NOAO Newsletter - March 1994 - Number 37

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NOAO Highlights!

Director's Office

Cerro Tololo Inter-American Observatory

Kitt Peak National Observatory

National Solar Observatory

Global Oscillation Network Group

US Gemini Program

Central Computer Services

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

Studying Galaxy Clusters at High Redshifts (1Mar94)

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Studying Galaxy Clusters at High Redshifts (1Mar94)
(from NOAO HIGHLIGHTS!, NOAO Newsletter No. 37, 1 March 1994)

Observations of high redshift clusters of galaxies have resulted in tantalizing insights into the evolution of galaxies in rich environments and of the most massive collapsed peaks in the cosmological matter fluctuation spectrum. The advent of modern, large-format optical and infrared array detectors and multi-object spectrographs has provided a wealth of new data on distant clusters and the spectral properties of the galaxies they contain. The number of known high-z clusters with published redshifts is remarkably small, however, primarily because spectroscopy on faint galaxies is so challenging. Nearly all observational effort has been concentrated on the same few systems, particularly at z &gt 0.5 where only a handful of clusters are known (mostly from deep photographic surveys). The incompletenesses and biases which may affect such catalogs at their limits may have unknown effects on our understanding of these most distant clusters.

[Figure not included]

K-band image of the z = 1.169 radio source 3C210, and associated cluster.

For his thesis at the University of California, Berkeley, Mark Dickinson (now at STScI) worked to expand the available sample of high redshift clusters and circumvent some of the usual optical selection biases by identifying and studying clusters around distant, powerful radio galaxies. Using the 2.1-m and 4-m telescopes at KPNO and the 1.5-m and 4-m telescopes at CTIO, Dickinson surveyed the environments of radio galaxies as well as known, optically selected clusters out to z = 0.8. Imaging through a large complement of narrow and intermediate bandwidth filters, he measured low-resolution "spectra" of complete samples of hundreds of galaxies, identifying cluster members and characterizing their spectral properties. S. Adam Stanford (IPAC/JPL), Dickinson and Peter Eisenhardt (JPL) have expanded on this work by extending these measurements into the near-infrared, taking advantage of the new, large-format IR detector technology used in the SQIID, IRIM and OSIRIS imagers to obtain deep wide-field J, H and K band imaging photometry for 18 clusters from nearby Coma out to z = 0.7.

Dickinson and Eisenhardt have recently begun to extend this work to still higher redshifts, beyond the limits of available optically selected samples. Using the new, improved IRIM with its NICMOS-3 array on its first night of regular operation on the KPNO 4-m, they imaged two powerful radio galaxies at z = 1.2 in the near infrared, taking

advantage of the camera's wide field of view to survey a region ~ 1.5 Mpc on a side around each target. Remarkably, they found that both radio galaxies are surrounded by large, centrally concentrated swarms of extremely red galaxies - so red, in fact, that their R-K and J-K colors match those expected for present-day (z = 0) ellipticals redshifted out to z = 1.2 with little or no spectral evolution. While there is as yet no spectroscopic confirmation of these galaxies' redshifts, the guilt-by-association is strong. Their colors are too red for them to be "normal" galaxies at z &lt 1 without invoking strong extinction; only the large k-correction expected for quiescent ellipticals at high redshift can account for them. Such red objects are not unknown in deep field surveys, but they are rare compared to the dramatic over-densities found near these radio sources.

The red colors render these clusters virtually invisible in deep optical images, suggesting that such systems might not be recognized in even the deepest optical surveys. Perhaps more importantly, if the colors accurately reflect the stellar populations in these galaxies, their last major episode of star formation must have occurred several billion years prior to z = 1.2. For closed cosmologies, this strains the limits on the age of the universe unless the Hubble constant is small. As their survey continues, Dickinson and Eisenhardt plan to employ this promising technique to expand this sample of "normal" cluster galaxies and extend it to still higher redshifts.

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The Most Luminous Seyfert 2 Galaxy Known (1Mar94)

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The Most Luminous Seyfert 2 Galaxy Known (1Mar94)
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The IRAS Faint Source Catalog (FSC) source 10214+4724 has been identified with a non-stellar object at a redshift of 2.286, making it among most bolometrically luminous objects known. The origin of the extreme luminosity of FSC10214+4724 is a problem. Two competing ideas are that it is a heavily obscured AGN or a site of prodigious star formation. To sort out such possibilities, R. Elston (CTIO), P.J. McCarthy (OCIW), P. Eisenhardt (JPL), M. Dickenson (U. of California, Berkeley), H. Spinrad (U. of California, Berkeley), B. Jannuzi (Inst. for Advanced Study, Princeton) and P. Maloney (U. of Colorado, Boulder) obtained near-IR spectra of FSC10214+4724, using CRSP on the KPNO 4-m telescope. The IR spectra are the key to understanding the source as they allow observation of the optical forbidden lines O [III] and N [II] at its high redshift.

The CRSP spectra sampled the highly-redshifted regions around Ha and Hbeta. The emission line ratios of N [II] 6584/Ha = 1.1 +- 0.2 and O [III] 5007/Hbeta &gt 20 lead to a classification of FSC1024+4724 as Seyfert 2, placing it out of the range of any known star-forming galaxy. It thus appears that the photoionization of its narrow line region is dominated by an AGN and not star formation. Any star formation region would have to be more heavily obscured than the AGN, a rather contrived solution. Following the upgrade of the CRSP spectrometer to a 256 x 256 InSb array, Elston used the KPNO 4-m to reobserve the spectrum near Ha in FSC10214+4724. Not only does the new array offer larger wavelength coverage, which is critical for the detection of broad quasar emission lines, it offers better performance. The spectrum in the figure was obtained at a resolution of about 550 in 1 hour through thin cirrus on the KPNO 4-m in November 1993. A S/N of about 3 is present in the continuum which has K = 16.5. No broad line emission is seen outside of the Ha and N [II] blend, suggesting that the red continuum in FSC10214+4724 is not due to a heavily reddened quasar, but rather is similar to that in other Seyfert 2 galaxies. Indeed, this Seyfert 2 type spectrum is very similar to other ultra-luminous IRAS selected galaxies making it seem that FSC10214+4724 is the luminous extreme of this class of galaxy rather than a new type of object.

[Figure not included]

Elston et al. also obtained a deep H band image of FSC10214+4724 while they obtained near-IR polarimetry. This image showed that

FSC10214+4724 was dominated by a bright point source and had several nearby companions. They argue that given their red colors and brightness they are much more similar to a group of early type galaxies at moderate redshift rather than a group of objects at the redshift of FSC10214+4724. To help explain such a rather improbable superposition they suggest that FSC10214+4724 may be gravitationally amplified by the foreground group. Recent Keck images by Mathews et al. may support this idea as they show FSC10214+4724 to have "arc" like extensions extending around the nearest companion to the north.

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Photometric Monitoring of Supernova (1Mar94)

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Photometric Monitoring of Supernova (1Mar94)
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At early times, supernovae (SNe) are exciting events, brightening by ten magnitudes or more. Recent observations at KPNO show that the late phases also hold some thrills. SN type II are core collapse events that show strong hydrogen lines in their spectra at early times. The SN light curves reflect the structure of the stellar progenitors and reveal the underlying energy sources created in the explosion that power the expanding debris. The exponential decline of some SN II is attributed to the half-life of 56Ni (77 days) and 56Co (111 days), but this is not the whole story. Years after a supernova's initial brightening, photometric observations show a slower decline rate than seen at earlier times. Indeed, SN 1957D, and SN 1980K, have been re-discovered years after explosion, and SN 1986J (shown in the picture) and SN 1988Z are still visible. All of these are strong radio sources, too. What is powering the optical light several years after the explosion?

[Figure not included]

The power sources for the sustained optical emission have not been securely identified, though many theories exist. One option is the interaction of the remnant with the stellar wind of the progenitor star, which is also the favored interpretation of the radio emission. Other alternatives include long-lived radioactive isotopes such as 57Co or 44Ti, which could power the decline at very late times. A powerful pulsar, which may not be detected directly at large distances, is likely in core collapse events and could excite the debris. Optical light reflected off circumstellar dust at shock breakout (light echoes) is another possibility. Measuring the energy release in optical passbands over several years provides important information to distinguish among these mechanisms.

R. Kirshner (CfA), L. Wells (NOAO), B. Schmidt (CfA), B. Leibundgut (ESO), P. Ruiz-Lapuente (CfA), and the late A. Porter (NOAO), have been monitoring SNe at very late times using the KPNO 2.1-m. The supernovae are generally declining very slowly, so monthly observations are adequate to monitor these objects. Observations under good seeing conditions for SN 1980K have reached down to 23.4 magnitudes in the B filter over 10 years past maximum light. The total flux emitted in the BVRI bands can be compared with estimates for the energy sources listed above. For example, SN1980K was observed to have a luminosity at the distance of NGC 6946 (the host galaxy) of 8 x 10**37 (D/7.5Mpc)**2 ergs s**-1. This probably rules out radioactive decay or light echoes as the energy source. Excitation by a pulsar would most likely result in narrow line emission, since only the inner material of the ejecta would be excited. Followup spectral observations show broad lines that may exclude this as the energy source. This leaves the interaction of the supernova ejecta with the remnant of the stellar wind of the progenitor star as the likely source of emission. Observations of old supernovae to faint limits with the 2.1-m thus are providing important clues to the last desperate stages of stellar evolution that precede stellar destruction.

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The NOAO CCD Mosaic Imager Project (1Mar94)

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The NOAO CCD Mosaic Imager Project (1Mar94)
(from NOAO HIGHLIGHTS!, NOAO Newsletter No. 37, 1 March 1994)

Individual CCDs have hit their size limit with the Tektronix 2048 x 2048 chips we now have in use at both KPNO and CTIO. We have been working for several years on the development of CCD mosaics to surpass this size, the ultimate goal being an 8192 x 8192 array with 15 um pixels. Because this is an ambitious project, we have set an intermediate goal of producing several 4096 x 4096 arrays using the same procedures that are required for the larger mosaic.

The mini-mosaic development has proceeded well for the last couple of years. Two-side buttable 2048 x 2048 CCDs with 15 um pixels were fabricated at the Loral Fairchild foundry. We contracted to Michael Lesser of Steward Observatory the task of thinning and packaging the CCDs. This part of the process turned out to require a substantial amount of research and development. In the meantime, we jointly developed a mounting scheme that would accommodate either thick frontside-illuminated or thin backside-illuminated CCDs, and Lesser packaged four thick chips for us to assemble into a prototype 2 x 2 array of CCDs. This prototype was put into a standard KPNO universal Dewar, and has seen engineering time on both the 0.9-m and 4-m telescopes. It has been run with both our old CCD controller and one of the new CTIO ARray CONtrollers (ARCON), which we will be installing at all our telescopes next summer.

The chips used in the prototype are of poor cosmetic quality, but they have allowed us to learn a great deal about how to assemble, operate, and reduce the data from a device this large. The gaps between the individual CCDs are about 600 um. The rows and columns are lined up to a couple of pixels and the whole array is flat to about 15 um RMS. This is fine for the f/7.5 focus of the 0.9-m, but is marginal at the faster 4-m prime focus. We believe that we can achieve flatness of 5 um RMS on the science grade device.

The reduction of data from the mini-mosaic is a time consuming operation. We have found it easiest to keep the data from the four chips separate through the bias subtraction and flat fielding operations. We then assemble the four individual images into a large composite image using astrometric solutions derived from observations of an open cluster. We have not seen any evidence for changes in the relative geometry from run to run, and so the hope is that users of this device will be able to use a predefined transformation. Because the devices are of poor quality, it is desirable to take a number of frames with different centers, register them, and combine them. The figures are two mini-mosaic images taken at the KPNO 0.9-m telescope. They are a single image of the full moon, and a combined image of five exposures of Abell 262, showing that the gaps and cosmetic defects can be successfully removed by this process.

[Figures not included]

Our hope is to finish up three thinned mini-mosaics in the next six months. These will be deployed at KPNO, CTIO, and at the WIYN telescope, where the 0.15 arcsecond pixel scale should be a good match for the superb image quality expected. At the same time, we have begun work on the large 8192 x 8192 mosaic imager. We have initiated a run of 2048 x 4096 CCDs at Loral Fairchild. These are three-side buttable and the eight best chips will be assembled in a 4 x 2 format to produce a square CCD array five inches on an edge. The design of the dewar, mechanical interface, shutter, and filter mechanism are well along. Watch the Newsletter for further details.

Mini-Mosaic and Mosaic Specifications

	Mini-Mosaic	Mosaic
Format	4096 x 4096	8192 x 8192
Pixel size	15 um	15 um
Readout time	150 seconds	150 seconds (goal)

Scale at 4-m PF	0.30"/pixel	0.30"/pixel
Scale at 0.9-m f/7.5	0.43"/pixel	0.43"/pixel
Field at 4-m PF	20' square	41' square
Field at 0.9-m f/7.5	29' square	59' square

Todd Boroson

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The KPNO Star Forming Regions Survey: A Database Project (1Mar94)

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The KPNO Star Forming Regions Survey: A Database Project (1Mar94)
(from NOAO HIGHLIGHTS!, NOAO Newsletter No. 37, 1 March 1994)

We have used the multichannel IR camera SQIID during several observing seasons to construct a database of JHK images in regions of star formation. This has been a novel approach to the scheduling and use of telescope time relevant to the Gemini era. The project is coming to fruition and we wish to inform our user community about its purpose and results.

It struck us forcefully during the commissioning of SQIID how well suited it is to a systematic program of mapping star forming regions. Operationally its parameter space is limited to celestial coordinates and exposure time. The information content of its output is very high, thus extraction of all the potential science from the data torrent it can produce may be beyond the interest or capability of any one small group. The first KPNO IR camera had been heavily used for studying star-formation, demonstrating the demand for such data, while considerations of uniformity and open access argued for a nontraditional approach to obtaining them.

We therefore initiated a project to provide a database for infrared studies of star formation. It is composed of observationally uniform and photometrically calibrated images of regions encompassing a variety of observational characteristics. In particular we have emphasized extended areal coverage of target regions, typically a significant fraction of a square degree. We selected regions for which this coverage seemed necessary and adequate. Other constraints were a distance from the Sun such that practical limits on sensitivity would produce physically useful results, and a distribution over the sky which is reasonably uniform over the Kitt Peak observing season.

Because of the novelty of this project, including the large amount of telescope time requested, it was submitted both to the TAC and to an independent panel of reviewers selected by the KPNO Associate Director. At their recommendation, we also formed an ad hoc advisory group to critique the proposal and provide ongoing contact with the community of star formation researchers. This group, chaired by Stephen Strom, provided valuable advice in determining the survey protocols. Probst has been responsible for defining and carrying out the observational program, and Merrill for developing data reduction strategies and processing the data flow.

We now have in hand data gathered with SQIID on the 1.3-m during three observing seasons, and are making it available to the community at large. A quick summary of target regions is given here. They represent about a third of the project as originally envisioned, exactly proportional to the amount of photometric weather we have had. The limiting magnitude for point sources is typically K = 14.4, H = 15.4, J = 16.3 with SNR = 10. Initially the regions will be available as sets of sky-subtracted, flat-fielded 15 x 15 arcmin images (corresponding to the observational protocol) accompanied by standard star frames taken the same night. They may be obtained via ftp transfer from a dedicated data storage area to which images will be added as they are processed. To keep the workload tractable we will not distribute images by other means, at least for now. As of mid-January we are busily processing data and working out the details for community access. This should be better defined by the release date of this Newsletter. For an update on the project and the information needed to retrieve images, ftp to ftp.noao.edu, log in as "anonymous" with your e-mail address as password, use command "cd

starform_project" to enter the project directory, and get the README
file. Use command "quit" to break the ftp connection after transfer.

                        Completed regions

                         Field Center   Field size, arcmin
Identification   (1950)   N-S x E-W

NGC 1333/H-H 7-11   0327+3103   27 x 54
M42   0532-0523   75 x 60
L1641   0534-0630   60 x 60
Cyg OB2   2031+4112   45 x 45*
NGC 7023   2101+6758   30 x 30
Cep A   2254+6145   45 x 45
Cep B   2254+6230   45 x 45

* Significantly brighter limiting magnitude in this region

Ron Probst, K. Michael Merrill

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NOAO 2000 - Planning for the Future (1Mar94)

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NOAO 2000 - Planning for the Future...(1Mar94)
A Progress Report from KPNO
(from NOAO HIGHLIGHTS!, NOAO Newsletter No. 37, 1 March 1994)

The decade of the 1990's is one of profound change for astronomy,
offering both challenges and opportunities to NOAO. While the funding
climate for the nation as a whole, and for NSF and NASA in particular,
appears less than optimistic, this decade will also see the
construction of staggering new astronomical facilities,
instrumentation, and detectors and breathtaking gains in scientific
capability through adaptive optics, interferometry, and other new
techniques. What is clear is that NOAO must change too, to meet the
challenges of the Gemini era and to provide for the best use of limited
national resources to meet the needs of the astronomical community in
the 21st century.

The scientific staff of NOAO have initiated in each division (CTIO,
KPNO, NSO, and the US Gemini Project Office) thoughtful discussions of
the future needs of the community and the role that NOAO should play to
meet those needs. The effort by the KPNO staff began with a detailed
examination of the programs within NOAO (telescopes, optical and IR
instrumentation, operations, software, etc.) and of where those
programs should lead in the year 2000. Small groups met in each area
to formulate recommendations for broader discussion by the whole
staff. Bringing these recommendations together and prioritizing them
into an overall program required developing a consensus among the staff
as to the most important issues. Using this consensus as a guide, we
are again tackling the details, focusing on the capabilities that NOAO
should be providing to the community at the start of the next century.

What emerged from these discussions was an overriding consensus of the
unique role of NOAO in the astronomical community. The National
Observatories have responsibilities in leadership, service, and support
of scientific research that are intrinsically different from those of
universities. The strength of our program, and of our community, lies
in our diversity and in our ability to support the wide spectrum of
American astronomy. NOAO must aggressively maintain the richness of
our full program, and must not emphasize one aspect of our program at
the expense of others - to succeed, the NOAO program must include
telescopes that perform to the highest standards of image quality and
throughput, an outstanding instrumentation program building instruments
widely recognized as the best, and a strong scientific and technical
staff leading forefront research and development programs. This broad
program, encompassing the Gemini 8-m telescopes at its heart, offers
the best path to the future. If "uniqueness" was the astronomical
buzzword of the 1980's, "diversity" may be the key to the 1990's.

The success of NOAO is often judged on how far and how quickly we push

back the frontiers of astronomical knowledge. This focus on excellence in research is clearly important, but our mission is broader than simply to enable the few to do the best research. Our mission must also recognize our role as scientists to serve national needs, and to encourage the long term health of our discipline. By enabling diversity in astronomy we allow for new and different perspectives, so that any field is not dominated so strongly by the scientific judgement of the few with access to private facilities. By providing access to competitive telescopes and instrumentation based on scientific merit, NOAO contributes to innovation and integrity in astronomy. The National Observatories also contribute to the intellectual health of the nation by involving the broadest possible community in forefront scientific research. Our users include scientists from all types of institutions - from small private colleges to big state universities to the most prestigious universities with their own facilities. Access to NOAO permits faculty members to remain scientifically and intellectually active, and to be better teachers, citizens, and role models for the wider community. As well as by providing access to facilities for graduate student research, NOAO contributes to the broadest education goals in the US through the opportunities we can provide for research experience in astronomy at the undergraduate level and through the excitement about science that educators who are active in research can bring to the classroom.

These additional goals are not met by emphasizing only the largest telescopes, or only the most forefront scientific programs, but rather by providing access to a range of facilities and capabilities. NOAO should provide not only the largest telescopes, but also enough telescope time to serve the broader needs of the community. Our large telescopes should be competitive with the largest in the world, and offer a range of capabilities. Our small telescopes should be specialized to keep the operations costs down, but well instrumented and of sufficient number to provide access to a significant fraction of the US astronomical community. Only in this way can we truly fulfill the mission of NOAO.

Representatives of the four scientific divisions of NOAO will meet together in late March to share our visions and to forge a joint consensus of where NOAO should be in the year 2000, and how we should get there. Following this NOAO-wide workshop, we will then invite community input and discussion of the draft NOAO plan.

Caty Pilachowski

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Management Changes (1Mar94)

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Management Changes (1Mar94)
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

I am very pleased to announce that Todd Boroson has been selected as the US Project Scientist for the Gemini telescopes project. With this appointment, Todd joins Malcolm Smith and Jacques Beckers as Associate Directors of NOAO. Todd was selected by a search committee chaired by Steve Strom. The committee selected Todd because of his "record of scientific and technical accomplishments while a staff member at a major private observatory (Carnegie Observatories), at a prominent university-based observatory (University of Michigan/MDM Observatory) and most recently at NOAO; .... his ability to communicate and work effectively with astronomers throughout the US and international communities; his understanding of the Gemini project and of potential NOAO/Gemini synergism; and his technical vision and commitment." I would like to express my appreciation to Steve and the committee (Gerry Neugebauer, Eric Persson, Hy Spinrad, Fred Gillett, and Steve Ridgway) for their work in carrying out the search process.

The section of this newsletter prepared by the US Gemini Project Office (USGPO) describes the role and responsibilities of this new division of NOAO. Fred Gillett, who served as Acting US Project Scientist for the past year, will continue to work with the office, concentrating on technical issues. A technical/administrative assistant, Kathy Wood,

has been added to the office, and recruitment for a managing engineer will be initiated soon.

Caty Pilachowski is now serving as interim director of Kitt Peak National Observatory pending initiation of a search for that position. In addition to managing the observatory, she is leading the effort to define a long range plan for KPNO as part of the NOAO 2000 effort, which is described elsewhere in this newsletter. The advent of the Gemini project, which will require substantial support from Kitt Peak scientific and technical staff, combined with extremely constrained budgets, requires a re-examination of the priorities for the Tucson-based nighttime resources. I very much appreciate Caty's willingness to assume this major responsibility at a time of very significant challenge and change. Those of you who are familiar with her past contributions to KPNO, to WIYN, to the AAS Publications Board, and to many other programs will, I am sure, have great confidence in her ability to lead the observatory aggressively forward.

George Jacoby, who had formerly been in charge of KPNO mountain operations, has been named Project Scientist for IRAF. Appointment of a Project Scientist has been one of the most frequent recommendations of the IRAF Users' Committee, and in his short tenure George has already demonstrated that he will have a major positive impact on program planning, priorities, and evaluation.

Sidney C. Wolff

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Science in the National Interest (1Mar94)

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Science in the National Interest (1Mar94)
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

At the end of January, the White House Office of Science and Technology Policy hosted a forum on "Science in the National Interest." The goal of the meeting, which was attended by about 300 scientists and research administrators, was to provide an opportunity for an exchange of views prior to the preparation of a document describing the research policy of the Clinton administration. A statement concerning technology policy was released last year. Several people who play a key role in shaping research policy spoke at the conference, and I would like to share with you some of the ideas that they presented.

The strongest statement in support of basic research was made by Vice-President Gore. He said that science has to be a top priority - that without it, civilizations stagnate. It is the policy of the Clinton administration to achieve sustained world leadership in basic science, mathematics, and engineering. The reasons offered by Gore for pursuing fundamental science include the fact that it is the source of medical and technical breakthroughs, that it is essential to the education process in universities, and that humanity has a need to define itself through better understanding of the natural world. Gore stressed that, in shaping its overall policy, the administration would not take a narrow view and emphasize only immediate results and short term goals.

All of the other speakers also stressed the importance of basic research, but they emphasized the need to develop an overall policy that would, as Congressman George Brown put it, marshall basic science to support societal goals. Brown is not comfortable with the phrase "strategic research," because to him that phrase implies micro-management of basic research. He does believe, however, that we should define strategic goals and should invest in the research needed to achieve those goals.

Investment was a common theme of the speakers. John Gibbons, the President's science advisor, said that a major objective of this administration is deficit reduction combined with selective investment. Senator Barbara Mikulski believes that we must set national goals and develop a plan to get there. Her definition of strategic research is research focused around important national

goals. In many ways, Senator Tom Harkin was bluntest of all - if you want to get funding, he said, you had better be in an investment program.

But what constitutes an investment program? In order to translate the goal of making strategic investments in research into specific programs, it is necessary first to examine some very large questions. Congressman Brown indicated some of those big picture questions. What is the future of work in our society? Will there be enough high wage jobs to sustain the middle class? What will be the impact of redesign of the health care system, which will surely rely more heavily on preventive care? How will we deal with environmental protection? How will the education system change in the information age? How will the development of the information superhighway impact geography-based higher education? How will we manage the social stresses of the information highway? How can we marshall innovation for the service sector? What is the role of the social sciences in understanding the roots of violence and in revitalizing family?

Implicit in these questions is a point stressed by Senator Rockefeller. There is in this country an exploding demand for better lives. That demand was masked by the cold war but must now be addressed. What is needed is a better relationship between the research that is authorized and the national goals that we seek; this better relationship requires new organizing principles for determining national directions, which must have the goal of achieving a more productive and humane society.

The US has up until now, according Rockefeller, lacked clear policies for using university-based basic research either to improve the quality of life or to help industry, which must be a partner in the effort. This lack is in clear contrast with the situation in defense and health, where such policies have existed. In particular, NSF has had in the past neither the mandate nor the incentive to assist industry. The constituency of the NSF has been the performers of research, not the users of research. NSF has filled its traditional role very well, Rockefeller believes, but Congress now wants to use NSF to do more. The NSF is expected to focus more on research of strategic interest to the nation. Simply relying on spinoffs and a few science and engineering centers will not be enough. It was also suggested by Rockefeller that consideration should be given to enabling industry to have a more direct voice in setting priorities, in determining the allocation of funds, and in designing research program. Perhaps funds should even be made available to industry to invest in universities. Rockefeller also stressed the importance of geographical equity. Universities impact the economies of their regions, and there is a moral obligation, he believes, to see to it that all parts of the country share in the benefits of university research.

Emphasizing the investment theme, Senator Mikulski described congressional appropriators as investment bankers, selecting those programs that will serve the needs, including the long range needs, of society. In this new era, she said, rather than smart bombs we need smart science and technology to win wars in the economic arena. We need a new paradigm - one in which science, new ideas, and new technologies lead to jobs in manufacturing. The Clinton administration believes, however, that it is essential to limit the risk of government failure in its investment program. Possible strategies include cost sharing and coordination with industry, broad-based competition for funding, and rigorous program reviews.

Senator Mikulski also suggested that some reorganization of the NSF might be in order. She pointed out that NIH does not have an institute of molecular biology but rather has a cancer institute, which includes as part of its program research in molecular biology. She asked whether the NSF should also be organized around themes that touch everyday life, such as global change and high performance computing.

Finally, Mikulski expressed her feeling that many scientists have developed a sense of entitlement - that every scientist with a PhD should be funded to pursue his or her curiosity. She would rather that we think of ourselves as all one country working together toward common goals.

In discussion sessions, participants examined a variety of issues in more detail. Of particular interest was the analysis of problems facing universities in this changing climate. Considerable time was spent on the issue of human resources and the education and training of both scientists and non-scientists. Several participants argued that there was no policy for development of human resources and that training was on auto-pilot, with support for graduate students simply being tied to grants. In many cases, graduate training is too narrow, and there was a strong feeling that the PhD should broaden not narrow options. Some people thought that the balance in training should change, with more emphasis on the ability to integrate knowledge as opposed to deep specialization. There was a general feeling that the

importance of teaching should be emphasized and that grants should not disconnect teaching and research. Exchange of personnel between industry and universities was thought to be desirable, as were internships in industry.

At the undergraduate level, introductory science courses were characterized as needing major change, and there was strong support for research experiences for undergraduates.

Mark Wrighton of MIT discussed several issues facing universities. He argued for federal support that enables rather than merely aids research, for stable and predictable overhead policies, and for an investment by the federal government in instrumentation. He also believes that there must be a major effort by universities to hold down costs of both research and administration; that there will have to be greater sharing of facilities; that higher priority should be given to undergraduate education, including providing appropriate incentives for professors; that universities will have to be right-sized (the preferred phrase for those at the conference with an aversion to the term "down-sizing"). The issues of deferred maintenance are formidable ~ so formidable that it appears unlikely than any single funding source can resolve them. Wrighton feels strongly that scientists must pay attention to issues relating to ethics and integrity.

Newspapers and television news programs are filled with stories of change. Reorganization and restructuring are making industry more competitive and fundamentally changing the ways business is done and the rate at which new products are introduced. Gore has presented a plan for re-engineering government. The changes in health and defense policy will ripple through the economy. The universities are undergoing major change. Astronomy is not immune to these changes. The good news for science is that virtually the only budgets that will be increasing in the next few years are the ones relating to science and technology. It is an open question, however, about the extent to which astronomy will benefit from increasing budgets given the changing priorities of the federal government. It will be a challenge for us as a community to devise effective arguments for support of the programs that we believe are most important during the next decade.

Sidney C. Wolff

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An Open Letter from the Optical/Infrared Panel of the Committee on Astronomy and Astrophysics (1Mar94)

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An Open Letter from the Optical/Infrared Panel...(1Mar94)
of the Committee on Astronomy and Astrophysics
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

The Optical/Infrared Review Panel of the Committee on Astronomy and Astrophysics of the National Academy of Sciences has requested that the National Optical Astronomy Observatories circulate the following letter to our user community. The review underway by the OIR Panel may well have profound effect on the way astronomy is done well into the next century, and we urge all users of national astronomy facilities to respond to the Panel's request for input.

Caty Pilachowski

Most of you have probably heard that the Committee on Astronomy and Astrophysics (CAA) has formed a panel (the "OIR Panel") to recommend a strategy for optical and infrared astronomy in the US. The charge to the panel, in response to a request by Hugh Van Horn and subject to approval by the National Research Council, is as follows:

1) Assess the context in which optical and infrared astronomy will be pursued in the coming decade, including existing and planned instruments worldwide, NASA missions, and likely technological developments. This examination must consider the appropriate mission

for the National Optical Astronomy Observatories (NOAO); the most effective use of NSF funds for support of facilities, instrument development, and research; and how best to structure our efforts to meet the challenges of the next decade.

2) Within this context, evaluate the mission of the NOAO and define its optimal role (including both nighttime and solar activities) relative to that of other government facilities and optical/infrared university observatories and research departments. This evaluation will take into account both the research and educational roles of the organizations.

3) Suggest and evaluate alternative strategies designed to optimize progress in the field, taking into account the funding available from various federal and nonfederal sources and projections for the future. Give advice for strategies and priorities within optical/infrared astronomy in the light of the expectation that the NSF resources available for these programs will be severely constrained in the coming decade.

The OIR panel members are: Richard McCray (Chairman), Bruce Carney, Jay Gallagher, John Huchra, Ken Kellermann, Tony Tyson, Judith Pipher, and Robert Rosner. In addition, Marc Davis and Jeremiah Ostriker are liaison members from the CAA, and Jill Knapp is a liaison member from the NRC Board on Physics and Astronomy. We are expected to deliver a final report to the NSF Astronomy Division by the end of 1994; that will require us to finish a draft report by September. Our report will actually be a report of the CAA, which will have the final say on its content.

Of course, a report such as this gives astronomers an opportunity to reaffirm and, we hope, strengthen the case for increased support of optical/infrared astronomy. We certainly intend to do that. However, we would not be responsive to our charge if our recommended strategy simply required such an increase. In carrying out our work, the OIR Panel will be guided by two principles. First, our recommended strategy must conform to the primary recommendation of the Bahcall Report (p. 12): "The highest priority for ground-based astronomy is the strengthening of the infrastructure for research, that is, increased support for individual research grants and for the maintenance and refurbishment of existing frontier equipment at national observatories." Second, our recommended strategy must be resilient: it must work in a pessimistic scenario for future NSF funding of optical/infrared astronomy as well as an optimistic scenario.

The reference in item (2) of our charge to solar activities at NOAO has led to some uncertainty which we hope to clear up here. If our panel should recommend changes in the way that NOAO serves the astronomical community, those recommendations might have implications for the future operations of the National Solar Observatories. Therefore, we must be cognizant of the potential impact of our recommendations on solar astronomy. We do not, however, intend to address scientific priorities for solar astronomy. If our recommendations raise questions regarding scientific strategy for solar astronomy, those questions will have to be addressed elsewhere.

The OIR Panel will hold its first meeting in Tucson on 24-26 February. At that meeting we will plan our work in more detail and we will open a dialogue with astronomers from NOAO and other observatories located in Arizona. We have also scheduled a meeting in Washington, DC, on 26-27 April, at which we will discuss the issues with the NSF astronomy division, and a meeting in Minneapolis, concurrent with the summer AAS meeting, at which we hope to hold a discussion with the community at large. We will hold one or two more meetings, at times and locations to be determined. We plan to consult with directors of both public and private observatories to understand better the factors driving the operating costs and the possible opportunities for achieving higher productivity through sharing facilities.

We believe that we can do our work most effectively through an open process that involves maximum participation by the community. Accordingly, a substantial part of every meeting of the panel will be conducted in open session, and we will invite members of the community to present a variety of perspectives to the panel.

We will also use the Internet as a tool to include all interested members of the astronomy community in the dialogue. Accordingly, we have established the following account:

oirpanel@jila.colorado.edu.

Please, if at all possible, use e-mail to the above address rather than hardcopy for all communication with the panel. Be sure to indicate whether your correspondence is intended as: (1) open to all interested astronomers; (2) confidential to the panel members; (3) confidential to the panel chairman. We hope that you will use option (1) unless there

is a compelling reason not to. All interested astronomers will be able to read the open correspondence and dispatches from the panel through anonymous ftp: ftp jila.colorado.edu. Username: anonymous. The password "oirpanel" will automatically transfer you to the right directory. Further instructions can be found there in the file read.me.

With the proliferation of large telescopes and major advances in instrumentation, optical/infrared astronomy is entering a golden age. The trick is to develop an evolutionary strategy in which all US observatories, both public and private, can be used to their maximum advantage. Perhaps new advances in technology, such as the information highway, will enable astronomers to use a greater variety of telescopes and instruments at lower cost than today.

Although the charge to the panel mentions the need for a strategy to deal with the possibility of a severely constrained NSF budget, we would be missing a big opportunity if we focused exclusively on the near-term issues. The most creative thinking will probably result from asking the question: what kind of infrastructure might be possible and optimal for optical/infrared astronomy on timescales of 10, 20, 30 years from now? We hope that our colleagues won't hesitate to offer their suggestions, even if such suggestions may invite criticism. A certain level of such "creative discomfort" may yield a better result in the task before us.

Richard McCray

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Future Availability of Kodak Photographic Plates (1Mar94)

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Future Availability of Kodak Photographic Plates (1Mar94)
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

At the AAS meeting in Washington DC, Gordon Brown of Kodak announced that they will no longer be making any plates other than the IIIaJ and IIIaF types. The IVN plate will be made until the raw materials are gone. Brown asked that those with long-term programs affected by this decision write to him with their needs. If there is support, he will see if Kodak would make Tech Pan plates with O sensitizing. You can write to him at:

Gordon Brown
Eastman Kodak Co.
343 State Street
Rochester, New York 14650

KPNO only has two telescopes that use plates, the 4-m at prime focus and the Schmidt. We have some plates on hand, but observers who want to use plates should purchase them directly, or contact us well ahead of time to see what we have available.

CTIO supports use of photographic plates with their Schmidt telescope, and has a limited supply available to users.

Bill Schoening

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News from AURA: Dick Malow Joins AURA (1Mar94)

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News from AURA: Dick Malow Joins AURA (1Mar94)
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

AURA is pleased to announce the appointment of Richard N. Malow as Special Assistant to the President for International Relations.

Malow left his post as the Clerk of the VA, HUD, and Independent Agencies Subcommittee of the House Appropriations Committee in January. During his 21 years on Capitol Hill, Malow had responsibility for more than 70 appropriationsaccounts for 20 Federal agencies, including the National Science Foundation and NASA. Formerly, Malow served in management positions in the Department of Agriculture and the Overseas Development Council.

Malow will join the AURA Corporate Office officially on 1 April 1994.

Lorraine Reams

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Engineering and Technical Services: The Aladdin 1024 x 1024 InSb Array: A Project Update (1Mar94)

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Engineering and Technical Services: The Aladdin...(1Mar94)
1024 x 1024 InSb Array: A Project Update
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

In the December 1993 NOAO Newsletter we introduced the Aladdin project. This a progress update on that effort. The critical design review on the readout design was held in December and the final design is now complete. The readout design tapes have been submitted to Orbit, which is doing the mask fabrication and wafer processing. There have been no changes in the specifications from those shown in the December Newsletter. The detector focal plane assembly (FPA) will mount in a Yamaichi socket (IC51-1244-410), and the hybrid package is a custom 124-pin LCC made specifically for this project.

The array is organized into four independent 512 x 512 quadrants. Each quadrant will be read from its corner towards the center so as to minimize any interface effects at the quadrant borders. If the various bias and clock lines for each quadrant are combined, 11 bias voltages and 10 clocks are required for operation. The array has 8 outputs per quadrant and the design goal is to read out the whole array in 50 ms. The design has both NMOS and PMOS output drivers, and the actual selection is made at the time of bonding. The NMOS drivers may have LED problems but provide for lower voltage operation while PMOS drivers are reputed to have lower noise and less tendency towards LED effects. During the readout evaluation we will carefully investigate these effects and make a determination as to which is the best approach.

The addressing structure is a CMOS shift register. The slow shift register is a three phase design while the fast register is a two phase design. The clocks are buffered on chip so the clock driver does not have to drive the on-chip capacitance. Resetting is done a row at a time so faster resets will be possible when using some of the low noise readout approaches. The row enable levels, which are critical to the unit cell performance, are under user control as an external bias. This makes sure the unit cell can be operated in an optimal manner and not be subject to internal variations in the shift register.

In selecting various design approaches, the philosophy was to give the user as much direct control as possible. In the past this has proven to be best and it has been fully implemented in this design. It does make for more bias levels and clocks, but the advantages far outweigh the disadvantages. After these modes have been fully explored, a later variation on the Aladdin design may eliminate or combine some features. By the next Newsletter we will be reporting on actual test data taken with the bare readout.

More information can be obtained by accessing the NOAO anonymous ftp area.
This can be done as follows:

```
    ftp ftp.noao.edu (or 140.252.1.24)
    log in as anonymous
    use your e-mail address as the password
    cd aladdin
    get README
    get any other files of interest
    exit with quit
```

The README file will contain any updates and a short description of the
contents of other files in the directory. If you have any questions or
comments they should be sent directly to me.

Al Fowler (afowler@noao.edu)

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NOAO Preprint Series (1Mar94)

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NOAO Preprint Series (1Mar94)
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

The following preprints were submitted during the period 1 November
1993 to 31 January 1994. Please direct all requests for copies of
preprints to the NOAO author marked with an asterisk.

546 *Sarajedini, A., "A Technique for the Simultaneous Determination of Globular Cluster Metallicity and Reddening Using (V,V-I) Color-Magnitude Diagrams"

547 Demarque, P., *Sarajedini, A., Guo, X.-J., "The Gap in the Color-Magnitude Diagram of NGC 2420: A Test of Convective Overshoot and Cluster Age"

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

549 *Suntzeff, N.B., Kraft, R.P., Kinman, T.D., "Summary of Delta S Metallicity Measurements for Bright RR Lyrae Variables Observed at Lick Observatory and KPNO Between 1972-1987"

550 *Elston, R., McCarthy, P.J., Eisenhardt, P., Dickinson, M., Spinrad, H., Jannuzi, B.T., Maloney, P., "The Seyfert II Nature of the IRAS Source FSC10214+4724"

551 *Kuhn, J.R., "Brightness Observations of the Sun"

552 Coulter, R.L., *Kuhn, J.R., "RISE/PSPT as an Experiment to Study Active Region Irradiance and Luminosity Evolution"

553 *Penn, M.J., Kuhn, J.R., "How Bright is the [Si-X] 1431nm Coronal Emission Line?"

554 *November, L.J., "Long-Lived Convective Flows in Quiet and Active Regions"

555 *Penn, M.J., Kuhn, J.R., Amaud, J., Mickey, D.L., Labonte, B.J., "Coronal Electron Density Measurements Using the Near-IR [Fe XIII] Emission Lines"

556 *Kuhn, J.R., Balasubramaniam, K., Kopp, G., Penn, M.J., Dombard, A.J., Lin, H., "Removing Instrumental Polarization from Infrared Solar Polarimetric Observations"

557 *Williams, W.E., Goodrich, J., Toussaint, R., "Image Quality Assessment for the GONG Project"

558 Abraham, R.G., *Valdes, F., Yee, H.K.C., van den Bergh, S., "The Morphologies of Distant Galaxies: I. An Automated Classification System"

559 *Livingston, W., "Surrogates for Total Solar Irradiance"

560 *Pierce, M.J., "Testing the Tully-Fisher Relations: A Comparison with Distances Estimated via Supernovae of Types Ia and II"

561 *Howard, R.F., "Average East-West Inclinations of Surface Magnetic Field Lines"

562 *Altrock, R.C., "Variations of Coronal Radiations at Optical Wavelengths"

563 *Giampapa, M., "Perspectives on the Relationship Between Activity and Fundamental Stellar Parameters"

Fleming, T.A., Schmitt, J.H.M.M., *Giampapa, M.S., "The X-ray Luminosity Function of the Nearby K and M Dwarfs: Results from ROSAT"

Linsky, J.L., Andrulis, C., Saar, S.H., Ayres, T.R., *Giampapa, M.S., "The Relationship Between Radiative and Magnetic Fluxes for Three Active Solar-Type Dwarfs"

564 *Komm, R.W., Howard, R.F., Harvey, J.W., "The Covariance of Latitudinal and Longitudinal Motions of Small Magnetic Features"

565 *Elston, R., Thompson, K.L., Hill, G.J., "Detection of Strong Optical Iron Emission in Redshift z &gt 3 Quasars"

566 *Silva, D.R., Elston, R., "Probing Radial Age/Metallicity Degeneracy in Early-Type Galaxies"

567 *Balasubramaniam, K.S., Regan, K., "Global Characteristics of Energy Release in Solar Flares and its Implications for the Solar Activity Cycle"

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Non-NOAO Preprints (1Mar94)

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Non-NOAO Preprints (1Mar94)
(from the Director's Office, NOAO Newsletter No. 37, 1 March 1994)

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

*Beckers, J.M., "Solar Surface Magnetism: Quests for Observations"

*Beckers, J.M., "Estimating the Effects of Nitrate Mining Activities on the Astronomical Site Quality of the Cerro Paranal Observatory"

Beckers, J.M., Melnick, J., "Effects of Heat Sources in the Telescope Beam on Astronomical Image Quality"

**Davis, L.E., "A GUI for an IRAF Aperture Photometry Task"

Dey, M.S., *Massey, P., "O Star Giant Bubbles in M33"

*Dunn, R.B., Smartt, R.N., "Novel Designs for Space-Borne White-Light Coronagraphs"

*Duvall, T.L., Jefferies, S.M., Pomerantz, M.A., Harvey, J.W., "The Frequency Variation of Solar Acoustic Wave Travel Times"

*Eggen, O.J., "Photometry of F-K Type Bright Giants and Supergiants. III. The Luminosity, Reddening and Heavy Element Abundance of GK Stars"

*Eggen, O.J., "Post-Main Sequence and Post Red Giant Branch Variables with Pulsation Periods Less than One Day"

**Fitzpatrick, M., "A GUI for the IRAF Radial Velocity Task FXCOR"

Forbes, D.A., Norris, R.P., *Williger, G.M., Smith, R.C., "A Nuclear Starburst Ring in the Spiral Galaxy NGC 7552"

*Hamuy, M., Suntzeff, N.B., Heathcote, S.R., Walker, A.R., Gigoux, P., Phillips, M.M., "Southern Spectrophotometric Standards. II."

*Jefferies, S.M., "Some Recent Advances in Iterative Blind Deconvolution"

*Jefferies, S.M., Osaki, Y., Shibahashi, H., Duvall, T.L., Harvey, J.W., Pomerantz, M.A., "Use of Acoustic Wave Travel Time Measurements to Probe the Near-Surface Layers of the Sun"

*Komm, R.W., "Wavelet Analysis of Solar Magnetic Structures"

*Komm, R.W., Howard, R.F., Harvey, J.W., "Solar Non-Rotational Motions"

**Lytle, D., "An IRAF Solar Data Pipeline into the World Wide Web"

Moses, D., Cook, J.W., Bartoe, J.D., Brueckner, G.E., Dere, K.P., Webb, D.F., Davis, J.M., *Harvey, J.W., Recely, F., Martin, S.F., Zirin, H., "Solar Fine-Scale Structures in the Corona, Transition Region, and Lower Atmosphere"

*Penn, M.J., "Probing the Depths of Sunspots"

*Ridgway, S.T., "The Impact of Adaptive Optics on Focal Plan Instrumentation"

Schrijver, C.J., *Harvey, K.L., "The Photospheric Magnetic Flux Budget"

**Seaman, R., "NOAO/IRAF's Save the Bits, a Pragmatic Data Archive"

Tsuji, T., Ohnaka, K. *Hinkle, K.H., Ridgway, S.T., "High Resolution Infrared Spectra of Silicon Monoxide and Silicon Isotopic Abundances in Cool Luminous Stars"

Windhorst, R.A., ..., *Green, R.F., "The HST Medium Deep Survey: II. Deconvolution of WFC Field Galaxy Images in the 13h +43 Degree Field"

** Available in the preprints directory on pandora.

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

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A Letter from the New Director (1Mar94)

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A Letter from the New Director (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

The Current State of CTIO

In the years since I left Chile in 1976, CTIO has continued its marvelous reputation for a standard of visitor service second to none. Scientific productivity in terms of astronomical discovery, published papers and reliability of operation of its telescopes has been excellent. CTIO has used relatively limited technical development resources to outstanding effect. A recent example has been the development of the ARCON CCD systems, which are as good as any in the world. A key to the success of CTIO has undoubtedly been the strong voice that active scientists have in the running of the observatory. That strong influence will continue.

On the other hand, I can hardly tell the difference between photographs of Cerro Tololo taken in 1976 and the appearance of the summit today. In contrast, Mauna Kea - which in 1976 had no telescopes bigger than the University of Hawaii 88-inch - is vastly and fundamentally changed. It has many large telescopes in routine operation with excellent image quality.

The Need for Change

I see that part of the challenge of the future will be to produce positive change while maintaining the traditions of scientific vitality and strong commitment to support of our visiting observers - the trademarks of Tololo's operations over the last 30 years.

Change is essential now. Why is it that while new telescopes have been appearing on mountains all over the globe - including in Chile - no large new telescopes have come to an observatory as successful as CTIO? A world-class organization can only go so far by tuning up its focal-plane instruments and redoubling its efforts to support visitors when its telescopes are smaller and/or have poorer images than potentially competitive facilities.

Current Priorities

We will respond to this need for change in a careful manner. The highest priority program in the observatory is to improve the quality of the images at the focal planes of the 4-m telescope. This program is under the leadership of Jack Baldwin. I expect occasionally to have to give this program higher priority even than support of scheduled observing time, as I believe in the longer term this will produce greater scientific benefit for our user community. A recent example of what can happen is that a few scheduled programs on the 4-m telescope have had to be delayed, modified or even cancelled in order to get the refigured f/8 secondary back onto the telescope. In a separate article by Jack Baldwin, you will see that not even this improvement will, by itself, guarantee significantly improved focal-plane imaging. Much more work is required - and will be supported - as an observatory priority.

It is important to realize that (i) the scientific and technical staff of CTIO will be taking this top priority seriously and (ii) that the increasing focus of the observatory's scientific and technical resources onto the 4-m upgrades will reduce the level of effort available for maintenance and support of the smaller telescopes at CTIO. 4-m telescope images with a FWHM around 1.3 arcsecs ceased to be really competitive five or six years ago! We are being forced to restrict significantly the range of options we can support on each of the smaller telescopes - and cease significant development activity on those telescopes, at least temporarily - in order to catch up on the 4-m.

Our second current priority is to finish off the introduction of ARCON readout and control electronics for our most-used CCD systems. This activity is certain to continue throughout 1994.

Our third current priority is to improve the capabilities of our infrared instrumentation offered on the 4-m. Progress will be severely constrained until completion of the f/14 tip-tilt secondary installation at the end of next year.

Longer-term Changes

We are in discussions with staff and users on how to get as much of the present observatory as possible into a truly modern and highly reliable state (Bahcall priority one) before the ramp-up to Gemini commissioning and operations gets under way in Chile. Given the present budgetary environment that many of us heard about at the recent AAS meeting, it seems unlikely that CTIO will receive any additional resources in Chile, and yet we expect that a large fraction of the available ETS effort will be needed to support Gemini South ramp-up activity for a period of about three years starting around 1998 - during which time the telescopes and instruments on Tololo could receive very little in the way of in-house development support.

In order for Tololo to provide what universities want, I believe we must open up more direct forms of cooperation. A university with preferred access to complementary facilities on Tololo and/or Pachon will be able to make optimum use of its (limited) access to Gemini South, and be in a unique position with regard to the traditional advantages of observatories in the Southern hemisphere - access to the southern skies in cooperative work with space-borne observatories such as HST, access to the Magellanic Clouds and the central regions of our galaxy and access to special regions of inhomogeneity in the large-scale flow of extragalactic systems. I therefore intend to do all I can to encourage, visit and work with universities in the US and Latin America with the aim of sharing the ability of CTIO to provide an excellent scientific operations environment for specific cooperative programs.

Until very recently, I had hoped we could divert some CTIO resources to collaborative programs with any universities wishing to help upgrade the small telescopes (in return for a few years of preferred access to these telescopes at, say, the 10-15% level). However, the need to

speed progress on the 4-m telescope upgrades effort coupled with the likely state of the CTIO budget over the next five years has led the CTIO scientific staff to the view that such small-scale collaborative efforts should not, after all, be encouraged - unless the budget forecasts improve.

Large new telescopes can be funded by private or university-based donations, but such funds usually require substantial endowments to cover operations. Tololo would seek the additional support necessary to provide an excellent environment for such operations in return for a fraction of telescope time to be made available to its general users.

Other projects will wish to retain a higher degree of independence and provide their own operating endowments. In such cases, Tololo would offer access to the site and suitable business support services in Chile on a full cost recovery basis. Cerro Pachon would, in such cases, function much as Mauna Kea does today. The only tax on telescope time in such cases would be the fraction due to Chilean astronomers.

Operations on Tololo - and in the future on Cerro Pachon - provide the only ground-based access to the southern skies at optical and infrared wavelengths for the vast majority of observers from the most energetic community of astronomers in the world. I am therefore certain that the future for this observatory is extremely good and that CTIO will respond well to the current challenges. Tololo stands ready to work in a flexible, imaginative, cooperative, energetic and open manner to improve ground-based access to the southern skies.

Malcolm Smith

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CTIO Instrumentation (1Mar94)

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CTIO Instrumentation (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

During the past quarter we generally have been successful in concentrating our engineering resources on our three top-priority areas for improvements: the package of optics and seeing improvement projects for the 4-m; development and implementation of ARCON CCD controllers; and work on the IR instrumentation.

Important progress was made in the image improvement program at the 4-m. A separate article describes the results of repolishing the f/8 secondary. Not described there is a sizeable project to improve the controllability of the focus and alignment mechanism for this secondary. The old motors and drives were replaced by a system consisting of three jack screws under precise computer control. The upgrades were completed while the mirror was being repolished, and will be an important component of our eventual active optics system for the 4-m.

We also put our 4-m primary mirror cooling system into routine daytime use. This system draws in air from inside the dome, cools it using a heat exchanger connected to the building's air conditioning system, and then blows the cold air up through the (unused) coud light path and into the mirror cell. A computer keeps the cooled air at a preset temperature which is a few degrees below the expected nighttime air temperature, and shuts the system down when the humidity gets too high. We are successfully cooling the mirror enough so that as it reheats during the night its outer skin seldom gets above the ambient air temperature. We have not yet made the extensive measurements needed to gauge the effect on seeing.

There has also been good progress with the ARCON CCD controllers. At the start of the quarter we had ARCONs running with four older CCDs which had been transferred over from the VEB controllers. The ARCONs are now in a sufficiently developed state that we are able to start bringing up new CCDs with them. Three are now in progress.

The first new CCD is a thinned Loral 3K x 1K which will be used in the Air Schmidt camera on the 4-m R-C spectrograph. We are hoping to have this ready to go in April, although it is touch and go. Once in use, this CCD will give us roughly a factor 2 increase in QE over the Reticon CCD that we presently use.

The second CCD now being characterized is a Tektronix 2048 x 2048 for the WIYN telescope. This is being brought up by Andy Rudeen, who is visiting CTIO from KPNO. Work is well along; the controller presently produces images with an engineering grade chip.

In addition, CTIO has obtained a new Tektronix 2048 x 2048 CCD, reportedly with much better cosmetics than our existing Tek 2K. This chip will be used for direct imaging and with the 4-m and 1.5-m echelle spectrographs. We have also made good progress with the ARCON for this chip, and hope to have it on the air by the middle of the year.

A fourth new CCD is in the queue, but work will not start on it until late in the year. It is a thinned Loral 1200 x 400, and will be dedicated to the 1.5-m Cassegrain spectrograph.

Two important IR instrumentation projects are now in full swing. The first is the conversion of the Infrared Spectrometer (IRS) to a 256 x 256 array. The array will be controlled by the KPNO WILDFIRE system, so most of the work will be done by the KPNO IR group. The second project is the construction of our new NICMOS imager, which will also use a 256 x 256 array, also controlled by WILDFIRE. This is the major mechanical project now occupying our machine shop. Both of these instruments should see first light in July. Actually, it will be third light in the case of the IRS, which has seen its share of upgrades. More details are given in an accompanying article.

Finally, we moved the console room of the 1.5-m. Or, more accurately, "they" moved it... this author can't find it anymore, and has gotten tired of looking for it. But it's rumored to be approximately one floor lower than it used to be, in a location offering much better thermal insulation from the telescope chamber. The new console is also larger and better laid out.

Jack Baldwin

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F/8 Secondary Back in Service at 4-m (1Mar94)

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F/8 Secondary Back in Service at 4-m (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

The f/8 secondary mirror went back into service on the 4-m telescope on January 1st, after an absence of eight months. It's a good news, bad news story. The figure of the secondary appears to be greatly improved, but the quality of the images at the f/8 focus has not improved as much as was hoped.

First, the Good News....

We deduced from tests on the telescope that the secondary mirror had two problems: (1) its conic constant was not properly matched to the primary mirror with the result that there was a large amount of spherical aberration at the design focus; and (2) there were high order aberrations coming from surface irregularities with diameters of roughly 10% of the mirror's diameter. We decided to correct the mirror's figure through ion polishing, to be carried out by Kodak, in Rochester, New York.

We started by obtaining a careful measurement of the mirror's surface figure, using interferometric tests against a Hindle sphere. This was done by Contraves Goerz Corporation, who presently have the NOAO Hindle sphere in their shop. Their results confirmed what we had found on the telescope and provided us with a detailed map of the high-frequency errors after subtracting off a pure hyperboloid shape (Figure 1a).

[Figure 1a not included]

Contour plot of the high frequency errors on the mirror surface before it was ion polished. The units of the high and low values are 0.001 waves, for a wavelength of 632.8 nm. Contour intervals are 0.5 wave.

We then calculated the change in the lower order shape needed to remove the spherical aberration problem at the nominal focus. This can be done to adequate accuracy without precise knowledge of the conics of either secondary or primary. The correction was specified as a differential change in the surface both because the ion polishing process works differentially and because the correction does not then depend on a detailed knowledge of primary figure, which is in some doubt at the level of precision required. We elected to change both the conic constant and the radius of curvature of the mirror, in order to minimize the total material removal. We added this low-order error curve to the high-order map from Contraves. After a bit of smoothing in the middle and extrapolating at the edges, this was the polishing map that we provided to Kodak.

The mirror was then sent to Kodak, who immediately made an alarming discovery - there were several series of micro-cracks on and near the surface of the mirror. These were scattered around at seven different locations on the mirror's surface and were 1-10 cm in length. We are unsure whether these cracks had always been present but had gone unnoticed at CTIO, or if they developed during the mirror's travels. In any case, the fear was that because of the local heating during the ion polishing process, these cracks might propagate because of stress. So we had Kodak grind them out into broader shapes in order to stress relieve them. This was done under the watchful eye of Gary Poczulp of the NOAO optical shop. The ion polishing then proceeded, in just one iteration taking less than a week, exactly as was originally promised by Kodak. We wish to note here that we were very favorably impressed by Kodak's professional approach and high-quality workmanship.

The final step was to send the mirror back to Contraves for a repeat measurement of its surface shape. The "after" result is shown in Figure 1b, again as a map of just the higher-frequency structure after subtracting off the lower order shape of the mirror. Figure 1c shows encircled energy diagrams calculated from the "before" and "after" high-frequency maps. These represent the image degradation just from the high frequency errors, and show that this went from being a substantial problem to being completely negligible.

[Figure 1b not included]

Contour plot after ion polishing. Same units as (a).

[Figure 1c not included]

Encircled energy diagrams calculated from the wavefronts shown in (a) and (b).

The new measurements also showed that the conic constant and radius of curvature had changed by approximately the right amount. These improvements appear to be confirmed by the measurements we have made since putting the mirror back on the telescope: the spherical aberration is reduced to less than 10% of its previous value and is now unimportant. The higher frequency terms also seem to be considerably reduced, at least to the extent that out-of-focus images appear to have a much more uniform surface brightness than they used to, and that when we use our program for fitting the spot patterns from our Hartmann screen, the rms high-frequency residuals are significantly smaller than they used to be.

Success! At least up to this point.

But There's Still a Ways to Go...

We are frequently obtaining 1 arcsec FWHM images with the f/8 (Figure 2). Unfortunately, the remaining low-order aberrations in the system prevent us from getting the really good images for which we are aiming. The images show stable structure on the subarcsecond scale, frequently breaking up into double images separated by about 0.5 arcsec (Figure 3).

[Figure 2 not included]

Radial profile of a star image from a 30 sec exposure.

[Figure 3 not included]

Contour map of star image from a 0.1 sec exposure.

We think that we interpret this as a combination of astigmatism and triangular aberration coming from the primary. At least the magnitudes

of those terms found in our Hartmann screen analysis are unchanged from the values measured one or two years ago. The tests made at that time indicated that the problem was with the primary mirror support system, and we intend to solve it in late 1994 or early 1995 with an active support system for the primary mirror.

However, we do not customarily see images like this at any of the other foci of the 4-m, so we are checking very hard to see if there could be an additional problem with the support of the f/8 secondary. Some major changes were made to the secondary mirror cell while the mirror was being repolished, so something may have gone wrong. All we can say for sure at this time is that we're trying to understand what is going on. We are carrying out numerous tests and measurements while using the mirror for routine observing (and generally receiving positive reports about the image quality, we should add).

...And Finally, Some Deeply Felt Apologies

We believe that the secondary mirror is much better than it used to be, and that this is worth the time that was spent without an f/8 focus. However, there was a highly unfortunate delay in getting the mirror back onto the telescope which prevented us from being able to support several scheduled observing runs. We did our best to either shift the affected astronomers to one of the other 4-m foci (if they could make profitable use of the time), or to reschedule their runs at a later time. We wish to humbly apologize to our colleagues who were affected in this manner, and even more so to the small number of astronomers who just plain lost their observing time. The problem arose mainly because of huge overruns in the time needed to measure the mirror's figure, and to a lesser extent because of the cracks. The schedule included what we thought was a generous contingency factor for this type of problem, but obviously we were wrong.

Jack Baldwin, Brooke Gregory

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CCD News (1Mar94)

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CCD News (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

ARCON has now become the principal CCD control system at CTIO. There are three ARCON systems in routine use, controlling Tek 1K and 2K chips and a Thomson 1K CCD. From November 1993 to January 1994, these three ARCONs were used for 181 of the 253 telescope-nights during which CCDs were used. This represents 72% of the CCD use on Tololo during this period.

Work is now underway to bring a second Tek 2K and a Loral 3K CCD under ARCON control. Both chips should be operational by the beginning of the second semester 1994. Two more CCDs, a STIS 2K and a Loral 1K, are expected to come on line under ARCON control during the second half of 1994. This should bring the use of ARCON- controlled CCDs to above the 95% level by the end of 1994.

On the software side, regions of interest and binning are now supported. All operation is now via the ARCON IRAF user interface, which has been augmented to incorporate control of the 4-m R-C spectrograph. Users are reminded that the latest copies of the ARCON software and instrument manuals are available by anonymous ftp (see Newsletter No. 35, p.16, for a summary of what is available in the CTIO FTP archives).

Tom Ingerson, Steve Heathcote, Alistair Walker

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IR News (1Mar94)

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IR News (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

This issue of the Newsletter has considerable news to report - both good and bad. We will be making two new instruments available during second semester - the HgCdTe Imager and the upgraded IRS. These will compensate for the departure of OSIRIS at the end of September. In addition, we have reluctantly decided to discontinue support of the single-channel IR Photometer. This latter decision is prompted by the recognition that we need to focus our limited resources if we are to provide competitive IR instruments on the CTIO telescopes. We welcome constructive feedback on this and some of the other issues raised in this article.

OSIRIS Departs

Our agreement with OSU ends in September 1994, at which time OSIRIS must be returned to the North to be used there. Its capabilities will be replaced by those of the HgCdTe Imager and the IR Spectrometer, as described below.

In the meantime, spectroscopic users will be pleased to learn that some modifications were made to the instrument to reduce the scattered light problems (especially in cross-dispersed mode); this has led to obvious improvements in performance. The broadband J filter has been replaced by a standard CTIO/CIT J filter, which gives better performance and color transformations, and the narrowband filters now include filters for 1.644, 2.122, and 2.166 microns, replacing several less useful filters originally present. These modifications were carried out in early January by Darren DePoy and Tom O'Brien (Ohio State U.).

OSIRIS will be shipped from Chile at the end of September and will therefore be available only during August and September. Based on past demand, we would expect to schedule it on the 4-m telescope in August and on the 1.5-m in September. Users should, however, try to avoid proposals where only one of these two months is acceptable, since we will not schedule it on more than one telescope during a given month. It will definitely not be available after 1 October.

HgCdTe Imager

Commissioning of this instrument is expected to take place during the June-July period. To allow for a shake-down period, though, we do not plan to schedule it until after 1 October. Since its capabilities and performance should be very similar to those of OSIRIS, we consider this to be a reasonable schedule. The instrument will made available on the 1.5-m and 4-m telescopes only.

For reference, the expected K magnitude performance under normal (0.8 arcsec) seeing on the 4-m is mag. 19.0 to 10% in 10 minutes. Since both seeing and background vary, actual performance may be somewhat better or worse. Performance on the 1.5-m will be roughly 1 mag. less sensitive with small pixels, and proportionally worse at scales which under-sample the seeing.

The available pixel scales are summarized below. These are approximate and will be measured more precisely when the instrument is commissioned on the telescope.

	Arcsec/Pixel		
Telescope	f/8	f/13.5	f/30
4-m	0.4	NA	0.1
1.5-m	1.1	0.6	0.3

The array, as in OSIRIS, is a 256 x 256 NICMOS III HgCdTe detector. The control of the array will be via the KPNO WILDFIRE electronics, using an upgraded version of the old CTIO IR Imager array electronics. Motor control will be done using the new CTIO motor controller, which will be interfaced with the array software. KPNO is producing most of the array control electronics.

Note that, unlike OSIRIS, you must specify the f/ratio at which you intend to work in your original proposal. Some switching between f/ratios is possible during the night, but it is time-consuming and should be thought of as appropriate for a change in program, and not for something like imaging all your program objects at two different scales. The switches that are possible are between f/13.5 and f/7.5 on

the 1.5-m, and between f/30 and f/8 on the 4-m. The latter switch is possible only if the f/30 secondary has been installed at prime focus; you must therefore request it in your original proposal - and justify it as well.

We will have room to install approximately 30 filters simultaneously. These will include the appropriate broadband filters and most narrowband filters of interest. If you have concerns about the latter please contact us before submitting your proposal to see if we have the filter and plan to install it as part of the initial complement. The initial set will definitely include 1% filters for Brackett-gamma and Paschen-beta, He I 1.083, H2 2.122, Fe II 1.257 and 1.644, and H2O, CO, and continuum filters.

Although this instrument will in principle work on the smaller telescopes, it is uncertain whether it will eventually be offered for use there. We will probably undertake some engineering tests on the 0.9-m and Schmidt telescopes during second semester, but the real issue is whether CTIO will run these telescopes with a permanently installed detector (large CCD in both cases), or whether we will have the resources to provide additional detector control hardware and to support a certain number of instrument changes. In any case it will definitely not be offered second semester.

IRS Upgrade

The IRS Upgrade project consists of the installation of a 256 x 256 SBRC InSb detector in the old, familiar IRS. (Think of it as Release 3.0 of the instrument.) The mechanical and optical aspects of the instrument will be largely unchanged, except that we have succeeded in slightly lengthening the spectrograph slit; as a result the pixel scales are 2.5 times smaller than before, and the spectral resolutions 2.5 times higher, assuming a 2-pixel slit. An additional grating has been purchased, a 75 l/mm grating blazed for 2.0 microns, which should be especially useful with the new, larger array, as it provides nearly complete coverage of a spectral window.

The array installation will take place in Tucson in April-May, and commissioning on the 4-m and 1.5-m telescopes will take place in late July. This work is being carried out jointly by CTIO and KPNO staff. We would not plan to make the instrument generally available until September at the earliest, and in September would schedule OSIRIS in preference to the IRS if the project could be done equally well with either instrument.

WILDFIRE will also control the IRS array, as well as providing motor control. As a result, you will actually be able to run the instrument typing on a single keyboard! We expect performance to be similar to that achieved by the analogous upgrade to CRSP at KPNO. The detector dark current should be less than a few electrons per second and the read noise should be less than 40 electrons. We would expect performance on the 4-m with good seeing (0.8 arcsec) with R = 700 to give S/N = 5 in about 1 hour at K = 16.

A summary of available gratings and their resolutions is provided below. Note that at any one time only two gratings can be installed at once and that grating changes require opening up the instrument. In consequence, you must specify the grating desired in the proposal, and once the grating choice is made (we may discuss it with you during the scheduling process), it cannot be readily altered.

Grating Name	Resolution at K	Coverage at K
12 l/mm, blaze 6.5 um	400	0.5 um (underfills array)
75 l/mm, blaze 4.0 um	1600	0.18 um
75 l/mm, blaze 2.0 um	800	0.36 um
210 l/mm, blaze 4.5 um	4800	0.07 um
632 l/mm, blaze 2.5 um	8400	0.03 um

The pixel scales for the lower resolution gratings are roughly 0.32 arcsec/pixel on the 4-m and 0.8 arcsec/pixel on the 1.5-m; the maximum usable slit length now appears to be about 50 pixels.

Note that the two gratings blazed around 2 microns cannot be used for the L or M bands. We have yet to find out how well the array works at the longer wavelengths, but users should assume that L band work is possible only at resolutions higher than 1000; M band work may or may not be possible at R = 4800. We will probably not have definitive answers until July; watch the September Newsletter for more information.

In order to simplify scheduling, we would prefer to establish a default grating configuration; we suggest that for the upcoming semester users consider using the combination of the two gratings blazed around 2 microns. Note that both of these should provide acceptable performance

in the J and H bands, and will work down to and below the CCD cut-off. (In fact, they should do better than a CCD at least down to 1.0 micron.)

As a future development, we are hoping to test a cross-dispersed grating in the instrument sometime second semester; it would offer a resolution like the OSIRIS cross-dispersed mode (R ~ 500), but would provide somewhat better short-wavelength coverage. As the grating and prism cross-disperser will be mounted in a single grating cell, this set-up would use one of the two grating positions in the instrument.

IR Single-Channel Photometry Discontinued

We regret to announce that support for single-channel IR photometry is being discontinued, effective July 1994. The present system will by then be the only use of the aging Tolnet computers, which are becoming increasingly difficult to maintain and repair - spares are no longer available, for example. The effort needed to convert to a more modern computer system and properly integrate it with the telescope control systems is difficult to justify compared with competing demands for resources, given the relatively modest demand for the IR Photometer.

We will attempt to support the one scheduled run (June 1994) with the instrument, but this is contingent on survival of Tolnet.

If any proposals are submitted for IR Photometry, we will try to contact the proposers and suggest alternatives in time for them to amend the proposal.

Search for 10-Micron Imager

The end of the IR Photometer means an end to mid-infrared capabilities at CTIO. Since this is the only southern site generally accessible to the US astronomical community, we regard this as extremely unfortunate - but we do not have the resources to resolve the problem on our own. We are therefore very much interested in entering into collaboration with an outside group, which would supply a 10-micron imager for use on the 4-m telescope. Additional capabilities are welcome but not essential. The terms of the agreement would be similar to those for the Rutgers Fabry-Perot or OSIRIS. Specifically, CTIO would not be in a position to provide technical resources beyond limited assistance in interfacing to the telescope. We would be able to provide reimbursement of some costs such as shipping or travel in support of NOAO users of the instrument. Some engineering and discretionary time could be made available, where the amount depends strongly on the overall demand for the instrument. The suppliers could, of course, apply for more time through the regular allocation process (past experience suggests they would do rather well).

The instrument would be made available to the NOAO community, with technical support to be provided by its supplier. We would block schedule or limit use as needed to keep the support burden reasonable.

This article constitutes an invitation to anyone who feels they would be interested in providing such an instrument; they should contact one of the undersigned to indicate interest. The instrument in question must be a working instrument, since the intention is to offer it to our users. While we will attempt to contact people directly, our failure to do so should not be interpreted as lack of interest on our part - please get hold of us if we don't get hold of you.

Jay Elias, Richard Elston,
Brooke Gregory, Malcolm Smith

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Estimating Lunar Phase Requirements (1Mar94)

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Estimating Lunar Phase Requirements (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

When you wrote your telescope time request, did you carefully work out

the lunar phase requirement? Or did you think to yourself, "I'm working on galaxies, I must need dark time!" and then put down "5" for your "number of days from new moon." One of the reasons why you did things in this way, as most of us do, was that there is no better way easily available. This brief note proposes to help you in this regard.

Some convenient data on Tololo sky brightness as a function of lunar phase can be found in another Newsletter article by Alistair Walker (1987) Although Alistair insists that these data should not be over-interpreted, they are in fact consistent at the 20% level with data on lunar disk brightness as a function of phase (e.g. Russell 1916, Minnaert 1961). For convenience the Walker (1987) numbers are reproduced below:

Table I
Sky Brightness as a Function of Lunar Phase

Days from	Sky Brightness (mag/arcsec2)				
New Moon	U	B	V	R	I
0	22.0	22.7	21.8	20.9	19.9
3	21.5	22.4	21.7	20.8	19.9
7	19.9	21.6	21.4	20.6	19.7
10	18.5	20.7	20.7	20.3	19.5
14	17.0	19.5	20.0	19.9	19.2

What do these show? First of all, the contrast between full moon and no moon is greatest at U and least at I. At U, the ratio is a factor of 100, while at I, it is a factor of 2. Extrapolation to the infrared shows that even at the J band the full moon contributes no more than a couple of percent to the night sky brightness. Furthermore, because the moon brightness peaks so sharply around full moon, the sky brightness is very much less only a few days away.

Let's take as a criterion for desirable sky brightness that the moon degrade your signal to noise by 10% - that is, that it increase total photon counts by 20%. Note that sky brightness varies during the night, seasonally, and even with solar cycle, and just at random by factors substantially greater than this. Consider several different cases:

CCD Imaging

For routine faint-object photometry, the relevant area of sky is roughly the area under the core of the PSF - which one can conservatively take as 1 square arcsecond. Using the numbers from the table, one can calculate a variety of examples:

1a) Faint stars, BVRI = 24. At these magnitudes the star itself contributes relatively little to the total brightness, so one need only ask at what point the night sky brightness is increased 20% by the moon. This happens first at the shortest wavelength - B in this example. Walker's numbers indicate that even at three days from new moon the effect should be significant (defined as 20%), but a comparison with lunar disk observations suggests that one can go three days safely and probably four days - especially if one recalls that at that phase the moon is not present most of the night. Also, if you are doing BVRI, only the B is affected - so your actual loss of efficiency is more like 2% than 20%.

At six days from new moon, the B sky brightness is roughly double, and that at V ~20% higher. Your overall efficiency, with the moon around less than half the night, is reduced by about 15% for a program involving equal dark BVRI exposures.

1b) Not so faint stars. At BVRI = 22, the star is already significantly brighter than sky at B, and roughly equal to sky at V. Thus the effect of the moon is substantially reduced, and one can go about six days from new moon before the total B counts increase by 20%. At BVRI = 20, one can safely work past quarter moon. If one is also doing U = 20, one is still restricted to times before quarter moon. Again, this is taking the worst-case filter; a multi-filter program can usually go to lunar phase one or two days brighter without serious loss of efficiency.

1c) Aperture photometry. If one's program is of isolated objects, then PSF fitting is not appropriate, and it is necessary to repeat the calculation for a larger aperture (synthesized) on the sky. Use of a 10 arcsec aperture is equivalent to shifting the calculations above by 4.7 magnitudes. (A 5 arcsec aperture shifts them by 3.2 mag.) This would indicate that aperture photometry at UBVRI = 15 can be done to roughly quarter moon.

1d) Galaxy photometry. This is really just another form of aperture photometry, but the easiest way to visualize it is recognizing that for most programs, the average surface brightness within the measurement aperture is fainter than sky - hence the lunar phase

requirements are similar to those for example 1a.

In summary, then, for most imaging programs gray or dark time is necessary. But really prime dark time is needed for only the most demanding cases.

CCD Spectroscopy

For visible-wavelength spectroscopy, the appropriate sky area is normally the slit width times the height of the extraction window. This depends on the instrumental set-up and the seeing, but is usually a few square arcseconds. If the slit is sufficiently narrow, one needs to correct for light loss from the object. Another consideration is that the V and R sky brightness values are due in large part to a small number of airglow lines, so that the situation in between these lines is in reality much more like that at B for spectroscopy. Here are some examples:

2a) CS/CCD observations of V = 20. Assume a slit width of 1.5 arcsec and window length of 3 arcsec. Then carry out the calculation at B = 20. The dark sky is contributing roughly 30% of the total counts. When one goes through the numbers, the total counts increase by 20% about six days from new moon.

For V = 18 one can work slightly past quarter moon.

For work on the 1.5-m the slit dimensions are larger, and the magnitudes given above need to be made brighter by perhaps 1.5 mag.

2b) Echelle observations of V = 18. Echelle slits tend to be narrower, but given that there may be loss of light from the object, the situation is not much different than for the Cass spectrograph at the same magnitude level. (Obviously, exposure times are longer - but the proportional effect of moonlight is the same.)

2c) Echelle observations of U = 16. If you weren't working in the ultraviolet, you could probably work right through full moon - but if you need to work at U you have to work at quarter moon or darker. The limiting magnitude for work at full moon at U is roughly 13.5. Note, though, that you still can't work very close to the moon, and if this is a potential problem you should specify dates when the moon is unacceptably close to your main object or objects.

2d) Argus observations of V = 20. The area under an Argus fiber is somewhat less than that used for the spectrograph calculations; light loss missing the fiber may or may not be greater. (Light loss in the fiber doesn't count, since sky photons are also lost in the same proportion.) To the accuracy of these calculations, the differences aren't significant; the conclusions are that for V = 20 (if you can find the objects) you need darker than quarter moon, for V = 18 quarter moon is acceptable, and for V = 16 even full moon is OK. (Conditions are undoubtedly somewhat more restrictive if you are working down at the blue limit of Argus.)

IR Observing

As noted above, the moon has no significant effect on the observations themselves. But it is often necessary to acquire the program objects visually. This is normally done in the red with a CCD TV. Since most of the telescope time is not spent on acquisition (one hopes), a greater than 10% loss of sensitivity is acceptable. If one sets this to be a factor of two increase in the R counts, then for extremely faint objects one cannot work within three days of full moon; once the objects get brighter than about R = 20 even full moon should be acceptable.

Of course, these data apply only when the moon is relatively distant from the object; when the moon is 30d away (and especially if moonlight reaches the telescope optics!) things are much worse. If this is potentially a problem, work out the dates when the moon will be within 30d of your main program objects and indicate those on the proposal as dates to avoid, for this reason.

Summary Table

It is suggested that you use this to help you in preparing your proposal - and if you feel you need more restrictive lunar phase than given here, you should provide a detailed explanation of the reasons why. Note that there are undoubtedly many cases not covered by the table, but it shouldn't be too hard to work out the relevant conditions. It is important to realize that these are fairly conservative numbers (10% loss of signal to noise in the bluest filter) and it is thus practical to schedule many proposals - especially those involving many nights - to include somewhat brighter time.

Table II

Acceptable Days from New Moon

Magnitude	BVRI Phot. PSF fit	UBVRI Phot. PSF fit	4-m UV Spect.	4-m Vis. Spect.
14	14	14	13	14
16	14	12	9	14
18	11	8	6	8
20	8	6	5	6
22	6	5	4	5
24	5	4	4	5

References

1) Minnaert, M. 1961 in Planets and Satellites, ed. G.P. Kuiper and B.M. Middlehurst (U. of Chicago: Chicago) 213.
2) Russell, H.N. 1916 Ap. J., 43, 103.
3) Walker, A. 1987 NOAO Newsletter, 10, 16.

Jay Elias

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Requests for CTIO Telescope Time February - July 1994 (1Mar94)

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Requests for CTIO Telescope Time February - July 1994 (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

Telescope		Nights Req.	Nights Sched.	Requested/ Scheduled	Visitor Nights	%Visitor Nights	Staff Nights	%Staff Nights	Eng.& Maint.
4-m	Dark	213	93	2.3	79	85	14	15	17
	Bright	191	71	2.7	63	89	8	11	
1.5-m	Dark	138	96	1.4	88	92	8	8	13
	Bright	202	72	2.8	71	99	1	1	
1-m	Dark	68	94	0.7	90	96	4	4	5
	Bright	121	47	2.6	47	100			
0.9-m	Dark	166	99	1.7	76	77	23	23	9
	Bright	54	48	1.1	42	88	6	13	
Schmidt		133	106	1.3	77	73	29	27	4

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Report of the CTIO Users Committee (1Mar94)

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Report of the CTIO Users Committee (1Mar94)
(from CTIO, NOAO Newsletter No. 37, 1 March 1994)

The CTIO Users' Committee held its annual meeting in Tucson on 8 and 9 December 1993, and after discussions with CTIO Director Malcolm Smith and Interim Director Mark Phillips, submitted the following report:

Introduction

US astronomy is facing a fundamentally changing situation. A new

generation of large telescopes is coming on line during a time at which level funding is expected and in which both the grants program and NOAO are already experiencing budget difficulties. The subsequent pressure on NSF astronomy funding and for CTIO in particular is a cause for serious concern. As a result, CTIO is proposing innovative plans for surviving a flat funding situation and preserving critical access for US astronomers to the Southern hemisphere. A major goal for CTIO is to have its existing telescopes and instrumentation on Tololo functioning at an extremely high degree of reliability and simplicity. Thus when commissioning occurs of the Gemini telescope at Cerro Pachon (which is expected to heavily affect CTIO's available manpower), the existing Tololo operation can be maintained with limited resources. The Committee strongly endorses these goals, and emphasizes the need to keep the smaller telescopes operating, as they have traditionally been a strong complement to the larger telescopes. Moreover, the Committee wishes to express strong support for the energetic approach and innovative ideas of the new CTIO Director, Malcolm Smith.

Due to the above issues, and to the arrival of the new Director, the Committee felt obliged to take a longer-term outlook than usual. As a consequence, issues concerning the long-term strategy for CTIO occupied much of the discussion and this is reflected in the report that follows. This discussion is ongoing and will continue to evolve as the budget picture develops. Thus the Committee urges CTIO users to contact individual Committee members with their thoughts about future strategies for CTIO, so that it can effectively advance the opinions of the user community.

Funding Outlook and Long-Range Planning

At a joint session of the KPNO and CTIO Users' Committees on 8 December, Hugh van Horn, the new Director of the Division of Astronomical Sciences at the NSF, outlined the funding difficulties facing US astronomy. The advent of a number of new large telescopes for the US community in addition to new technological developments, such as adaptive optics/ interferometry and large format detector arrays, will create a need for additional funds to operate these facilities. However, the expectation at present is for flat funding levels in the foreseeable future. Given that the NSF astronomy grants program is already severely constrained, as is the NOAO budget (which has experienced a decline of ~30% in real dollars over the past decade), a careful review is being undertaken of the future of optical/IR astronomy in the US. A major component of this review will be to examine the future mission of NOAO. Clearly, difficult decisions will have to be made regarding the balance of funding between the individual grants program and that for the national centers. The Director emphasized the importance of obtaining input from the entire astronomical community in conducting this review and proposed that the KPNO and CTIO Users' Committees serve as a vehicle for canvassing the user community. Consequently, our Committee will carry out a survey similar to the one already conducted by the KPNO Users' Committee. In addition, individual users are urged to contact members of the Committee with their thoughts on long-term issues for CTIO (e-mail addresses of all Committee members follow at the end of this report). It is essential that the planning process for NOAO go forward with strong input from the community.

Impact of Gemini on CTIO Operations

In the joint session of the KPNO and CTIO Users' Committees a report was given on the status of the Gemini project. The project is well on track: all international partners are now on board, funding has been secured, and a number of major contracts for the telescope subassemblies are expected to be awarded during the next year. The main issue regarding CTIO is the impact that Gemini South will have on operations at Tololo. The role of CTIO in Gemini operations is still under discussion and remains to be clearly defined. Nevertheless, facing flat funding, the US money for Gemini operations will have to come from somewhere, and the logical expectation is that CTIO will "pay" by having some personnel switched to Gemini duties. Thus it is the expectation of the CTIO staff that the commissioning of the Gemini telescope on Cerro Pachon (which is likely to begin in 1998) will place especially heavy demands on CTIO personnel. As a result, it is essential for the existing telescopes on Tololo to be operating in the most reliable and efficient manner possible by the time that the commissioning of Gemini South is underway. The Director has proposed partnerships between CTIO and universities as a means of ensuring that the above goal will be expedited. The recent ongoing collaborations with the University of Michigan (upgrade of CCD imaging at the Curtis Schmidt), the Space Telescope Science Institute (upgrades to the spectrograph cameras on the 1.5-m and 1-m telescopes), and the Ohio State University (loan of their OSIRIS IR instrument) are possible examples of constructive partnerships between CTIO and the universities. A limited amount of observing time has been allocated to these partners in exchange for instrumentation upgrades. The Committee enthusiastically endorsed this approach. However, we have since

learned that at the worst-case budget levels predicted over the next five years CTIO will not have any resources available for this sort of matching of effort on the smallest telescopes, if they are to keep the larger telescopes (down through the 1.5m) operating at an acceptable level. The Committee strongly opposes a decline in the CTIO budget to that level. Instead, we must ensure that the existing, well-run, and unique (for US astronomers) CTIO operation is not sacrificed when Gemini is commissioned.

Instrumentation

Joint KPNO/CTIO Instrumentation Projects

During the joint KPNO and CTIO Users' Committee meeting, several ongoing and future instrumentation projects were described that are being carried out in collaborations between the KPNO and CTIO staffs. The goal of the joint instrumentation effort is to undertake major instrumentation programs that would not be possible at the individual observatories. The CTIO Users' Committee commends the cooperative spirit evident in the programs. This approach is particularly important given the expectation of a severely constrained budget in the future. At the same time we wish to emphasize the importance of the individual instrument efforts being undertaken by the ETS group in La Serena.

ARCON Controllers and 4-m Imaging Performance

At present most of the CTIO instrumentation effort is committed to the production of ARCON controllers and to progress on the imaging performance at the 4-m telescope. These projects appear to be proceeding expeditiously. We were pleased to see timelines on these projects, and look forward to seeing real improvements in the image quality at the 4-m next year.

Implementation of New CCDs

The Committee is concerned about the rate at which new CCD chips, already received by CTIO, are being implemented on the Tololo telescopes and urges CTIO to have the new chips available as soon as possible. NOAO has distinguished itself in providing top-quality CCDs on its telescopes and it is critical that this advantage be maintained at Tololo. While in general the Committee fully endorses the concept of completing one instrumentation project before starting another one, enough manpower needs to be reserved for commissioning of the new CCDs on a parallel track to the major instrumentation projects underway.

IR Instrumentation

Given the progress made with both the ARCON and 4-m imaging upgrade projects, the Committee is pleased that a full-scale effort is now being made in the area of IR instrumentation. The Committee endorses both the short-term and long-term plans put forward at the meeting. Specifically, the short-term plan, already well underway, is to (1) commission a NICMOS 256 x 256 HgCdTe imager by mid-1994 and (2) upgrade the IRS with a 256 x 256 InSb array using the KPNO WILDFIRE control electronics by late-1994. Completion of these projects will allow Tololo to catch up to the existing technology at other observatories. In the meanwhile, CTIO users will continue to have access to OSIRIS for the first nine months of 1994 through a joint arrangement with Ohio State University. The long-term plan involves a major joint IR instrumentation project between KPNO/CTIO/USNO and SBRC to develop 1024 x 1024 InSb arrays. This collaboration is an important example of joint cooperation in instrumentation between KPNO and CTIO and is fully endorsed by the Committee.

The joint IR instrumentation is predicated on an f/15 image scale at the 4-m telescopes (so that IR instruments can be duplicated and/or shared with f/15 foci at the KPNO 4-m and Gemini telescopes), and so a new f/15 secondary for the CTIO 4-m is required. Last year the Committee recommended that funds for this secondary be provided by NOAO, rather than coming exclusively from the CTIO budget. We are very pleased to learn that NOAO will indeed fund the f/15 secondary.

Smart Controllers

CTIO is in immediate need of replacing many of its aging Camac controllers for spectrographs, filter wheels, etc. In so doing, it is taking the lead at NOAO in implementing a new generation of smart controllers. It clearly would be highly desirable for NOAO and Gemini to standardize on this smart controller technology as soon as possible, to allow for a compatible set of controllers at NOAO and Gemini sites in the future. The Committee commends CTIO for its efforts in the area of smart controller development and hopes that discussions (and agreement) on a standard for NOAO and Gemini will soon take place.

Multi-fiber Spectroscopy

The Committee recommends that CTIO explore the feasibility of duplicating the KPNO Hydra multi-fiber positioner. Given the popularity and success of both Hydra and Argus, it would be very productive for the science conducted at Tololo to have an instrument with the expanded number of fibers offered by Hydra. If feasible, such a project would be another example of the joint KPNO/CTIO collaborative instrumentation projects that are strongly endorsed above by this Committee. We emphasize, however, that given the limited manpower available, any effort of this kind should not detract from the IR instrumentation efforts.

Small Telescopes

As previously mentioned, an important goal is to have operation of the smaller telescopes so efficient that their impact on mountain operations will be minimal - especially during the commissioning of Gemini South. The new large telescopes coming on line will not be able to replace the small telescopes, which historically have been a vital component to the user community. With these upgrades they will continue to complement the science carried out by the large telescopes. In particular, the Committee encourages CTIO to convert the smaller telescopes to the new telescope control system, VxWorks, in order to be consistent with the 4-m, 1.5-m and Gemini.

TAC Procedures

The Committee is pleased by the modifications to the proposal review procedures that have been instituted since last year. However, especially now that the external referee system has been abolished, it is particularly important that automatic feedback be given by the TAC for failed proposals. The Committee feels that lack of feedback for failed proposals is an important source of user dissatisfaction. Moreover, the Committee reiterates its recommendation from last year that membership on the TAC be sufficiently broad to cover all fields.

Other Procedures

Both Malcolm Smith and Mark Phillips gave detailed responses to the recommendations made in the Committee's report from last year. The Committee is very pleased with the careful response of CTIO to these recommendations, and particularly acknowledges the leadership during the last year of former Director Bob Williams and Interim Director Mark Phillips. We urge that the "Response to Last Year's Users' Committee Report" remain an agenda item for future meetings.

Given the present climate of uncertainty surrounding the long-term mission of NOAO, the CTIO Committee recommends that a joint executive session of both KPNO and CTIO Users' Committees be held during the 1994 meeting.

Remote/Service Observing

Remote observing is not yet possible because of the NASA satellite bandwidth (no T1 line is yet available). The main obstacle to service observing lies in the manpower needed to carry it out. It may be possible to establish cooperation between Universities and CTIO in a mutually beneficial program of training graduate students as service observers. Such an arrangement, if pursued, should be undertaken with an eye toward promoting the efficiency of operation that is needed to maximize productivity under tight budget constraints and for giving graduate students valuable experiences that they would not ordinarily obtain at their home institutions.

Data Archiving

Data archiving in the long term will become an increasingly important issue, especially in times of tighter funding. The Committee encourages CTIO to investigate potential cooperation with existing facilities which have developed expertise for maintenance of publicly accessible archives. Such a collaboration might substantially reduce the imposing manpower and financial requirements for setting up a long-term public archive of CTIO data. As a first step, however, the Committee encourages CTIO to implement the "save the bits" procedures presently in place at KPNO. For the future, the Committee believes that in principle public access to archival ground-based optical/IR data obtained at the national observatories should be similar to that established for the space-based observatories.

Miscellaneous Observer Support Issues

1) It is very inconvenient to have the library so far away from the summit. CTIO is encouraged to find space for a library in the new building currently under construction on the summit.

2) There should be a public workstation or a terminal for the astronomers who are not currently observing but are at the summit. While observers are encouraged to spend only a minimum number of nights on the mountain, some observers arrive at the mountain early due to restricted travel

possibilities on weekends. Moreover, graduate students and other new observers may need to arrive early to watch their telescope and instrument in operation before going on the telescope themselves. In addition, observers occasionally have a night or two between runs. A good place for this workstation would be in the new library on the second floor of the new building.

3) Under the current travel policy, thesis students are switched from full to partial support if their advisors accompany them. This policy imposes a heavy financial penalty on thesis advisors who wish to assist their students in an initial observing run. CTIO is urged to change this policy so that the thesis student still receives full travel support if accompanied by his/her advisor.

4) There is a definite need for good quality DAT drives at the summit for the increasing number of observers with DATs at their home institutions.

Safety Issues

The Committee applauds the efforts by CTIO to maintain high safety standards, and is very pleased with its response to a minor accident that occurred last April. However, given that an accident did occur, we feel that it would be wise to conduct an external safety inspection at CTIO.

Light Pollution

The Committee is concerned (and has heard from several users) about the growing number of lights visible from the summit at CTIO. The light pollution, which arises not only from La Serena/Coquimbo but from smaller nearby towns as well, will increase with the economic growth of the region. Light pollution must be addressed in order for CTIO to remain competitive, and as we know from our experiences in the US, an early and concerted effort is essential for light containment to be effective. We therefore support in the strongest terms the efforts of the CTIO Director to address this problem.

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A New Procedure To Apply for Telescope Time at KPNO (1Mar94)

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A New Procedure To Apply for Telescope Time at KPNO (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

We are pleased to announce a new, simplified procedure for applying for time on Kitt Peak telescopes, including:

1) a revised, shorter proposal form,
2) a new LaTeX template for proposal preparation,
3) the opportunity to submit proposals via electronic mail, and
4) only a single copy required for proposals submitted on paper.

The new proposal form is only three pages long, including the scientific justification, but it retains most of the information included on the previous, longer form. The new form is more similar to the one in use for CTIO. We encourage all users applying for time at

KPNO to obtain the new form and to use it for telescope time applications due 31 March 1994. A paper version of this new form is attached to the end of this Newsletter, and is also available via anonymous ftp (see below) as both a LaTeX template (and style file) and as a postscript file (for those who still have typewriters around!).

The LaTeX template, prepared by Chris Biemesderfer, should also simply the process of preparing proposals. The template follows the approach adopted by the American Astronomical Society for abstracts for papers present at meetings submitted electronically, and for manuscripts submitted to Society journals. This approach has become familiar to many astronomers, and we hope you will find it easy to use to apply for telescope time at KPNO. A similar form was used successfully for the KPNO Queue Scheduling Experiment last year. A mechanism for including figures with the proposal has also been provided, as some 40% of the proposals we receive include figures!

Proposals may be submitted either electronically or on paper. Instructions for electronic submission will be e-mailed to KPNO users in late February, or may be obtained via anonymous ftp, along with the necessary LaTeX files. Proposals submitted electronically via e-mail must arrive before midnight MST on 31 March to be considered for the fall observing semester. To submit a proposal on paper, you must mail it to arrive at the Office of the KPNO Director by 5:00 pm on 31 March, but only a single copy need be sent. Please do not send duplicate paper and electronic submissions of your proposal. The necessary number of copies of your proposal will be produced by NOAO for both electronic and paper submission. Proposals submitted electronically will be acknowledged by return e-mail, and proposals submitted on paper will be acknowledged by the usual letter.

To obtain the new electronic version of the KPNO proposal form, login via anonymous ftp to ftp.noao.edu (140.252.1.24) (login as "anonymous" with your e-mail address as the password). Change directories to kpno/kpnoforms, and get the necessary files. This files include the LaTeX template, the .sty "style file" (so you can print out copies of the proposal form yourself and detect any problems), a sample proposal, the instructions file, and a postscript version of the blank form. These files should be available by the time you read this.

Comments, concerns, or questions about the new submission process may be addressed to the KPNO Director's Office, or to the e-mail address kpno@noao.edu. We appreciate your patience as we work through this first semester of electronic submission.

Caty Pilachowski, Phil Massey

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A New Science Opportunity: Key Projects at KPNO (1Mar94)

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A New Science Opportunity: Key Projects at KPNO (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

Kitt Peak National Observatory is initiating a program whereby large observing projects or sets of projects with broad implications can be supported at Kitt Peak. We will call these "key projects". While there may not be a complete consensus on the definition of a "key project," we provide the following guidelines as a starting point.

A key project is an observing program which is expected to make significant progress in answering a scientific question of general interest. For operational reasons, it requires no more than about 20 nights per semester on any combination of Kitt Peak telescopes (with any instruments) and may last up to three years. It may be a single large project, it may be a series of related projects all aimed at addressing a single important issue, or it may be a sequence of projects in which the outcome of each specifies the observing strategy for the next. These rules are not rigid; they are open to modification if a strong case can be made.

In order to evaluate the community's interest in this kind of access to

the KPNO facilities, we are planning to fund a small number of workshops to be organized by prospective proposers of key projects. Our idea is to bring small groups together for a day or two in Tucson to explore a strategy for a key project. We will provide travel funds and pay room and board expenses. We will provide access to local expertise in the capabilities of any of the Kitt Peak telescopes and instruments. We would hope the outcome of such a workshop would be a proposal for a key project to be submitted for the fall 94 or spring 95 semester. We are prepared to fund several such exploratory workshops, based on a short proposal (less than one page) which would indicate the nature of the problem to be addressed, the general approaches to be explored, the makeup of the proposing team (limited to six participants from outside Tucson), and the dates desired for the meeting. We point out the desirability of including a KPNO collaborator, but will not insist that one be included.

We will accept proposals until 1 July 1994, for groups to meet in July, August, or September to assemble proposals for the 30 September 1994 deadline for the spring 1995 semester. After 1 July 1994, we will choose up to three proposals to be funded for small project development workshops.

Please submit proposals by mail, FAX, or e-mail to:

Caty Pilachowski
Kitt Peak National Observatory
P.O. Box 26732
Tucson, AZ 85726-6732
(catyp@noao.edu) 602-325-9360 (FAX)

Proposals for Key Projects on KPNO telescopes will also be accepted from individuals and groups which are not funded for project development workshops or which do not apply for such funding.

Proposals for Key Projects will be reviewed through our normal Telescope Allocation Process. Use the new, standard form for KPNO proposals (a copy accompanies this Newsletter), but the scientific justification can be increased to two pages. Please indicate that your proposal is a Key Project on the line describing long term status.

Criteria in addition to scientific merit for reviewing Key Projects will include the following:

1) The scope of the project is such that access to significant amounts of telescope time are necessary to make progress on the scientific question.

2) KPNO telescope time will comprise most of the observing for the project, and is not just a component of a larger project.

3) Key projects will be selected to provide for us experience on several KPNO telescopes, and not all will be assigned to the 4-m.

4) The proposals should address how the large body of data collected will be made available to the community. (NOAO resources can be provided to assist with this in some cases.)

Caty Pilachowski, Dave De Young

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Direct Imaging Improvements (1Mar94)

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Direct Imaging Improvements (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

During the past semester we have significantly upgraded the direct imaging capabilities at both our largest and smallest telescopes. As described in the following two articles, we have implemented the scan-table for large chips (e.g., the Tektronix 2048 x 2048) at the 4-m and provided a new filter-bolt and shutter assembly at the Burrell Schmidt.

In addition to these, we are currently in the process of a major revision to the direct imaging manuals at the 4-m, 2.1-m, 0.9-m, and Burrell Schmidt, combining them all into a single document. The new manual provides as much information as we have been able to gather: what the focus differences are between the various filters; what the focus change with temperature and zenith distance is; improved measurements of the actual count rates at our various telescopes; and all the "village wisdom" about flat fielding (what works and what doesn't) that we have been able to gather from staff and visitors. We hope this document will now be a more useful reference at the telescope, as well as aiding potential users at the proposal-writing stage. This manual (and its supplemental operational guides for the 0.9-m and Burrell Schmidt telescopes) will be available via anonymous ftp to "ftp.noao.edu" and can be found in the subdirectory kpno/manuals.

As an additional tool for planning, Frank Valdes of the IRAF group has also updated and improved the "ccd exposure guide" task ccdtime; the new routine now permits calculating exposure times for the various Kitt Peak telescope and CCD combinations as a function of SNR, bandpass, and lunar phase. We find this task invaluable. It will become generally available once IRAF V2.10.3 hits the streets; in the meanwhile, it can be run from any visitor account downtown.

There has been a slight revision to the CCD acquisition software ICE ("IRAF Control Environment") which makes it even easier to analyze focus frames for direct imaging. Consult the ICE manual for further details!

Finally, as a reminder, we list here the (measured) plate scales and field-of-view of standard direct imaging telescope and CCD combinations.

Telescope/CCD	f-ratio	FOV (arcmin)	Scale ("/pixel)
4-m + T2KB	2.8	16.0 x 16.0	0.470
2.1-m + T1KA	7.5	5.2 x 5.2	0.305
0.9-m + T2KA	7.5	23.2 x 23.2	0.680
0.9-m + T2KA	13.5	13.1 x 13.1	0.384
Schmidt + S2KA	3.3	65.0 x 65.0	2.028

Phil Massey

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Instruments Available on KPNO Telescopes (1Mar94)

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Instruments Available on KPNO Telescopes (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

This list summarizes the instruments that will be available on KPNO telescopes for the September 1994-January 1995 observing season. Two classes of instruments exists: "Primary Instruments" for regular block scheduling and "Reduced-Availability Instruments" that are only scheduled in instances of very high scientific merit. Visitor equipment will be scheduled only if it a) is unique, b) is required for a project of very high scientific merit, c) conforms to block scheduling, and d) has small impact on KPNO operational and engineering resources.

Primary Instruments

4-m Telescope:	PF Camera + direct CCD (T2KB)
	Echelle + (UVFast, Red Long, or Blue Long camera) + CCD (T2KB)
	R-C Spec + CCD (T2KB)
	CryoCam (with new 800 x 1200 Loral Chip)
	IR Cryogenic Spectrometer (CRSP)
	Cryogenic Optical Bench (COB) [Nov-Jan only]
	Simultaneous Quad Infrared Imaging Device (SQIID)

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                    IR Imager (IRIM)
                    Fourier Transform Spectrometer (FTS) [Note 1]

2.1-m Telescope:    GoldCam (CCD spectrometer with dedicated 1K x 3K Loral
                       Chip)
                    CCD Direct Camera (T1KA)
                    Cryogenic Optical Bench (COB) [Nov-Jan only]
                    Fiber Optical Echelle (FOE)+ CCD (T1KA or TI5)
                    IR Imager (IRIM)
                    IR Cryogenic Spectrometer (CRSP)

Coude Feed:         Coude Spectrograph + (camera 5 or 6) + CCD (T1KA, TI5,
                       or T2KB)

1.3-m Telescope:    Simultaneous Quad Infrared Imaging Device (SQIID)
                    Cryogenic Optical Bench (COB) [Nov-Jan only]
                    IR Cryogenic Spectrometer (CRSP)
                    IR Imager (IRIM)

0.9-m Telescope:    CCD Direct Camera + CCD (T2KA)
                    CCD Photometer (CCDPHOT) (T5HA)

Burrell Schmidt:    Direct or objective-prism + CCD (S2KA)
                    Direct or objective-prism + photograph plates [Note 2]

                     Reduced-Availability Instruments

All Telescopes: Visitor Instruments
4-m: PF Camera + photograph plates [Note 2,3]
2.1-m: White Spectrograph + photograph plates [Note 2]
1.3-m: Mark III (optical) Photometer + GaAs coldbox [Note 1,3]

Notes:  1) No long-term proposals.
        2) Visitors must provide their own photographic plates.
        3) Limited to programs that have already been started.

Caty Pilachowski
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Drift Scanning at the 4-m (1Mar94)

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Drift Scanning at the 4-m (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

In 1986 we implemented a scan-table for the Prime Focus CCD camera that allowed much "flatter" (more uniform) images to be obtained. In this mode a scanning table on which the CCD is mounted is stepped by a few rows while the charge is shifted simultaneously by the same number of rows; the procedure is continued until the requested number of rows and total integration time have been achieved. Since a given point in the resulting image has actually been observed with a number of different pixels of the detector, the non- uniformities in the chip have been effectively averaged in producing the final image. The flat-fielding job is therefore easier, as you are starting with intrinsically much flatter data.

We have recently upgraded the system to work with our large Tektronix 2048 x 2048 devices and to make it considerably easier for users to both obtain and reduce their data. In addition to the new scan-table itself, the data acquisition software ICE has been modified to do basically it all for you: all the user needs to specify is the number of rows he or she wishes to scan in addition to the integration time. The integration time is divided by the number of rows one wishes to average over, and the table is stepped (and the charge clocked) that often - although care must be taken not to exceed the rate of a few Hertz! In typical use, one might short-scan in order to reduce the effects of the night-sky fringing in the I-band, as Marc Postman (STScI) has done in the accompanying pair of images. After a little experimenting he choose to scan 60 rows to smooth over the higher-frequency (and higher amplitude) fringes apparent in the unscanned image. The low-frequency stuff still needs to be removed by normal

de-fringing techniques, but the fact that he is starting with something much flatter to begin with makes this job far easier.

[Figures not included]

In addition to updating the instrument hardware and software, we have also prevailed upon Frank Valdes of the IRAF group to modify the CCD reduction code to check for and process scanned images. If one attempts to reduce a scanned image with an unscanned flat-field, the software will now do the numerical smoothing of the flat-field image to match what would have been obtained if the flat-field had been scanned in the first place. (Thus the user need only obtain unscanned flats.)

In the words of one user, "Why would anyone not scan?"

Phil Massey

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A Big Filter Wheel and Shutter for the Schmidt (1Mar94)

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A Big Filter Wheel and Shutter for the Schmidt (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

Since its inception, the Schmidt CCD system has used a sliding filter bolt containing 2-inch x 2-inch slots and a small shutter, all recycled from the original 4-m prime focus CCD system. The corners of the 2048 x 2048 CCD (S2KA), the workhorse detector at the Schmidt, were vignetted by the filter and shutter assemblies. In addition, because there were no mechanical stops (i.e. detents), filter positioning was not as repeatable as desired, which occasionally resulted in low-level flat fielding problems. To overcome these difficulties, a new 4-inch x 4-inch filter wheel and shutter have been built for the Schmidt CCD system. These are slight modifications of the filter wheel and shutter in use at the 4-m and 0.9-m telescopes.

An added benefit of this system upgrade is that the filter position will be readable and controllable from the CCD software (ICE). Schmidt observers will thus find that their headers actually contain the correct filter information, which makes processing the images much easier.

A dedicated set of 4-inch UBVRI filters has been fabricated for the Schmidt, as well as 2-inch inserts for filters not available in the 4-inch size. The collection of 4-inch narrow-band filters procured for use at the 4-m and 0.9-m will be available for use at the Schmidt. In addition, a set of 4-inch Stromgren uvby filters has recently been purchased and is resident at the Schmidt (although these are, of course, also available at the 4-m and 0.9-m). All users of 4-inch filters (other than UBVRI) should be aware that there is now increased demand for these filters; therefore specifying accurately which filters you plan to use on your ORPF ("pink sheet") has become increasingly important.

We would like to acknowledge the many individuals who have contributed to the implementation of the new filter wheel and shutter, particularly Tony Abraham, Scott Bulau, Lee Groves, Bill Schoening and Rob Seaman.

Finally, an X-Terminal has been installed for the Schmidt to allow users to work on reductions, etc. in a warm, well illuminated area.

Taft Armandroff, Phil Massey

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Hydra Takes a Vacation (1Mar94)

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Hydra Takes a Vacation (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

As most Hydra fans know, the multi-object fiber positioner is moving to the 3.5-m WIYN telescope. Converting Hydra to WIYN is a major undertaking, and as a result the instrument will not be available to users for the fall semester. Our current goal is to make Hydra available on a shared risk basis in early 1995. Please see the article on "WIYN proposals" elsewhere in this issue.

Sam Barden

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Spectroscopic Multiplexing at the 4-m (1Mar94)

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Spectroscopic Multiplexing at the 4-m (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

Greedy observers (aren't we all?) have been able to obtain spectra of as many as 100 objects at a time at the 4-m using Hydra. However, now that Hydra is moving to WIYN we would like to remind users that there exists a complementary mode of multiple object observation at the 4-m using "multi-slit" masks. These masks can be used with either the Cryogenic camera (for low dispersion work) or with the regular R-C spectrograph (for moderate dispersion work).

Multi-slit masks typically contain perhaps a dozen slits distributed throughout the 5 arcmin field. In this mode, a pattern of slits is created on high contrast photographic film corresponding to the positions of program objects, say a cluster of faint galaxies or stars within a galactic cluster. This film is then used at the focal plane of the telescopes to serve as an entrance mask for the spectrograph. There is a small light loss (approximately 10%) in the film base but under normal conditions this loss is comparable to seeing variation losses. The slit allows precise determination of the sky signal immediately adjacent to the object and thus enables excellent sky subtraction.

The advantages of multislits over Hydra are: (a) closer spacing of objects, (b) better sky subtraction in fields with variable background, and (c) probably higher throughput under many seeing conditions. The disadvantages are: (a) considerably smaller field, (b) more limited number of objects, and (c) the fact that the wavelength range covered is a function of position within the focal plane. The overhead time is probably similar, about half an hour. Clearly, whether the multislit mode has advantages or not for your program depends on your requirements.

If your program would benefit from multi-slits be sure to specify this in your observing proposal. Further details can be extracted from the cryogenic camera instrument manual or by contacting us.

Phil Massey, Jim DeVeny

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A New Improved CRSP (1Mar94)

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A New Improved CRSP (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

Thanks to heroic efforts by the IR&D group, the hardware, electronic, and optical modifications to CRSP were completed in time for the engineering time in October. After some minor adjustments, the upgraded CRSP operating under WILDFIRE went into service as a visitor instrument in late October and has been used some 50 nights since on the 1.3-m, 2.1-m, and 4-m telescopes.

User response has been enthusiastic. The 30 micron pixels (vs 76 for the old array) provide much improved sampling of both the slit and spatial field. This has resulted in an improved ability to remove telluric features, as well as somewhat higher spectral resolution. The reduced dark current (down from 50 e-/s to 1-2 e-/s) and read noise (35 e-, single read) yield a larger dynamic range and increased sensitivity on long exposures with the high resolution grating.

A significant portion of the old CSRP manual is now obsolete. By the time this article is published, the new version of the manual should be completed and available. A figure-less version should also be resident in /kpno/manuals or "ftp.noao.edu". In the meantime, prospective users may contact me directly (rjoyce@noao.edu) for information.

Dick Joyce

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Fall 1994 Scheduling of the Cryogenic Optical Bench (1Mar94)

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Fall 1994 Scheduling of the Cryogenic Optical Bench (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

The Cryogenic Optical Bench (COB) will not be available to visitors in September-October 1994 in order to provide a test period for a new camera module. It will return to service in November 1994 with the original optics (0.3 arcsec/pixel at the 4-m).

The camera undergoing these tests is part of the ongoing effort to deliver improved spatial resolution at the 4-m telescope. This new f/15 camera will provide a plate scale of 0.12 arcsec/ pixel, and so will be diffraction limited at the longer wavelengths of COB's 1-5 micron range. The camera will be installed in COB this summer and tested in August and September.

Results of this effort will be reported in subsequent issues of the Newsletter. A determination of whether to offer this high resolution mode of COB as a user facility will be made early in 1995, based on the success of the tests and community input.

Ron Probst

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Preparing for WIYN Proposals (1Mar94)

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Preparing for WIYN Proposals (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

With the WIYN Observatory nearing completion, it is not too early for potential users to begin planning for their observations. Commencement of science operations continues to be scheduled for January 1995. During approximately the first six months of WIYN science operations, all approved proposals for NOAO WIYN time will be scheduled as "shared risk" queued observations, as described in "Planning for Early WIYN Science Operations" in NOAO Newsletter No. 36 (December 1993). The anticipated deadline for accepting applications for WIYN "shared risk" queue observations is 30 September 1994.

WIYN proposal and time allocation process details have not been finalized at this time. These details will be released on 15 August 1994. At that time, we will describe the current status of the telescope and instrumentation as well as the application, proposal review, and program scheduling process. All material will be in the directory wiyn/sciops/shared accessible by anonymous ftp to the machine "ftp.noao.edu". The README file in that directory will provide further instructions. Please contact Dave Silva (dsilva@noao.edu or 602-325-9358) if further assistance is required. Readers may request notification of information release either in electronic or paper form from Dave Silva.

To assist in preliminary planning for WIYN observations, we now describe the anticipated capabilities of the two instruments which will be available to NOAO users of WIYN: Hydra/MOS and the WIYN Imager. Further WIYN instrument information will be included in the 15 August proposal release.

The WIYN Imager will be mounted at one Nasmyth focus. At the heart of the Imager, we hope to have a Mini-Mosaic CCD system. The Mini-Mosaic is a 2 x 2 mosaic of Loral 2048 x 2048 CCDs. The individual CCDs are being thinned and AR-coated by Mike Lesser of Steward Observatory. Depending on the final AR-coating, these CCDs are likely to have very high quantum efficiency (70%+) below 4000 A. The Mini-Mosaic is being constructed by the NOAO/KPNO CCD group led by Rich Reed. The pixel size is 15 microns which translates to 0.14 arcsec/pixel and a total FOV of approximately 575 x 575 arcsecs. At this writing, it is anticipated that the Imager will be available for general "shared risk" use on approximately 1 January 1995.

The Hydra Multi-Object Spectrograph (Hydra/MOS) will be mounted at the other WIYN Nasmyth focus. For a complete description of Hydra/MOS at WIYN, see "Hydra to Undergo Metamorphosis for WIYN Telescope" in NOAO Newsletter No. 35 (September 1993). At this writing, it is anticipated that Hydra/MOS will be available for general use by 1 March 1995.

The general plan for the WIYN "shared risk" science program is to rank Imager and Hydra/MOS proposals jointly and then construct an observation queue that addresses the most scientifically meritorious projects while thoroughly testing WIYN technical capabilities. However, we intend to review and schedule separately Imager observations that require extraordinary image size (< 0.7 arcsec FWHM).

WIYN was designed to deliver 0.40 arcsec FWHM images not including atmospheric distortion (Johns and Pilachowski 1990, SPIE Conf. Proc. Vol. 1236, "Advanced Technology Optical Telescopes IV", p. 2). What is the intrinsic seeing on Kitt Peak? The median seeing at the MDM Hiltner 2.4-m is clearly subarcsecond and is often in the 0.6-0.7 arcsec FWHM range on long exposures. If the WIYN site is as good as the MDM Hiltner site, we expect that WIYN will deliver median images of 0.7 arcsecs FWHM with some periods of sub-half-arcsecond images. As a comparison, median uncorrected images at the Canada-France-Hawaii telescope are about 0.7 arcsecs FWHM. To take advantage of those times, NOAO will accept WIYN proposals for Imager projects that require exceptional seeing. These proposals will be ranked by scientific merit as usual and then placed in a separate observing queue. When exceptional seeing conditions arise, observations in this queue will take precedence over the normal MOS/Imager queue. Given the likely low frequency of such exceptional periods, we caution potential proposers that it is likely that only small programs will be accepted during "shared risk." Further details about this special program will be released on 15 August.

We encourage all potential WIYN proposers to contact Dave Silva (dsilva@noao.edu) with questions about the capabilities described

above. We also welcome any and all science operations suggestions.

Dave Silva, Caty Pilachowski

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The WIYN Telescope Update (1Mar94)

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The WIYN Telescope Update (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

During the last few months the WIYN Project achieved several important milestones as we near the end of the construction phase. Major components of the control system have been completed and installed by the University of Wisconsin Controls Group. The telescope mount is now able to slew and track under computer control and tests of the control system and mount are underway using a finder telescope attached to the optical support structure. Glitches in the servo system are being quickly resolved by the Controls Group and the early indication is that the telescope will perform well.

The NOAO WIYN mirror group completed the laboratory assembly of the active mirror support system, and then connected the mirror to the supports and installed the whole assembly under the optical tower for testing. Interferometric tests using the same null lens used for polishing demonstrated that the redesigned active axial supports perform extremely well when pointed towards the zenith, the only orientation we can test. The rms figure of the finished, supported mirror is 0.04 waves (at 6328 A), producing images with a mere 0.033" FWHM, about a factor of 4 better than specified for the mirror operating in the telescope under varying thermal conditions and elevation angles. The support system and mirror cell were shipped to Kitt Peak in early February. The mirror will be aluminized in the 4-m vacuum chamber, and the cell will be "fit" to the telescope structure before the primary mirror is installed.

Work on the secondary mirror was completed by Contraves, U.S.A. in Pittsburgh, and the mirror has been shipped back to NOAO for installation in the mirror cell. The surface figure of the mirror is 0.030 waves RMS and meets WIYN's secondary mirror image error budget of 0.05 arcsecond.

Work also continues on the tertiary mirror cell and supports. The rotator assembly that mounts the tertiary mirror on the primary mirror cell is complete and ready to be installed.

Requirements for the telescope control system graphical user interface (GUI) have been completed. NOAO has undertaken to write the GUI software as part of the control system hand- off from the UW Controls Group. NOAO involvement at this phase will help assure that the WIYN GUI is reasonably consistent with those at other NOAO telescopes, and that operators and observers will find WIYN operations to be familiar.

Thermal testing of the enclosure is underway using the KPNO 10 micron infrared camera and thermocouple probes throughout the structure. In nighttime tests with the dome vents opened up, the air temperature within the telescope chamber tracked the outside temperature to 0.13 degree C RMS. Surface temperatures within the chamber generally tracked the air except for those surfaces exposed to the night sky which cooled below the air temperature. Reflective coatings will be used to control surfaces where this is a problem. No major sources of heat were apparent in the telescope chamber even while the telescope and dome drives were operating.

We expect the commissioning phase for the WIYN Project to begin in May after completion of the optics installation and other major telescope systems. During commissioning the performance of the telescope will be brought up to the levels specified in the project Scientific and Technical Requirements. Commissioning of instruments on WIYN (Hydra and the WIYN Imager) will occur during late summer and fall, and WIYN operations are expected to begin early in 1995.

Matt Johns, Caty Pilachowski, Dave Silva

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Requests for KPNO Telescope Time 1 February - July 1994 (1Mar94)

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Requests for KPNO Telescope Time 1 February - ...(1Mar94)
31 July 1994
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

Telescope		Nights Req.	Nights Sched.	Requested/ Scheduled	No. of Proposals	Number Sched.	Total No./ Scheduled	Staff Nights	%Staff Nights
4-m	Dark	257	69	3.7	72	23	3.1	6	9
	Bright	165	70	2.4	45	20	2.3	12	17
2.1-m	Dark	187	83	2.3	37	21	1.8	18	22
	Bright	164	67	2.4	33	16	2.1	6	9
Coude Feed		129	127	1.0	18	16	1.1	19	15
1.3-m		203	142	1.4	37	29	1.3	29	20
0.9-m	Dark	155	83	1.9	31	18	1.7	8	10
	Bright	86	60	1.4	17	13	1.3	9	15
Schmidt		142	60	2.4	21	10	2.1	6	10

KPNO received 288 proposals from visitors and staff combined. Of these, 10 were long-term proposals but none were granted long-term status. Five proposals which had previously been granted long-term status were also scheduled.

Lloyd Wallace

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What You Think of Us (1Mar94)

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What You Think of Us (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

KPNO distributed a questionnaire last October to help us evaluate both how we are doing and how we can best meet the needs of the astronomical community. The questionnaire went via e-mail to the 520 non-NOAO proposal applicants from the last three years. We wish to thank the 166 respondents who returned completed forms.

Several of the most significant results of the survey are listed below and in bar chart form. The complete detailed summary is available by anonymous ftp from ftp.noao.edu (140.252.1.24) in the kpno/question subdirectory as the file "summary". We are still in the process of extracting the many thoughtful comments that were often included in the returned surveys, and those will be made available when compiled.

- 65% of our users are from universities, distributed nearly equally from graduate students to full professors.

- The primary reason for using KPNO is reliable instrumentation.

o 69% of our users paid for their recent runs with funding from either NSF or NASA, while 12% found their observing plans hampered by not having funding.

o 91% felt the TAC process was fair most of the time. 81% felt the TAC comments they received on denied proposals were useful.

o Observing runs at the 4-m should be kept to an average of length of 3 nights.

o The response to problems at the telescope was at least adequate 95% of the time and excellent 72% of the time.

o 95% of the respondents having experience at other observatories described KPNO telescopes as comparable or superior to those used elsewhere.

o 28% of the respondents reported that their observing runs exceeded a 90% success rate, while 52% reported a success rate exceeding 70%. The reason most cited for lack of success was weather (55%).

o IRAF is used as a primary system by 85% of our users. 92% find it sufficient for quick-look reductions at the telescope, and 90% were happy with the ICE control system for CCDs.

[Bar charts not included]

George Jacoby

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Save the Bits: the First Hundred Days (1Mar94)

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Save the Bits: the First Hundred Days (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

The "Save the Bits" archive has been quietly taping raw CCD data on Kitt Peak since its auspicious "first byte" on Moon Day (20 July) 1993. Originally restricted to KPNO optical CCD images taken with ICE (the IRAF Control Environment), the archive now also includes NSO CCD images from the nighttime program at the McMath telescope. As we go to press, images from the KPNO infrared instruments are about to be added to the archive datastream via an update to the WildFIRE software.

Fully automatic operation of the archive queue began in early October. During the intervening time (one hundred days) more than 45,000 images have been archived, amounting to 120 Gbytes of data, about half of which are calibration frames. We are in the process of converting the July-September images into the standard format soon, substantially increasing the quoted totals.

Observers should not rely on the archive for routine data backup. Personal attention by each observer to safe taping practices is the only true way to protect your data; see the following article for a reminder.

Rob Seaman, Caty Pilachowski

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Writing Good Bits (1Mar94)

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Writing Good Bits (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

The observing support staff has dealt with a number of cases recently where observers had considerable difficulty in writing their data to Exabyte tape. In nearly every case the observer was using "video grade" tapes rather than computer grade tape. Switching to computer grade tape invariably fixed the problem. This has led to frustration on the part of the observers, who waste hours dealing with the Exabyte, and also to wasted effort on the part of the support staff, in attempting to chase a problem that was due to poor quality tapes.

We therefore remind you that quality really does count - either bring computer grade tapes with you, or buy the tapes from us on the mountain. We buy Sony QG112MAa tapes and have yet to hear of any problems when observers use them.

We also wish to remind observers that although the "Save the Bits" archive has been in full-swing operation for several months, the responsibility for the safety of your data remains your own. We strongly urge all of our users to follow the "safe taping" procedures given in the ICE manual:

1) Each night write your data to tape in FITS format using whatever media you like (Exabyte, DAT, nine-track tapes).

2) Read the headers on the tape to make sure all your data is really there.

3) Remove the tape, take it with you when you leave the dome, and stick it under your pillow.

4) During your run make a second copy of your data (this may be on a single tape containing everything from the run).

5) Only when you have substantiated that the data is also on the second tape is it safe to delete images.

Di Harmer, Jim DeVeny, Phil Massey

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What We Got Done This Quarter (1Mar94)

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What We Got Done This Quarter (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

During the fall and winter the bulk of engineering activity at Kitt Peak shifts to completing projects started during the previous summer shutdown and to planning for the coming one. Installation of the oil cooling system at the 4-m was completed and tested, although implementation has been delayed until problems with the hour-angle servo drive system are resolved. Resolving those problems is a high priority with the group just now, and we are hopeful of a fix before this Newsletter reaches you. The 2.1-m cryo-cooler was installed and tested successfully with SQIID. At the Burrell Schmidt Telescope, a new filter wheel assembly was completed and will soon be tested. A new secondary mirror cell and mercury band have been designed for the 0.9-m telescope to fix problems there with optical alignment and collimation. Work is also underway on a new Surrurie truss to improve thermal performance of the primary mirror, and on providing ventilation to the dome. These efforts should lead to substantial improvement in delivered image quality on the 0.9-m telescope.

The IR Instrumentation Group has completed an electronics upgrade for IRIM and CRSP so that both instruments are in routine service with the WildFIRE array controls and observing interface. A detent mechanism was added on the filter wheels in the Cryogenic Optical Bench (COB) to provide repeatable filter positions, and the instrument is ready for

testing (and shared risk observing this spring) on the telescope. Two lab test dewars have also been built for the Aladdin Project (a development project with SBRC to produce 1024 x 1024 InSb array detectors). One of the dewars is for use by SBRC and one by the NOAO IR group. Fabrication started on the camera/ collimator unit for the High resolution IR Spectrometer Phoenix. The grating blank was sent to Milton Roy for replication, and the detailed design for the optics and slit and filter wheel was started.

The Optical/UV Instrumentation Group fabricated parts for four new CCD dewars (including one for the Bench Spectrograph when it moves from the 4-m to WIYN, and one for the WIYN mini-mosaic detector), and the CCD development project continued with testing of new devices from SITe (formerly Tektronix), STIS, and the Loral foundry run. A conceptual design for the the large mosaic camera (81922 pixels), including a dewar, shutter, filter mechanism, corrector support system and telescope interface was also developed, and a Preliminary Design Review will be held in the near future. Most of the remaining resources of the OUV group were devoted to the conversion of the 4-m Hydra fiber positioner for use at WIYN. The new focal surface assembly for Hydra at WIYN was assembled, and detailed design of the calibration system and spacer assembly was started.

During this period we also hosted a "Town Meeting" for Kitt Peak users at the AAS meeting in Crystal City in January. Announced at the meeting were two new KPNO initiatives, electronic submission of proposals and the Key Projects initiative, both of which are described in more detail in this Newsletter. Preliminary results from the KPNO User Questionnaire were also presented, and are also described in this Newsletter.

During this last quarter, KPNO also received 172 scientific visitors on the mountain associated with observing runs.

Caty Pilachowski

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Querying Kitt Peak by E-mail (1Mar94)

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Querying Kitt Peak by E-mail (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

Need some information about Kitt Peak and don't know who to ask? A general purpose computer mail account has been set up to answer any questions you have about visiting Kitt Peak or Tucson. The address is:

kpno@noao.edu

Such general questions you could send to this account are: how to submit requests to Kitt Peak for observing time, questions about instruments, who to ask about the PDS or Grant machine, the shuttle times to Kitt Peak, etc. The mail will be checked daily and you will receive a confirmation of receipt of your electronic mail. Your question will be routed to the appropriate staff person at NOAO.

Pat Patterson

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Museum Inherits the No. 3 16-inch (1Mar94)

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Museum Inherits the No. 3 16-inch (1Mar94)
(from KPNO, NOAO Newsletter No. 37, 1 March 1994)

If you visited the Museum this year, you probably noticed that a few things are missing! Land was cleared and exhibits removed in preparation for the relocation of the 16-inch telescope and the installation of some brand new exhibits.

Construction of the telescope dome is scheduled to begin in March. The 16-inch will be dedicated to use by the general public, including amateur astronomers. Future plans include retrofitting the telescope for daytime observing for the many tourists that visit Kitt Peak. We will also install a CCD camera and autoguider system. The Museum staff has already received at least a year's worth of observing requests!

In April we will begin installing new exhibits. The first will focus on the history of Kitt Peak both astronomically and culturally. In the interim, the Museum is receiving a face-lift of new paint and carpet.

In the midst of these changes, our public programs continue to grow. December and January were record-breaking months for the volunteer program, with a contribution of over 400 volunteer hours each month. We are lucky to have such an outstanding group! Many thanks to all of the visiting astronomers and NOAO/Kitt Peak staff members that give invaluable time and advice to the Museum's projects.

Melissa Collier, Karie Meyers

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From the NSO Director's Office (1Mar94)

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From the NSO Director's Office (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

The 1993 NOAO visiting committee met at the National Solar Observatory this year from 28 November through 2 December with Jim Hesser, from the Dominion Astrophysical Observatory, as its chairman. The NSO staff appreciated this opportunity to have their work reviewed and to express their views on the status of the observatory. The visiting committee has recently submitted its report to the AURA Board where it is currently being reviewed. Look for a summary of the report in the next Newsletter.

Decreasing and constant dollar level funding, uncorrected for inflation, continues to eat away at the quality of the observatory. Capabilities, observer support and the ability to start new initiatives are slowly eroding. The outlook for funding in the near future does not promise better times ahead soon. In this climate one wants to preserve the ongoing program as well as possible. New initiatives are, however, the only way to do well in the long run. The NSO staff is, therefore, starting to prepare a "Future Directions Plan" for the observatory. The Sac Peak and Tucson NSO staff are focussing their efforts on two main themes for this plan: long-term and short-term solar variability. Although the first step in developing this plan will occur inside NSO, it is our intention to define it jointly with the solar community. It will examine the role of the current capabilities of NSO, the need for their upgrades, as well as define the case for future initiatives such as the IR program, the McMath upgrade, LEST, the Large Reflecting Coronagraph, RISE, and the adaptive optics program.

I expect soon to implement my management plan for NSO. Its definition is almost complete. In it I will create seven branches within NSO, three at the NSO/SP division, two at the NSO/KP division, and two within NSO/GONG. The seven branch heads will form a management team with me as chairman. More details later!

Jacques Beckers

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PSPT News (1Mar94)

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PSPT News (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

The Precision Solar Photometric Telescope (PSPT) project has completed a series of seeing/scintillation experiments, designed to determine if high photometric precision and good, full-disk spatial resolution can be obtained using a scintillation monitor. The results look good (a preprint is available from R. Coulter or J. Kuhn). Most of the current effort is now going into making a 10-Mpixel/s Thomson 1K x 1K CCD camera work with our DSP system. The first RISE/PSPT Newsletter describes our activities to date in greater detail, and was recently distributed. It is available by anonymous ftp from ftp.sunspot.noao.edu in the directory /pub/rise, or by contacting Roy Coulter (roy@sunspot.noao.edu) or Jeff Kuhn (jkuhn@rise.sunspot.noao.edu).

Roy Coulter, Jeff Kuhn

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IR Tools for Solar Astrophysics: What's Next? The 15th NSO/Sac Peak Summer Workshop (1Mar94)

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IR Tools for Solar Astrophysics: What's Next?...(1Mar94)
The 15th NSO/Sac Peak Summer Workshop 1st Announcement
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

New opportunities to understand the sun are appearing as optical infrared detector technology begins to accommodate astronomical needs. The first meeting on this subject occurred in Tucson two years ago, during which time this new window into (primarily) photospheric problems was broadly explored as an IAU colloquium. With new developments in IR array technology and with the coming of fully reflecting coronagraphs, there are fascinating possibilities for direct measurements of plasma magnetohydrodynamics in the corona. Unfortunately, the new experimental capabilities are outpacing our current theoretical and observational understanding of the corona; consider the fact that, until recently, the most up-to-date measured IR coronal spectra date from the 1960's and early 1970's. The impending observations demand new models and calculations - from more accurate atomic models to determine line wavelengths to new ideas about MHD processes in the solar atmosphere. A major goal of this meeting will therefore be to identify some of the largest gaps in our current understanding, and to focus interest on how IR observations can contribute to the outstanding empirical and theoretical issues of coronal, chromospheric, photospheric, and related nighttime astrophysical problems.

The National Solar Observatory at Sacramento Peak traditionally hosts a "summer" workshop dealing with topics in solar physics. These meetings have proven successful at bringing together observers and theoreticians in an environment which fosters very constructive interaction. This 15th NSO/Sac Peak Summer Workshop will encompass new developments in

all areas of IR solar physics, but will emphasize topics such as the following largely unanswered questions: What coronal emission lines can we expect to see out into the far IR? How best can we measure T, p and v in the corona? What diagnostics can be obtained from the strong He I 1083 nm line? Can we use forbidden lines and Zeeman splitting to map the magnetic field in the hot plasma? What observable consequences can we expect from competing coronal heating models? What capabilities can we expect from 2-m (or larger) reflecting coronagraphic telescopes, where scattered light (atmospheric and telescopic) is far reduced from that of conventional instruments?

We expect the workshop to attract the interest of some of our colleagues responsible for the IR technology we plan to use in the future. Furthermore, much of the instrumental capability developed for the solar problem (e.g. a large reflecting coronagraph) will have important applications in nighttime astrophysics - we also hope to include some of the latter community in the workshop.

This announcement is aimed at identifying prospective participants, and soliciting comments on both the structure and content of the workshop agenda. We anticipate a four-day meeting some time during the third week in September or the first part of October. If you are interested in this workshop, or have comments on how it should be structured, please contact Jeff Kuhn or Matt Penn at the National Solar Observatory, Sunspot, New Mexico 88349, phone (505) 434-7000 by 28 February. E-mail contact is preferable to jkuhn@sunspot.noao.edu or mpenn at the same internet address. To date, Jeff Kuhn, Matt Penn, Ray Smartt, Jack Zirker, and Don Neidig from NSO/Sunspot, Doug Rabin from NSO/Tucson, Jacques Beckers, NSO, and Serge Koutchmy have agreed to help with the meeting organization.

Jeff Kuhn, Matt Penn

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Welcome New Scientific Staff (1Mar94)

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Welcome New Scientific Staff (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

Sydney D'Silva, formerly with the Theoretical Astrophysics Group at the Tata Institute of Fundamental Research (TIFR), joined the NSO staff on 30 November 1993. His interests mainly surround the question of deciphering the nature of the sub-surface connection and structure of surface magnetic features, particularly sunspots, plages, and ephemeral regions, (a) through the study of the dynamics of flux-tubes, and (b) through helioseismic studies. His other interests might involve working out new schemes of data-gap filling, particularly in the context of the GONG data.

Christoph Keller arrived on 3 January 1994. He received his PhD from the Swiss Federal Institute of Technology (ETH) in Zurich in 1992, where he held a post-doc position until the end of 1993. He is currently working on high-resolution observations of solar magnetic elements and the spectroscopy of intra-network field. His interests include the design of instruments and image restoration in general.

Yuhong Fan has joined the NSO/Tucson staff as a Post-doctoral Fellow starting 1 December 1993. She received her PhD in Astronomy last fall at the Institute for Astronomy, University of Hawaii. Her dissertation, completed under the supervision of George Fisher, was on modeling the dynamic evolution of rising active region flux tubes through the solar convective envelope. Yuhong plans to continue her work on flux tube dynamics by comparing the results of numerical simulations with observational data to understand the physical origin of various properties of active regions and their implications for the solar dynamo.

Accompanying Yuhong is her husband, Douglas Braun, who has joined the NSO extended staff through the Solar Physics Research Corporation. Doug is no stranger to the NSO community, having spent one year in residence as a NRC Post- doctoral Fellow under the supervision of Tom

Duvall in 1989. Doug returns to us after serving four years as Assistant Astronomer at the University of Hawaii. Doug's primary research interests lie in the field of local helioseismology, whereby observations of solar p-mode oscillations are used to probe localized inhomogeneities in the solar atmosphere and interior such as sunspots and subsurface magnetic fields.

Yeming Gu has also joined the extended NSO scientific staff through the Solar Physics Research Corporation. Yeming arrived in December from the Physics Department of the University of Arizona, where he did his PhD thesis research in computational problems in solar interior modeling based on helioseismic observations. He is working at NSO on problems in LTE radiative transfer through inhomogeneous atmospheres and in computational techniques in local helioseismology.

Andrew Jones arrived at NSO on 12 January to join the "South Pole" group (Stuart Jefferies, Jack Harvey and Tom Duvall). He will be helping with the instrumentation, and also the reduction and analysis of data from the earlier trips. Andrew's background is in both stellar and solar seismology. On the solar side he has been involved heavily with both the LOI and GOLF instruments for SOHO, as well as working on the SLOT/SLOE ground-based, low-degree intensity oscillations measurements. On the stellar side he has tried several approaches to measuring "solar-type" oscillations. Though it may be possible to detect stellar p-modes from the ground, he is uncertain whether any real science will come from this, as we will always be restricted to only the very brightest stars. So again we have to turn to space missions, and he was part of the study team for the failed PRISMA proposal, and now finds himself PI on the STARS proposal. This will aim to observe many thousands of stars with very high photometric precision, and by concentrating measurements in open clusters a real advance in our understanding of stellar structure and evolution may come.

Jacques Beckers, Ann Barringer

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New Near-Infrared Solar Coronal Observations at NSO/Sac Peak (1Mar94)

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New Near-Infrared Solar Coronal Observations...(1Mar94)
at NSO/Sac Peak
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

The first ground-based observations of the Si X coronal emission were made using the 40-cm coronagraph, 3-m Littrow spectrograph, and the Michigan Infrared Camera at the Evans Solar Facility. Two previous observations of this line were made from aircraft flying in the path of a total eclipse. The new wavelength measurement of 1430.08 +- 0.01 nm places the emission in the center of a small atmospheric transmission window - a lucky break for observers! More coronal emission wavelength measurements were made; this time for the two "well-known" Fe XIII emission lines. The new wavelengths for these lines are 1074.62 +- 0.01 nm and 1079.78 +- 0.01 nm. Surprisingly these Fe XIII positions have not been updated since the lines were discovered by Lyot in the 1930's.

The intensity of the Si X emission is rather faint; the measured intensities range from 1 to 10 millionths of the solar disk center brightness. This is very different from some recent work whichsuggested that the brightness would be 100 millionths! The 1075 nm Fe XIII emission ranged from 15 to 45 millionths of Sun center brightness, while the 1080 nm emission was about 5 millionths. This work will be detailed in a forthcoming paper.

Many other solar coronal emission lines are predicted to exist in the 1000 to 2000 nm wavelength regime. Only one spectrum exists (of a small wavelength region) from data taken in 1970, but recent observations suggest that there may be problems with these measurements. What are the exact wavelengths of these near-IR coronal lines? What are the intensities of these lines? Can these emission lines be used to accurately measure the temperature, density,

velocities and magnetic fields of the solar corona? These are the questions driving new work behind the coronagraph at NSO/Sac Peak.

[Figure not included]

Matt Penn, Jeff Kuhn

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Improvements in The Grating Drive of the Main Spectrometer (1Mar94)

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Improvements in The Grating Drive of the Main...(1Mar94)
Spectrometer
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

There are two gratings mounted back to back in the main spectrometer: a 16.5 x 12.5 inch replica grating used to cover the spectrum 300 nm to 2.5 um and the 18.5 x 14.5 inch original grating which extends the spectrum to 12.5 um. The spectrum is scanned with a screw drive pulling on a steel tape wrapped around the spool containing the gratings.

Photographs of the hyperfine structure of Hg 546.1 nm demonstrate a resolving power of about one million. However, when used in the scanning mode, as we normally use the spectrometer, it is much less - the linearity and smoothness of the drive are slightly worse than we had hoped and need - errors of 1 x 10**-4 to 5 x 10**-4 nm. To reduce the error, we have redesigned the tape-drive and are installing a new high-precision lapped screw and nut in February 1994.

Keith Pierce

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Magnetic Tape Policy (1Mar94)

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Magnetic Tape Policy (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

NSO now has a uniform policy which can be summarized by quoting from the current version (December 1993) of the observing proposal form: "Please bring appropriate magnetic tapes, otherwise NSO will provide tapes at cost." This policy matches that of the nighttime facilities on Kitt Peak; it applies both to visiting observers and to requests for archived data.

Many of you will not see a change, as most parts of NSO have implemented this policy informally for some time. Please be sure to check ahead that the type of tape you prefer (Exabyte or DAT, usually) is supported by the instrument or archive in question.

Doug Rabin

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Solar-stellar Spectrograph Upgrade (1Mar94)

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Solar-stellar Spectrograph Upgrade (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

The final optical design for the cross-dispersing of the echelle grating in the McMath-Pierce solar-stellar spectrograph includes up to three prisms as the cross-dispersing elements. The specifications have been finalized, and it is anticipated that by the publication date of this Newsletter the prisms will have been ordered from the vendor. The design of the transfer lens that will image the orders onto a large-format, 1024 x 3072 CCD array has also been accepted, and the optical elements are about to be ordered. The design will provide a high-throughput capability operating over a wavelength range extending from the K-line to about 700 nm with good order separation. The third prism will be removable so as to provide enhanced throughput in the blue with good order separation extending to about 520 nm. The modifications will include an option to permit the observer to still use the conventional Milton & Roy gratings or the echelle grating with an interference filter in a single-order mode. Machining of the mechanical components is now underway.

Mark Giampapa, Jorge Simmons, Dave Jaksha

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NSO Observing Proposals (1Mar94)

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NSO Observing Proposals (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

Current deadlines for submitting observing proposals to the National Solar Observatory are (1) 15 April 1994 for the third quarter of 1994 for solar instrumentation and (2) 31 March 1994 for the fall semester (August-January) of 1994-1995 for the NSO/KP Solar-Stellar Spectrograph. Forms, information and a Users' Manual may be obtained from the Telescope Allocation Committee at NSO/SP, P.O. Box 62, Sunspot, New Mexico 88349, for the Sacramento Peak facilities (sp@sunspot.noao.edu) and at NSO/KP, P.O. Box 26732, Tucson, AZ 85726, for the Kitt Peak facilities (nso@noao.edu). A TeX or UNIX roff version can be e-mailed at your request or obtained by anonymous ftp from ftp.sunspot.noao.edu.

Dick Altrock

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Experiments on Grating Performance at 12.3 Microns (1Mar94)

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Experiments on Grating Performance at 12.3 Microns (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

Using the stellar dewar `DERF', which contains a bib single-channel detector cooled with liquid helium, and the IR grating of the 13.6-m spectrometer, we have managed recently to measure the Mg emission feature at 12,319.5 nm. The line was observed to have a strength of about 20% near the limb in agreement with FTS results. The resolving power of the grating at these wavelengths is about 0.2 nm, or comparable to the width of the Mg feature. However the performance in terms of S/N is far from optimum. Several difficulties are encountered. The filter passband is too great (about 3 fm), resulting in excess thermal noise from the spectrograph, most likely the grating. Also terrible channeling is found with all filters tried so far. The maximum acceptance angle at the detector amounts to only about 2 arcsec. Since the telescope diffraction limit at this wavelength is about the same, this might be considered a good match, but we have no way to improve throughput by lowering spatial resolution as would be normal practice. Alignment has been difficult. The sun is no longer the dominant signal. We see spectra as the grating is rotated even when the slit is not open! Emission from parts of the tank plus air molecular absorption within the tank exceed the solar component. In other words, the setup remains very experimental as we continue to learn about the problems of operation at these long wavelengths.

Bill Livingston, Dick Joyce,
Ken Hinkle, Doug Rabin

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Nighttime Scheduling (1Mar94)

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Nighttime Scheduling (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

As was previously announced, the nighttime program at the McMath-Pierce has been accepting proposals on a semester schedule in line with KPNO, which schedules February-July and August-January. Due to unforeseen scheduling conflicts with the McMath-Pierce daytime program, we are shifting the approved semester nighttime programs to coincide with NSO's daytime scheduling. Since NSO's quarterly schedule begins on the calendar year, the semester proposal deadline will change to 15 October for the spring semester and 15 April for the fall semester. The spring semester will run January-June and the fall semester July-December.

Although we will continue to accept proposals on a semester basis, we will schedule the approved time in quarterly blocks. This means that you will receive notification of allocated time twice per semester (every quarter), rather than once per semester.

We apologize for any inconvenience this adjustment may occasion.

Doub Rabin, Mark Giampapa

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NSO Telescope/Instrument Combinations (1Mar94)

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NSO Telescope/Instrument Combinations (1Mar94)
(from NSO, NOAO Newsletter No. 37, 1 March 1994)

Vacuum Tower Telescope (SP):	Echelle Spectrograph Universal Spectrograph Horizontal Spectrograph Universal Birefringent Filter Fabry-Perot Interferometer Filter System Advanced Stokes Polarimeter Slit-Jaw Camera System Correlation Tracker Branch Feed Camera System Horizontal & Vertical Optical Benches for visitor equipment Optical Test Room
Evans Solar Facility (SP):	40-cm Coronagraphs (2) 30-cm Coelostat 40-cm Telescope Littrow Spectrograph Universal Spectrograph Spectroheliograph Coronal Photometer Dual Camera System
Hilltop Dome Facility (SP):	Ha Flare Monitor White-Light Telescope 20-cm Full-Limb Coronagraph White-Light Flare-Patrol Telescope (Mk II) Sunspot Telescope Fabry-Perot Etalon Vector Magnetograph Mirror-Objective Coronagraph (5 cm) Mirror-Objective Coronagraph (15 cm)
McMath-Pierce Solar Telescope Facility (KP):	160-cm Main Unobstructed Telescope 76-cm East Auxiliary Telescope 76-cm West Auxiliary Telescope Vertical Spectrograph: IR and visible gratings Infrared Imager Image Stabilizers 1-m Fourier Transform Spectrometer Stellar Spectrograph System 3 Semi-Permanent Observing Stations for visitor equipment
Vacuum Telescope (KP):	Spectromagnetograph High-l Helioseismograph
Razdow (KP):	Ha patrol instrument

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Global Oscillation Network Group (1Mar94)

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Global Oscillation Network Group (1Mar94)
(from GONG, NOAO Newsletter No. 37, 1 March 1994)

Sites

Eight site survey instruments continue to operate at the six GONG sites, plus downtown Tucson and Sacramento Peak. Another instrument will be installed at Kitt Peak in the near future. The network continues to see the Sun about 93.5% of the time. The two major papers reporting the site survey methods and results have been submitted to Solar Physics. A paper reporting on observations of the dust generated by the Mt. Pinatubo eruption has been drafted, and will be submitted in the near future.

Work continues to progress on the preparation of the field sites to receive the GONG instruments. At the Big Bear Solar Observatory (BBSO), a small land fill adjacent to the causeway out into the lake

will be required to seat the station. Members of the GONG and BBSO staff met with the Army Corps of Engineers in January to discuss the applications for the various necessary permits. In all, four different permits are required, including the Corps of Engineers, the State water quality and wildlife agencies, and the local water district. In a parallel activity, requests for bids for engineering services to design the landfill have been issued. Work will probably begin this summer.

A final location for the site at NOAA's Mauna Loa Observatory has been selected and agreed to by all parties. The site use agreement has been forwarded to NOAA for signature. NOAA intends to have other construction underway on the site in the May to July time frame and GONG expects to coordinate its preparation work with those activities. The High Altitude Observatory, which operates a solar observatory at the same site, will be providing on-site support for the GONG observation program.

The GONG Project Manager, Jim Kennedy, will be traveling to the sites in the Canaries, India, and Australia, in February for detailed discussions with the engineering and technical staffs and potential contractors at those locations regarding the land work there. It is expected that administrative and technical details will be worked out that will clear the way for work to begin at those sites in the next few months.

Similarly, there are ongoing discussions with CTIO in Chile to those same ends. Meetings with CTIO are tentatively planned for late March or early April. Everyone is anxious to see which of the sites will be the first to break ground.

Instrument

At the end of December, the GONG project received three interferometers from the manufacturer, Interoptics. Two of the units were immediately tested in our optics lab. The tests were promising so the least perfect unit was installed in the GONG prototype instrument. Solar observations confirmed good performance. The second unit was also installed and performed well. Tests of the third unit indicated that it would also function properly. As a result, the project accepted the three interferometers. Two more are nearly finished and all ten units should be delivered by the end of February. This will complete a long quest for the principal optical component of the GONG instrument.

The wavelength transmitted by the interferometers was found to vary less than 1/20 wave across their apertures. This is equivalent to less than 600 m/s in measured velocity. Temperature sensitivity proved to be almost exactly the same as calculated or 550 m/s per degree C. The interferometers are mounted inside ovens which maintain temperature constant to 50 micro degrees. Therefore the basic GONG signal will be stable at the 3 cm/s level before decomposition into spherical harmonics. Earlier realizations of the interferometer produced disturbing ghosts from multi-order quarter-wave plates in the arms of the interferometer. Thanks to the skill of the manufacturer, it was possible to eliminate these ghosts by fabricating very thin quartz wave plates on the mirror surfaces of the interferometer. The major disappointment is associated with the polarizing beamsplitter coating. It introduces a phase shift with angle of incidence that diminishes the angular field of view in one dimension. The effect of this is to introduce a velocity gradient across the image of the Sun in the GONG instrument. It is typically about 1000 m/s across the solar diameter or about 1/4 of the solar rotation gradient. In practice it should not be a problem.

We now have interferometers for Big Bear, Mauna Loa, and Tenerife in hand, with the balance due us by the end of February. We are presently awaiting the delivery of entrance windows and the remaining narrow-band interference filters to complete the complement of critical optical elements.

[Figure not included]

This picture shows two of the production GONG Michelson interferometers manufactured by Interoptics. The coin is 25 mm in diameter.

Progress was also made on adding an integrated image velocity signal to the output of the GONG instruments. A port originally designed to use a laser reference signal can now be used to provide a velocity signal integrated across the solar image. Tests to date indicate excellent performance.

GONG's three instrument makers, supplemented part time by two members of NOAO's instrument shop, are continuing to work overtime to complete mechanical parts in time for field station first light this spring. About 85% of the 450 mechanical parts that make up the GONG instruments

are now complete. Where possible, sets of drawings are being prepared for bid so that the less critical items can be fabricated outside of our shops. At the present time most of our effort in house is going into fabrication of the camera rotators - the last major mechanical element of the instruments and into component assembly. These latter items now appear to be on the critical path to field instrument integration.

Excellent progress is also being made with electronics production. We have completed enough production chassis to populate all six field instruments. The main electronics racks are also complete, including intra-rack cabling and harnessing. By mid to late February these racks will be transported to the integration site so that external cable manufacturing can begin. Bringing up the rear for electronics is circuit board production. Only a few relatively simple boards still remain in the printed circuit routing queue. More than 100 populated and wave-soldered data boards have already arrived and are undergoing visual inspection prior to beginning burn-in.

Data Management and Analysis

The main thrust of algorithm development for the GONG DMAC Pipeline has been along the lines of temporal filtering and merging. The project has adopted a baseline temporal filter of a weighted 21-point running mean that is re-normalized over gappy data, and independently applied to individual site days. This filter is quite effective in removing the leakage of strong low-frequency power from solar velocity fields (primarily rotation and supergranulation) and instrumental residuals into the p-mode band. However, it has two drawbacks: daily data strings with a low duty cycle must be discarded, degrading the overall performance of the network; and the filter results in a complicated - and so far unknown - response in the merged power spectrum. The project has tested an alternative "deterministic detrending" (DD) method in which the known velocity fields of observer motion, solar differential rotation, and limb shift are modeled and subtracted. This method does not discard any data, and has no power spectrum signature, but cannot easily remove supergranulation or instrumental residuals. The tests showed that the DD method worked reasonably well on days free from clouds, but poorly otherwise.

Due to a lack of resources, the Project cannot address either improving the DD method, or the power spectrum signature of the baseline filter. Instead, we have decided to retain the baseline filter, and proceed with using it in the course of applying our baseline merging algorithm to a 15-day time series of artificial data which is now available. This will allows us to both develop the production code, and to gain practical experience for the task of merging the GONG data. No attempt will be made to remove the filter signature from the merged spectrum. A scientific visitor, Shushant Tripathy (Udaipur Solar Obs.), has recently arrived and will be investigating ways to improve the DD method.

In the context of the merging algorithm, the scheme of correcting the images with their derived MTF as developed by Cliff Toner has been shown to be very effective in reducing atmospheric effects in the spectrum. A dramatic demonstration was provided by the ability of the method to remove the strong periodic features inserted into the spectrum by the hourly magnetograms which have a different focus from the routine observations. Indeed, the NSO South Pole group has found that the method can restore intensity images obtained through cirrus, allowing the use of substantial numbers of images previously though to be useless.

The GONG DMAC Users' Committee (DUC) held its sixth meeting in Tucson on 7 January. Topics discussed included peak finding, 16 vs 32-bit storage of the time series, DSDS developments, and a processing history log.

Suzanne Forgach left the project on 31 December. Suzanne had been working with the Site Survey data and calibrating data from the GONG prototype instrument.

GONG's anonymous ftp disk storage area has moved from the VAX cluster to a DECstation in the GONG/DMAC building. The network address has changed from robur.tuc.noao.edu (140.252.1.10) to helios.tuc.noao.edu (140.252.8.105). helios is the DSDS user machine. The disks on robur are no longer readable by an anonymous user.

A significant system upgrade of the Data Storage and Distribution System (DSDS) is underway. When completed in June, the DSDS will be on two Sun SPARC10's with SOLARIS 2.3 using ORACLE's data base management system and with a new design for the file catalog. Despite various problems which were encountered with ORACLE's DBMS and with SOLARIS, the conversion which began during the fall, is on schedule. Initial tests of data base intensive DSDS operator functions indicate that the new file catalog design will result in an order of magnitude

improvement in performance. This alleviates concerns about the capacity of the DSDS during the network phase of the project. During the last quarter, the DMAC calibrated, produced site-day l-nu spectra and 4-minute averages for 17 prototype data days: 9, 23-24, 29-31 October; 5-7, 25-27 November; and 10, 12, 16-18 December. The prototype instrument recorded data from 23 December through 4 January which the DMAC will reduce in the near future.

Project Management

The project has been advised that it will not receive the $2.85M FY 1994 funding requested to begin the planned network deployment in July. It appears that, once again, the NSF will be unable to provide GONG with the budget called for in the NOAO Program Plan. Now that deployment is imminent, this recurring problem may have some particularly unsavory impacts on the project. This will be even more acute if next year's budget continues this pattern.

In these stringent times, it is most important to accomplish the GONG research program with the least overall cost. Delays in beginning the scientific observations are very expensive. The project's overhead and personnel costs continue marching on, whether the science is being done or not. The project must have all of the sites in its six-station network operating to meet its fundamental scientific requirement for virtually continuous data. Economy dictates that all of the stations be deployed in as brief a time as possible (six months).

Moreover, there is a clear scientific requirement for several years of observations, in order to make the frequency measurements with the required precision, and to observe cyclic and secular changes. Combined with the gigabyte/day data acquisition rate, and the need to verify proper operation of the six instruments, this leads to the need to be able to process data at the observing cadence. Anything less will lead to an unmanageable backlog of data that would seriously threaten the integrity of the program.

Unfortunately, the minimalist approach to funding the project over the past four years has forced repeated deferral of the purchase of the main production processing systems for the DMAC. It appears that this will occur again this year, leaving the project's data reduction capacity in serious doubt in 1995.

Since 1990, budget projections have shown that this chronic underfunding approach will lead to the need for a one- or two-year funding bump to secure the DMAC systems and cover the necessary one-year overlap in full staffing for both the instrument and DMAC groups during deployment. If the FY 1995 budget is at current levels, not only will the DMAC be compromised, but the network deployment may have to be stretched out over a period of 18 months or more. Such a delay would increase the overall cost of the project by more than $1.5M.

As of this writing, the final amount of the available FY 1994 funding is still unclear. Nevertheless, steady - if painfully slow - progress is being made on all fronts. Depending on the actual budget figure, it is still possible that deployment could begin as early as November 1994. Other deployment options are also under consideration and will be reviewed by the project and the GONG Scientific Advisory Committee.

John Leibacher and the GONG Team

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The Role of the US Gemini Project Office (1Mar94)

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The Role of the US Gemini Project Office (1Mar94)
(from USGPO, NOAO Newsletter No. 37, 1 March 1994)

The US Gemini Project Office is not a part of the Gemini Project. It is a division of NOAO which provides a liaison between the US community and the Project. It keeps the US community informed about issues relevant to the Project. It polls the community through a number of

different processes to develop a US point of view. It then carries this point of view to the project. The USGPO is set up within the NOAO headquarters building in Tucson, and can be reached by e-mail (usgpo@noao.edu), FAX (602-325-9360), telephone (602-325-9352), or the usual NOAO mail address. Listed below are some of the specific activities in which the USGPO is involved.

o Focal Point for US technical interests in Gemini

   Undertake and support technical studies.

   Participate in design reviews for Gemini project.

   Advocate US interests in work package allocation process.

   Participate in technical committees.

   Serve as point of contact for US bidders interested in Gemini work.

o Focal Point for US scientific interests in Gemini

   Chair US Science Advisory Committee (SAC), support US SAC activities.

   Develop US position re science requirements.

   Act as watch dog for science requirements and technical implementation.

   Lead US delegation to Gemini Science Committee, participate in delegation selection.

   Participate in performance assessment for design reviews.

   Provide further science support as requested.

o Focal Point for US instrumental interests in Gemini

   Contribute to definition of instrument procurement approach.

   Encourage development of US role in instrument procurement.

   Communicate with community re instrumental opportunities.

   Serve as contact for US groups interested in Gemini instrumentation.

   Review/monitor US instrumentation development.

o Advocacy

   Give presentations concerning Gemini at scientific and technical meetings.

   Give presentations on project status and US involvement at institutions which make up the US astronomical community.

   Act as press contact for US-related issues.

   Present formal and informal status reports to US astronomical community.

Todd Boroson

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Activities of the US Gemini Project Office (1Mar94)

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Activities of the US Gemini Project Office (1Mar94)
(from USGPO, NOAO Newsletter No. 37, 1 March 1994)

As reported in the last Newsletter, a letter was distributed in mid-December describing the process by which US institutions could participate in providing instruments to Gemini. A copy of this letter may be obtained by contacting the USGPO (usgpo@noao.edu). A brief summary of the process is as follows: Based on the responses to the

request for letter of intent, the US Gemini Science Advisory Committee (US SAC) identified the following instrument work-packages as the community's highest priority interests:

1) optical arrays and controllers for imagers, spectrometers, acquisition, active and adaptive optics functions

2) IR arrays and controllers for imagers and spectrometers

3) optical imagers to support both science and field acquisition functions at both telescopes

4) a 1-5 micron imager (already allocated to the University of Hawaii)

5) a 1-5 micron spectrometer (for the northern telescope)

6) a mid-infrared imaging capability (not in the project's baseline instrumentation complement)

The US SAC also endorsed a strong role for NOAO both in the development of a "strawman" plan for the Gemini project and in the design and fabrication of instruments allocated to the US. The "strawman" plan is used in two ways. First, it is a demonstration to the Gemini project and the Gemini Board that the interest and capability to supply these instruments exists in the US. In that sense it is a placeholder for whatever US proposal is selected to supply the instruments. Second, it is a start on a real proposal which will ensure that at least one viable option exists for each US-allocated instrument.

The plan under development will be presented, as part of a larger international plan including all first-light instruments, to the Gemini Board in May. Following the board's approval, a general request for proposals will go out to the US community. Scientific and operational requirements for each of these instrument work- packages will be distributed. Competing proposals will be reviewed by an impartial panel, and one will be selected on a basis which will be described in detail in the call for proposals. The Gemini Project will then begin negotiations with the successful proposers so that specifications, a schedule, a funding profile, and a management structure are in agreement.

A number of design reviews and milestones are expected in the next few months. The telescope critical design review and Cassegrain rotator preliminary design review will be held in early March. Two reviews are planned for the f/16 chopping secondary, one in mid-February to discuss the scientific requirements, one in early March to critique a conceptual design.

The Gemini Science Committee meets in early April in Cambridge, England. The principal agenda item will be discussion of the instrument plan currently being developed by the Gemini Project with the assistance of the national project scientists.

The colloquium series begun last year by Jay Gallagher, Richard Green, and Fred Gillett is regarded by the USGPO as a great success and a model for ongoing communication to the US community. More than a dozen colloquia about the Gemini Project and the role of the US community were given during the fall at US institutions. This program will be continued in the spring; please contact us if you would like a USGPO associate to visit and talk about Gemini.

Todd Boroson, Fred Gillett

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Thanks to Fred Gillett, Jay Gallagher, and Richard Green (1Mar94)

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Thanks to Fred Gillett, Jay Gallagher, and ...(1Mar94)
Richard Green
(from USGPO, NOAO Newsletter No. 37, 1 March 1994)

I want to express my appreciation to Fred Gillett, Jay Gallagher, and

Richard Green, who have worked very hard on USGPO activities during the past year. Each has contributed substantially in ways that were complementary and extremely useful to the efforts of the Gemini Project, the US astronomical community, and the USGPO. Jay Gallagher initiated, developed, and organized a wonderful program to increase the community's awareness of the project. I certainly hope to continue and to build on the colloquium and display material which he developed. Richard Green assisted in the community interactions, and also took a leading role in solidifying the relationship between Gemini activities and NOAO. His insight into the subtleties of policy issues provided a sure path through the rocky politics of an international project. Fred Gillett, while having overall responsibility for all the activities of the USGPO, made major contributions in technical areas. His attention to the scientific implications of technical decisions will ultimately result in a dramatically better telescope for the US astronomical community.

Todd Boroson

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Preliminary Design Review of the Primary Mirror Assembly(1Mar94)

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Preliminary Design Review of the Primary Mirror...(1Mar94)
Assembly
(from USGPO, NOAO Newsletter No. 37, 1 March 1994)

A preliminary design review (PDR) of the Gemini Primary Mirror Assembly (PMA) was held 6-8 December 1993. The PDR Committee was unanimous in finding that the design approach presented will lead to the successful development of a PMA that will achieve the specified scientific performance requirements under most observing conditions. Action items were identified in order to prepare the PMA subsystems for a critical design review in about a year. Cost and schedule for the PMA were not part of this PDR. The report of the PDR Review Committee, together with the Gemini Project response will be available shortly. Contact the USGPO to receive a copy.

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Finding the FTP Archives at NOAO/Tucson (1Mar94)

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Finding the FTP Archives at NOAO/Tucson (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

The past two issues of this Newsletter have attempted to make our anonymous FTP archives more visible to the community. As many of you have probably noted these archives are spread out over various machines; the confusion is increasing since the number of anonymous FTP archives at NOAO/Tucson seems to be increasing. An attempt has been made to consolidate these archives for the outside user. We are still experimenting with the best way to present these archives so additional changes may be made over the coming months but we will keep you informed.

We now have one general FTP address for the anonymous FTP archives at NOAO/Tucson - ftp.noao.edu. The archives themselves have really not moved, but through the magic of automounting all the archives do indeed appear to be on the same node. This also has the advantage that

if it becomes necessary to move an archive it will be transparent to
our users since they can continue to access the archive at ftp.noao.edu,
regardless of where it is.

For large file transfers, it may be slightly more efficient to still
log onto the actual node, i.e., if you are transferring an IRAF
distribution you may still want to ftp to iraf.noao.edu. Or if the
ftp.noao.edu node goes down for some reason the old addresses will
still work (see the accompanying article in this section of the
Newsletter for a consolidated listing of what's in our FTP archives and
the alternate addresses).

To log into the NOAO/Tucson anonymous FTP archive type:

    ftp ftp.noao.edu (or 140.252.1.24)
    log in as anonymous
    user your e-mail address as the password
    get README
    cd &lt directory_of_choice&gt
    binary (for transferring binary files including files that end in .Z)
    quit to exit

If you experience any problems with accessing the archives please send
mail to grandi@noao.edu or jbarnes@noao.edu.

Steve Grandi, Jeannette Barnes

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NOAO FTP Archives (1Mar94)

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NOAO FTP Archives (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

We have decided to consolidate the listings of the FTP archives that
are available at NOAO. In previous issues of the Newsletter these
listings were in the division sections, but some felt that this was too
confusing. So we are trying a new format.

A summary of the archives is listed below. When an alternate address
is available it is given in parentheses. See the README or equivalent
files in the directories for more information about specific archives.
This listing also reflects the new general address, ftp.noao.edu (with
directories mounted read only), where appropriate (see the accompanying
article in this section of the Newsletter for more on the NOAO/Tucson
FTP archives).

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

ftp sunspot.noao.edu (146.5.2.1), cd pub
     Directory containing SP software and data products - coronal maps,
     active region lists, sunspot numbers

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

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

     catalogs - Directory of astronomical catalogues, at this time only
           the Jacoby et al. catalog, "A Library of Stellar Spectra," is here

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

     gemini (gemini.tuc.noao.edu) - Information from the Gemini Project

     gong (helios.tuc.noao.edu, cd pub/gong) - Directory containing GONG

helioseismology software and data products - velocity,
modulation and intensity maps, power spectra

iraf (iraf.noao.edu) - IRAF network archive containing IRAF
distributions and documentation

kpno (orion.tuc.noao.edu) - KPNO directory containing filter
information, hydra information, new LaTeX observing form
templates, new wavelength atlas for HeNeAr lines, instrument
manuals, KPNO observing schedules, platelogs for 4-m PF, user
questionnaire, SQIID scripts for data reduction

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

noao (gemini.tuc.noao.edu) - Miscellaneous databases, report from
Gemini WG on the high resolution optical spectrograph

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

preprints - NOAO preprints that are available electronically

sn1987a (helios.tuc.noao.edu, cd pub/sn1987a) - An Optical
Spectrophotometric Atlas of Supernova 1987A in the LMC

starform_project (mira.tuc.noao.edu, cd pub/sfproject) - Directory
containing progress reports and information on when/where to
obtain SQIID star formation project data

tex - LaTeX utilities for the AAS/ASP

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

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

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

The following numbers are available for the machines mentioned above:

argo.tuc.noao.edu	= 140.252.1.21
ctios1.ctio.noao.edu	= 139.229.2.1
ftp.noao.edu	= 140.252.1.24
gemini.tuc.noao.edu	= 140.252.1.11
helios.tuc.noao.edu	= 140.252.8.105
iraf.noao.edu	= 140.252.1.1
mira.tuc.noao.edu	= 140.252.3.85
orion.tuc.noao.edu	= 140.252.1.22
sunspot.noao.edu	= 146.5.2.1

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

Jeannette Barnes

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1994 Software Conference (1Mar94)

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1994 Software Conference (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

Preparations for the Fourth Annual Conference on Astronomical Data
Analysis Software and Systems (ADASS) are now underway. The Conference
is being sponsored by the Space Telescope Science Institute, the
National Optical Astronomical Observatories, and the Smithsonian

Astrophysical Observatory, with anticipated funding from the National Aeronautics and Space Administration and the National Science Foundation. The Conference will be held in Baltimore on 25-28 September at the Omni Inner Harbor Hotel, and is being hosted by STScI. The ADASS Conference provides a forum for scientists and programmers concerned with algorithms, software, and software systems employed in the reduction and analysis of astronomical data.

The members of the Program Organizing Committee for this year's Conference are Rudi Albrecht (ST-ECF/ESO), Roger Brissenden (SAO), Carol Christian (UC Berkeley), Tim Cornwell (NRAO), Dennis Crabtree (CADC), Daniel Durand (CADC), Bob Hanisch (STScI), Rick Harnden (SAO), George Jacoby (NOAO), Barry Madore (IPAC), Dick Shaw (STScI), Karen Strom (U. of Massachusetts), and Doug Tody (NOAO). Betty Stobie (STScI) is chair of the Local Organizing Committee.

The meeting agenda will consist of invited and contributed talks and poster sessions on the following special topics: Astronomical Data Modeling and Analysis, Design and Development of Graphical User Interfaces, Network Information Systems, and Parallel and Distributed Processing. Special interest "Birds of a Feather" sessions will also be held.

For further information please send mail to softconf@stsci.edu (Internet) or look at the information on the World-Wide Web with the home page address http://ra.stsci.edu/ADASS.html. Betty Stobie, the local Chair, can be reached by phone at (410) 516-8671 or by FAX at (410) 516-6864.

Doug Tody, George Jacoby, Jeannette Barnes

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Thanks to the IRAF Users' Committee (1Mar94)

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Thanks to the IRAF Users' Committee (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

This year's IRAF Users' Committee report is included below. I wish to thank the committee members for their time and energy in preparing the report, which I believe is accurate and fair. Several of the recommendations presented have been implemented already (see accompanying articles); others (e.g.: documenting algorithms, more frequent releases) describe more complex issues which will take some time to sort out. Should you wish to express your opinions about the IRAF Project, feel free to contact me or one of the committee members.

George Jacoby (IRAF Project Scientist)

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Report of the IRAF Users Committee Meeting 1993 (1Mar94)

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Report of the IRAF Users Committee Meeting 1993 (1Mar94)

The IRAF Users' Committee held their annual meeting at NOAO on Friday 3 December 1993. Committee members are listed below along with their e-mail addresses. IRAF users should feel free to contact any one of us

should they wish to raise any issues concerning IRAF, though of course specific questions should be addressed to the IRAF staff at NOAO.

Committee Members:

Belinda Wilkes, Chair (SAO)
belinda@cfa.harvard.edu
Carol Christian (EUVE)
carolc@soc1.sol.berkeley.edu
Peter Eisenhardt (absent) (JPL)
prme@kromos.jpl.nasa.gov
Craig Foltz (Steward Obs.)
cfoltz@as.arizona.edu
Bill Oegerle (STScI)
oegerle@stsci.edu
Jeff Pier (USNO)
jrp@nofs.navy.mil

Carol Christian, Craig Foltz and Bill Oegerle are rotating off the committee this year. Any users who would like to serve (the normal term is three years) should contact Belinda Wilkes at the e-mail address given above.

Report

1) The committee was very impressed with the new X support shown in demos, a great deal of progress has been made and it will make IRAF much more user-friendly and fun to use. We recommend that an early deadline be set for the release of 2.10.3 (in the first quarter of 1994). The further development of GUIs for existing tasks should be considered a second priority to providing the GUI tools (i.e. xgterm, ximtool) to the community who have been awaiting them for well over a year.

2) We are very impressed with the increased level of use of IRAF worldwide. The IRAF group is currently critically staffed. It has the highest number of users of any project at NOAO and its level of support should reflect its great importance to the astronomical community. It is essential that the funding for the IRAF group should be maintained at least at the current level and we strongly recommend that this level be increased. This increase may take the form of a direct increase of funding to allow new hires or an increase in the level of support at NOAO from outside the core IRAF group.

   As an illustration of the level of outside user support, the IRAF group answers 7-10 messages per day. While some of these questions are trivial and take only minutes to answer, the more complex questions may require several days and the input of a number of different people. As is the case for any large and successful software project, user support is an essential component of the work. The efficient handling of user support is a testimony to the dedication of the IRAF group. However we are very concerned about the extent to which this takes valuable time and resources away from the development due to the small number of people involved. This is one of the main reasons for our recommendation of an increase in funding and support for IRAF at NOAO.

3) We strongly urge that the IRAF Beginner's Guide, which has been available in draft form to a limited distribution for over a year, be generally released. This document is extremely useful even in its current, preliminary state, and should be available for those users who need it most, ie. those who are new to IRAF and do not know how to get it except by official means.

4) Some members of the IRAF team have concentrated during the past two years on the development of the user interface including GUIs. This has been an essential priority given the stage of IRAF development and the current status of the technology. However, while we support and are excited about the development of GUIs for all scientific tasks, we recommend that after the release of 2.10.3, the scientific priorities (new tasks, enhancements to old ones, see 12) should once again be brought to the fore and move along in parallel to the technical developments.

5) The IRAF Mail Network should move forward asap after the release of 2.10.3. Its availability will solve many of the current problems in communication with users and also help lighten the daily load of the IRAF support group at NOAO as users begin to answer one another's questions. We note that it needs to be well-publicized amongst the whole IRAF User community and easily available to ALL users so that those at small institutions should have access as well as those at large.

6) We were very pleased with the description of the planned cookbooks and look forward to seeing them in the near future. We would particularly like to emphasize the importance of the echelle cookbook.

7) We are concerned about Open IRAF. This is something new which does not appear to be directly serving the current user community. The drive appears to come mostly from the space community (EUVE, AXAF).

While we understand the need for IRAF to move forward with these current and future missions in mind, we strongly recommend that NASA funding from the projects concerned be utilized for this major development.

8) We were very impressed with the tutorials described by Jeannette. We would like to encourage their distribution and the writing of more. They will be very useful both to new users and those learning new tasks.

More General Comments

9) We are very pleased with the appointment of George Jacoby to oversee the IRAF software group and already are seeing the results of his interest and efforts.

10) We want to emphasize the need to make things (software and documentation) available as soon as it is usable. For example the Beginner's Guide (mentioned above) was already in draft form last year and was already very useful and filled an important gap at that time. It should have been made available then rather than now and should be put in the proper doc directory NOW. This is also true of xgterm and ximtool. No new IRAF releases were made this year. We strongly recommend that the IRAF group move towards more, smaller releases (patches?) at shorter intervals (6 months ~ 1 year) so that newly developed software or bug fixes are made available to the users in a timely manner.

11) There needs to be documentation of the algorithms used in the software. In general such details are not included in the help files so that user's have to contact IRAF staff for more information. A particular example of this is the multispec format files, the contents of which are briefly documented in one obscure place but the details of how eg. the noise is computed are not mentioned anywhere. For a scientist to be able to use this noise spectrum, s/he needs to know how it was derived.

12) Scientific Priorities: The committee finds it very hard to make scientific priorities without any information on the size of any job or the trade-offs involved. This aside, we would like to emphasize the importance of the following topics:

Scientific Priorities:

Lists of changes to task parameters provided with releases
Error propagation
Noise modelling
Pixel masks
Mosaicing of registered images

13) Ximtool should include the best features of both imtool and SAOimage. Based on the demo of the Alpha test version, it appears that many capabilities (such as the zoom windows) are not implemented yet and we must await the Beta test version to see these. We recommend that progress toward that enhanced version be an extremely high priority.

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Hands-on Exercises for Learning IRAF (1Mar94)

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Hands-on Exercises for Learning IRAF (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

Some IRAF exercises have been developed that may assist the novice user in learning IRAF. These are hands-on exercises using real data provided by our KPNO staff and cover general IRAF procedures, CCD reductions, photometry, spectral extractions and wavelength calibration, and data input/output. The exercises have been packaged into a tar file; the tar file contains the data, the exercises themselves, and charts for the stars to be identified for photometric calibration and the line identifications for the wavelength calibrations. The exercises have been developed for the latest release of IRAF, version 2.10.2, and assume the user is using an xterm window and SAOimage (v1.07). These exercises may be useful both for the scientist and for students in the classroom setting.

The exercises can be obtained from our anonymous FTP archive in the
following manner:

```
% ftp iraf.noao.edu (140.252.1.1)
ftp&gt  log in as anonymous
ftp&gt  use your e-mail address as the password
ftp&gt  cd iraf.old
ftp&gt  get readme.exer2102
ftp&gt  binary
ftp&gt  get exer2102.tar.Z
ftp&gt  quit
```

The readme.exer2102 file contains more information about the exercises
including instructions for their installation.

New IRAF users may find the document A Beginner's Guide to Using IRAF
(IRAF Version 2.10) - Draft a useful learning tool as well. This
manual is also available in the IRAF network archive and can be
retrieved in the following way:

```
% ftp iraf.noao.edu (140.252.1.1)
ftp&gt  log in as anonymous
ftp&gt  use your e-mail address as the password
ftp&gt  cd pub
ftp&gt  binary
ftp&gt  get beguide.ps.Z
ftp&gt  quit
```

The document can be printed to a local PostScript printer on a Unix host
using a command such as

```
% zcat beguide.ps.Z | lpr -P&lt your_printer_name&gt
```

Please direct any questions to jbarnes@noao.edu.

Jeannette Barnes

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IRAF Update (1Mar94)

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IRAF Update (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

Most of the effort of the IRAF group this past quarter continued to be
directed to development of the new graphical user interface (GUI)
software for IRAF, including xgterm and ximtool, in anticipation of the
next projected public release of IRAF in spring 1994. The last issue
of this Newsletter went into detail about this work and what is being
developed.

Alpha testing of a major part of what we have been calling the IRAF
Mail Network began in January. Beta testing of this new facility by
our list of beta test sites will begin shortly. The IRAF Mail Network
consists of many interrelated network services, including those
services that are in heavy use today such as the FTP archive, the IRAF
Hotline, and the IRAF sitemail, plus a number of new services such as
network news, a World Wide Web server, a Mosaic interface, and a scheme
for remotely executing IRAF over the network. Because of the many
diversified services perhaps a better name for this project would be
the IRAF Information Network.

The new network service that just went into operation is a USENET and
e-mail based network news facility. This consists of a collection of
newsgroups organized as a USENET alternate news hierarchy called adass,
after the software conference of the same name (astronomical data
analysis software and systems). Although our main interest in
developing this was to have a place to put some IRAF newsgroups, we
named the new news hierarchy adass in case there is any interest in
expanding this in the future to include other non-IRAF astronomy
software newsgroups. Existing alternate news hierarchies comparable to

adass are bionet (for the biological sciences community) and gnu (the Gnu software).

The advantage of an alternate news hierarchy is that it is easier to target the desired community, in our case the astronomical community. The disadvantage of starting a new news hierarchy is that initially there is no distribution system in place. To carry the newsgroups locally a site must get a feed from some other site. To read or post news, an individual need only have some NNTP-based newsreader software and access to an NNTP (network news) server somewhere on the net which carries the desired newsgroups and which permits the user to read and post news. As part of the mail network project we will be providing an NNTP server on the main IRAF server iraf.noao.edu which will allow anyone to read and post to the adass newsgroups (but only to those newsgroups).

The current list of newsgroups are the following (this may change):

adass.general	important announcements
adass.misc	miscellaneous discussion
adass.admin	adass newsgroup administration
adass.test	test postings
adass.conference	adass software conference
adass.iraf.readme	the mail network README file
adass.iraf.announce	new iraf software or facilities
adass.iraf.applications	applications discussion group
adass.iraf.programming	programming discussion group
adass.iraf.system	system issues, system administration
adass.iraf.misc	miscellaneous discussion
adass.iraf.buglog	project buglogs (computer generated)
adass.iraf.sources	small programs or documents

The adass.iraf newsgroups are intended to be shared by the IRAF user community and all the groups and individuals developing software for IRAF (i.e., not just the NOAO IRAF group). The next issue of the IRAF Newsletter will have more detailed information on the IRAF Mail Network, including information on how to subscribe to or otherwise access the new facilities. Individuals interested in helping beta test the netnews facility should contact the IRAF group.

A Frequently-Asked-Questions (FAQ) list is being developed and should be available shortly in our FTP archive. FAQ lists serve two purposes: they help users solve immediate problems, and they also serve as a learning tool since users can read through the FAQ list and learn things that they might not otherwise find out about.

In addition to developing the GUI system facilities (xgterm, ximtool, and the GUI toolkit) we are experimenting with a number of new IRAF applications (IRAF tasks) with integrated GUIs. These applications have a full graphical user interface using multiple windows, pop down menus, command buttons, scrolling lists, etc., plus custom facilities for interactive graphics and imaging. Early versions of these new GUI-based applications have been demonstrated at recent astronomical conferences (see below).

These demonstration GUIs include an image browser that allows the user to browse directories and select images, then list the image header or display the image; a radial velocity GUI built as a front end to the radial velocity task FXCOR; a spectroscopic tool that combines features of SPLOT and SPECPLOT into a powerful GUI for spectroscopic data analysis; a GUI for click and point aperture photometry, using graphics markers to mark on the displayed image the region in which photometry is to be done; and a help tool that provides the user with a graphical interface to the IRAF online help system. These GUI tasks, plus others, will eventually be packaged as an addon package (to the next IRAF release) to give our users a chance to experiment with them.

The IRAF Users' Committee (IUC) met in Tucson in early December, and the new GUI software, including xgterm, ximtool and the developmental GUI-based science applications, were demonstrated to them. The committee was excited about this new development and was anxious to see the new software released to the user community. The IUC met for one day; presentations by the IRAF group were made to the committee, and priorities for future development were discussed. The IUC's report is presented as a separate article elsewhere in this Newsletter.

Members of the IRAF group attended the AAS meeting in Washington DC in early January and demonstrated the new IRAF software and talked with many of our users in the astronomical community. The demonstrations of the new software were well received and again users are anxious for the new release of IRAF and the eventual availability of the GUI software. We enjoyed meeting and talking with our users at this meeting, and we thank the many of you who stopped by our booth. For further information about the IRAF project, please contact Jeannette Barnes,

Central Computer Services.

Doug Tody, Jeannette Barnes

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Tape Recycling 1 July 1994 (1Mar94)

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Tape Recycling 1 July 1994 (1Mar94)
(from CCS, NOAO Newsletter No. 37, 1 March 1994)

We still have many old tapes hanging in our downtown tape library that are signed out to non-NOAO staff; these include, but are not limited to, mountain T-tapes. This is just a reminder that on 1 July 1994 we plan to recycle or discard any of these tapes that have a date on them prior to 1990. No warnings of any kind will be issued. If visitors or prior NOAO staff members have tapes that may be dated earlier than 1990 and are concerned about keeping the data, please contact us as soon as possible. If you have any concerns about this policy please contact jbarnes@noao.edu.

Jeannette Barnes, Bruce Bohannan, Steve Grandi

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