions warrant, superseding the less-frequent PM visits.

The lens-slide assembly (the mechanism that moves an additional lens into the light path for the purpose of obtaining calibration images), is showing some signs of age. We have had to call on the Big Bear staff on several occasions to apply a quick fix, and now, other sites are beginning to show signs of a potential problem as well. In response, we have incorporated a complete overhaul of the assembly (disassemble, clean, re-lubricate, and reinstall) into the PM task list. It is hoped that the added maintenance will solve this problem.

We rely greatly on our on-site staff to handle the failed equipment and to keep the network down-time to a minimum. The total number of images lost due to general hardware problems is equivalent to approximately nine hours of data (the exabyte drives are responsible for most of the hardware-related downtime). These hours reflect the total time that any site was inoperative regardless of weather conditions or whether another site was acquiring good images at the time.

We would like to welcome two ETS employees, Rich Lund, and Sang Nguyen, a former GONGster, into the operations group, each is working part-time for the project. They are working with the current instrumentation, both in-house and in the field, and have already begun to participate in the camera upgrade effort.

Data Management and Analysis

The p-mode reprocessing campaign (data that have been reprocessed or initially processed with the improved p-mode pipeline) added GONG months 1, 2, and 3, which were not previously processed, boosting the available data set to months 1-34 (950507-980911). Low-l time series and power spectra were produced from the first six GONG months and compared with the six-month power spectra that began with GONG month 4. Despite some concerns about angular registration during the startup of network operations, we are confident about the reliability of the spectra from the first six months, and believe that the month-long spectra are adequate for identification of mode frequency information. This effort completes the reprocessing campaign which began in mid-1997.

During the past quarter, month-long (36-day) velocity, time series, and power spectra were produced for GONG months 31, 32, 33, and 34 (ending 980911), with respective fill factors of 0.77, 0.85, 0.75, and 0.82. The project also produced tables of mode frequencies for GONG month 6, 9, 12, 27, 28, 29, 30, and 31. These mode frequencies were extracted from power spectra that was produced from 108-day time series.

Sean McManus joined the GONG Project on 18 November and will be producing global p-mode data products in addition to continuing the development of the Project's web-page.

Data Algorithm Developments (and some science)

The frequencies of the solar oscillations have now been determined for all nine independent 108-day blocks covering the period 28 September 1995 to 1 July 1998. During this time, solar activity has rapidly increased with the onset of cycle 23. The GONG measurements clearly show the expected increase in the basic frequencies of the oscillations, and in addition, it is now possible to detect very small shifts (a few nanoHz) at the very start of the new cycle. The GONG frequencies also show more subtle variations (of the so-called "even" splittings) that are well-correlated with the activity level, and which appear to be linked to the spatial distribution of the magnetic field.

The multi-taper spectral analysis is in the final testing stage. A random-restart test, which will verify that the determination of frequencies from multi-tapered spectra is insensitive to the initial guess, is underway. Once completed, multi-tapering will be included in the routine pipeline processing of the GONG spectra.

As discussed in the last Newsletter, we no longer temporally deconvolve the spectra. Instead, a scheme has been developed to correct the estimated line widths and amplitudes for the effects of an incompletely filled time series. The new algorithm was derived by comparing deconvolved and non-deconvolved spectra with varying temporal fill factors, and it works quite well. In fact, the results with this method indicate that it may be possible to measure solar-cycle related variations in the widths and amplitudes.

The leakage-matrix calculation has been greatly improved; however, it does not yet incorporate all known processing and observational effects: the modulation transfer function (MTF) and the vector nature of the oscillatory velocity field

must still be implemented.

The Analysis Team has initiated the study phase for planning the development and rewrite of a new peakfind program, and because it is well-known that the step of determining the oscillation parameters is the most difficult stage in the data reduction process, this effort will not be taken lightly. In order to break new ground and avoid duplicating previous efforts, our current concept of the new algorithm will likely include the simultaneous fitting of multi-tapered spectra observed in velocity and intensity, an asymmetric line-profile model, explicit treatment of the leakage matrix, and a multi-dimensional fit.

New Camera Development

Silicon Mountain Designs has delivered eight production cameras, and once tested and evaluated, the two cameras, which were originally purchased for the GONG Lab and Tucson shelter feasibility study, will be returned for modification. At this point, optical and electronic tests indicate that the performance is well within our specifications, except for a minor discrepancy regarding temperature regulation, which SMD is working hard to correct. In addition, DNA Enterprises has delivered the initial camera electronics prototype, which will boost our software development efforts, and they are proceeding with a beta version of the data acquisition software, with expected delivery in late-January.

In a parallel effort, we are proceeding with fabrication of two prototype data-caching chassis which will house the data storage peripherals. Upon completion of testing, these units will be installed at the Tucson facility, which will mark the beginning of the upgrade process.

The camera development team has been strengthened by the arrival of Tad Morgan, a real-time programmer, who will be helping to develop the software interfaces required by the new and upgraded hardware.

John Leibacher

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NOAO Newsletter - Global Oscillation Network Group - March 1999 - Number 57

Warren Ball

The recent passing of Warren Ball, a senior engineer for many years in these organizations saddens the NOAO, NSO, and GONG communities. Warren designed many of the crucial parts of the GONG instrument and shared his incredible wealth of knowledge with the designers and builders of the rest of the GONG system.

I first met Warren when the Mayall 4-m Telescope was undergoing initial testing. There was an oscillation in one of the drives and some way was needed to detect the oscillation so that a correction signal could be fed back into the control system. As a practical engineer interested in simple solutions, Warren used a phonograph stylus and a small stick of wood glued respectively to fixed and vibrating pieces of the mounting to generate the correction signal. When I heard about this elegant solution, it was obvious that Warren was someone who would be good to know. He participated in many instrumentation projects in NOAO and NSO, always finding nice solutions to difficult engineering problems. When the GONG project started, we were lucky to have him as a senior engineer. He is responsible for most of the analog electronic systems in the GONG instrument and developed the logic for the complicated GONG timing system. His most impressive tours-de-force for GONG are the guider and the oven that holds the temperature-sensitive optics. The former uses no moving parts yet is able to negate the effects of clouds at the solar limb and the latter is stable to about 10 microdegrees no easy feat. But no less important are the multitude of little tricks and techniques that Warren gently suggested to help the designers of other aspects of GONG. I know that I counted on his advice countless times.

Warren's rich store of engineering knowledge was based on a broad background of experience. He served in the military, was a gold miner in Central America, flew his own airplane, and constantly tinkered with things. He possessed an insatiable appetite for learning. His office was famous as a source of strange and wonderful gizmos. Once we were curious if a piece of glass had any radioactivity. He said, "No problem," reached under his desk and pulled out a Geiger counter!

His legacies are many on Kitt Peak, and around the world in the GONG project. And they continue. As I was writing this note, a need for a thin, flexible, heat-transferring membrane came up in the design of one of the instruments for the

SOLIS project. I remembered that we had a similar need in GONG and that Warren found just the right material. Problem solved! Perhaps those two words best capture our fond memory of Warren. He is missed, but well remembered.

Jack Harvey

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Gemini North Nears First Light

At the time that this is being written (early February), the Gemini North Telescope is thought to be within a week or two of first light. For Gemini, first light is not merely an optical milestone, but requires closure of the secondary tip-tilt loop. At this point, the primary and secondary mirrors have been aluminized, the telescope has produced respectable images using a prime-focus wavefront sensor, and the pointing of the telescope has been verified. The f/16 secondary is in place and work is ongoing to control it with the wavefront sensors in the acquisition and guide unit. A borrowed near-IR imager, QUIRC (from the Institute for Astronomy), is mounted on the telescope for these initial optical commissioning activities.

A dedication of the Gemini North telescope is scheduled for 25-26 June 1999. USGP expects to issue the first call for proposals at the end of 1999, with proposals being due (through the standard NOAO process) at the end of January 2000. Operations handover, at which the telescope is deemed ready for scientific use, is scheduled for June 2000.

Todd Boroson

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NOAO Newsletter - US Gemini Program - March 1999 - Number 57

USGP Instrumentation Program

Near Infrared Imager (NIRI)

The Gemini Near Infrared Imager (NIRI) optical fabrication is complete, and the mechanical fabrication is expected to be done shortly. After satisfactorily completing the first cold test, the instrument was disassembled for installation of wiring in the dewar. Klaus Hodapp, the instrument PI at the Institute for Astronomy, University of Hawaii, plans to install mechanisms into the dewar and conduct the next cold test in March, with a goal of performing final alignment before mid-1999. NIRI will be one of the commissioning instruments for the Gemini North Telescope, which is nearing first light.

Near Infrared Spectrograph (GNIRS)

After completing an AURA review in October, the GNIRS instrument team has been restructured with a new Project Manager, two new mechanical engineers, and a new lead designer/draftsman. The new team toured the Gemini Hilo Base Facility and the Gemini North facility on Mauna Kea, and presented a revised packaging concept directed at meeting the instrument performance requirements and Gemini interface specifications. This repackaging activity will culminate in a review currently scheduled for this summer. The current estimate for delivering the instrument is late 2002.

Thermal Region Camera System (T-ReCS)

Charles Telesco (PI), and his team are on schedule for a Critical Design Review to be held in late May. Gemini has approved the team's request to add a limited spectroscopic capability to the baseline 8-26 m imager, which has a single plate scale of 0.09"/mm. The contract with the University of Florida calls for delivery to Cerro Pachon in early 2001.

Near Infrared Arrays and Controllers

With ten hybridization attempts by Boeing SBRC, two very good science grade arrays have been produced. The program was placed on hold temporarily to increase the odds of obtaining even better devices in the future. After shipping two controllers in 1998, NOAO will deliver the GNIRS controller later this year.

GMOS/HROS Science CCD's and Controllers

EEV in the UK has encountered delays in delivering the science arrays for the GMOS dewar. NOAO is proceeding with final software integration.

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IRAF Update

The IRAF V2.11 upgrade for OpenVMS running on the VAX and the DEC Alpha is now available from our network archives on iraf.noao.edu in the */iraf/v211/VMS7/* directory. The README file in this directory contains details pertaining to the release. With the VMS/IRAF release IRAF V2.11 is now available for all currently supported IRAF platforms including SunOS and Solaris, Dec Alpha systems running Digital Unix V4.0, Hewlett-Packard systems running HP-UX 10.20, SGI IRIX, IBM AIX, and PC-IRAF platforms including Slackware Linux V3.3, Red Hat Linux V5.0, and FreeBSD V2.2.5.

A few sites have received Solaris 7 and have been asking about IRAF support. We have only recently received our copy of Solaris 7 at NOAO; it will be installed on a local system for IRAF support sometime in February. Early reports from the field suggest that the existing Sun/IRAF V2.11 release will work under Solaris 7, but we have not yet tested this. A V2.11 patch this spring will provide full support for Solaris 7, as well as other enhancements, such as the Y2K fixes mentioned below, support for the upcoming science GUIs release, and some early elements of Open IRAF (e.g. improved host execution facilities). A new version of X11IRAF is also planned.

The next major system upgrade will be the upcoming PC-IRAF release, which will upgrade PC-IRAF platform support as well as provide the latest V2.11 patches. FreeBSD support will be upgraded to FreeBSD 3.0 or later, Slackware Linux to V3.6 or later, and RedHat Linux to 5.2 or later (these are the versions we are currently running here). New support for Solaris x86 (using Solaris 7) and Macintosh Linux is planned for this release. We have been planning to use MkLinux DR3 for the Macintosh Linux port, but there has been some discussion with users recently regarding whether this is the best platform for us to support, or whether we should use LinuxPPC instead. The problem is that Apple is terminating support for MkLinux. However, the Linux community is expected to take over support for MkLinux; there is talk of expanded coordination of MkLinux and the only other Linux variant for the Mac, LinuxPPC. Our inclination is to port to MkLinux as planned, since this is what a number of us have already bought and installed, but the matter is still under consideration and a final decision has not yet been made. Mac users are encouraged to contact us concerning your preferences.

As reported in the last issue of this Newsletter we do not expect any major Y2K-related problems with IRAF. A few minor Y2K problems nonetheless exist and an IRAF V2.11 patch will need to be installed before January 2000 to correct these problems. This patch will also add support for the new FITS DATE-OBS (date and time) format; we are making these changes to IRAF now. A fully Y2K compliant release of IRAF for all supported platforms is slated for the V2.11 patch planned for the spring of 1999. More details about IRAF and the Y2K problem are available on the Web page http://iraf.noao.edu/projects/y2k, which will be updated as the Y2K project progresses.

Support for sinc interpolation was added to the 2D image interpolation routines. Support for drizzle resampling was added to both the 2D and 1D image interpolation routines. The sinc interpolant preserves the high frequency information in the resampled images more accurately than polynomial-based interpolants, although at the expense of greater execution times. The drizzle resampling algorithm can be used to enhance the resolution of dithered images in some circumstances. All the appropriate IMAGES package tasks were upgraded to support the new resampling options.

A spectroscopic exposure time calculator task called *spectime* has been written. Given an input spectrum in absolute flux units or a reference flux value and blackbody temperature for a blackbody spectrum, it applies atmosphere, telescope, spectrograph, and detector efficiencies to estimate detector photon counts and signal-to-noise ratios (S/N) for the spectrum. One can ask for an exposure time to reach a particular S/N at a reference wavelength or obtain the

S/N for a specified exposure time. The expected detector counts and S/N as a function of wavelengths covered by the spectroscopic observation are graphically displayed.

The *spectime* task is written as a general tool. All calibration information is specified in a set of calibration files. These files can be in a system database, in the user's directory, or a combination of both (allowing users to edit and override system tables). The optical components that can be included cover most types of spectrographs, including long slit, fiber, and echelle instruments. The task is in the final stages of development. It will be used as the engine for a NOAO/SCOPE proposal preparation tool and will be available on the Web. It will also be made available as an IRAF add-on task and eventually in new releases of the IRAF system.

An interesting new project we are just starting is a data reduction pipeline for the NOAO Mosaic imager. This will capture raw Mosaic data as it is acquired on the mountain and automatically carry it through a number of stages of processing at various locations, eventually producing offline archives at NOAO of both the raw and processed data, as well as an online archive of the processed data to be maintained off site. This project is interesting not only for the scientific capability it will provide for wider access to Mosaic data, but as a major step towards data archiving at NOAO, and as a testbed for developing IRAF software for automated data reductions and the Open IRAF facilities for component-based processing. The archive pipeline will be implemented as an extension of the existing Mosaic DHS and developmental Open IRAF facilities.

Members of the IRAF group attended the Astronomical Data Analysis Software and Systems (ADASS) Conference in Urbana, Illinois in early November. The following papers were presented at the conference on current IRAF projects:

- *Automatic Detection of Linear Features in Astronomical Images* by Matthew Cheselka
- *Xguiphot: A New Aperture Photometry Tool for IRAF* by Lindsey E. Davis
- *Intensity Matching Algorithm* by Frank Valdes
- *Pupil Image Removal Algorithms* by Frank Valdes

The papers will appear in a future volume of the *Astronomical Society of the Pacific Conference Series*.

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 (available on USENET or via a moderated mailing list which you can subscribe to by filling out a form on the IRAF Web page) provide timely information on IRAF developments and are available for the discussion of IRAF related issues.

Doug Tody, Jeannette Barnes

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NOAO FTP Archives

The NOAO FTP archives are found at the following FTP addresses. Please log in as "anonymous" and use your email address as the password. Alternate addresses are given in parentheses.

```
ftp ftp.sunspot.noao.edu (146.5.2.181), cd pub
   SP software and data products--coronal maps, active region lists, sunspot
   numbers, SP Workshop paper templates, meeting information, SP observing
   schedules, NSO observing proposal templates, Radiative Inputs of the Sun
   to the Earth (RISE) Newsletters and SP newsletters (The Sunspotter).
   The NSO/SP archive can also be reached at http://www.sunspot.noao.edu/ftp/.

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

ftp ftp.noao.edu (140.252.1.54), cd to:

   catalogs---Jacoby et al. catalog; "A Library of Stellar Spectra";
   update to Helen Sawyer Hogg's "Third Catalogue of Variable Stars in
   Globular Clusters"; "Hipparcos Input Catalogue"; "Lick
   Northern Proper Motion Program: NPM1"; "CoudÃ© Feed Spectral
   Library"; "General Catalog of Variable Stars, Volumes I-V 4th ed."
   and "Name-Lists of Variable Stars Nos.  67-76."
```

```
ctio (ctios1.ctio.noao.edu)---CTIO archives--- Argus and 1.5m BME
information, 4-m PF plate catalog, filter library, instrument manuals,
standard star fluxes.  (This archive is a nightly mirror of those files
on ctios1.)

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

gemini_NOAO (orion.tuc.noao.edu, cd pub)---Documents from the US Gemini
Project Office.

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

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

kpno (orion.tuc.noao.edu)---KPNO archive of filter lists and transmission
data, CCD and IR detector characteristics, hydra (WIYN) information,
4-m PF platelogs, reference documents, and sqiid data reduction scripts.

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

noao (gemini.tuc.noao.edu)---Lists of US areacodes and zipcodes, various
LaTeX tidbits, report from Gemini WG on the high resolution optical
spectrograph, etc.

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

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

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

utils---PostScript tools.

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

The following additional IP numbers are available for the machines mentioned above:

```
argo.tuc.noao.edu    = 140.252.1.21
ctios1.ctio.noao.edu = 139.229.2.1
gemini.tuc.noao.edu  = 140.252.1.11
helios.tuc.noao.edu  = 140.252.26.105
iraf.noao.edu        = 140.252.1.1
orion.tuc.noao.edu   = 140.252.1.22
```

Questions may be directed to: Steve Heathcote (sheathcote@noao.edu) for the CTIO archives, Frank Hill (fhill@noao.edu) for all solar archives, Steve Grandi or Jeannette Barnes (grandi@noao.edu or jbarnes@noao.edu) for all others.

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

Jeannette Barnes

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