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NOAO Highlights!

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

A Call for Help (Including Selections from "Science and the American Dream: Healthy or History" by Neal Lane) (1Mar96)

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A Call for Help (1Mar96)
(from NOAO Newsletter No. 45, March 1996)

If you ever apply for grants, or if you ever apply for time on NSF's national optical or radio facilities, this call is for you. It comes from none other than NSF Director Neal Lane and was delivered by him in person at the Baltimore AAAS meeting. It is reprinted for you in these pages. It really means that you should get involved personally. No, it is not something the people at the AAS, or at the NSF Astronomy Division, or at science consortia such as AURA, can do for you. Yes, they advocate our science, but that can only go so far. Personal interactions among friends and neighbors are by far the most important and most effective means to communicate. Each of us in Washington, at the consortia, at the AAS, and at the NSF, has only so many neighbors.

Each of us is a constituent of only so many elected officials. Your word counts more with your friends and neighbors more than does ours. Tell them what is good and important about what you and others in the community do. Tell them that astronomy exemplifies that science is the "endless frontier" of which Vannevar Bush wrote a half century ago. And tell them that NSF matters for basic science and astronomy and for the future. NSF may be the best friend you have. It needs your help now. I urge you to read Neal Lane's words carefully, then go out and do what he asks. Do it for your friend, and for your science.

Goetz K. Oertel

Selections from "Science and the American Dream: Healthy or History" as delivered by Neal Lane, Director, National Science Foundation at the AAAS Annual Meeting, Baltimore, Maryland, 9 February 1996.

I have titled my remarks today "Science and the American Dream: Healthy or History." The American Dream is about opportunities, aspirations, and a better quality of life. In the past, science has provided an important pathway to that dream. Whether or not this will continue to be true is a question of great concern to me and the subject of my talk.

Interest and support for science in America dates back to the beginning of the Republic. Substantial funding and major mobilization of science toward national goals dates primarily from World War II.

Professor Dale Jamieson of the University of Colorado, Boulder wrote the following in his paper (National Research Council conference, 1993) entitled What Society Will Expect From the Future Research Community, "In the good old days, roughly from the end of World War II until the end of communism, the relationship between science and society was clear and secure. Now it seems confused and chaotic. In the good old days we (America) were rich and scared. Because we were scared we wanted science to protect us. Because we were rich, money was no object--... The research community lived up to its part of the bargain. It protected us from the Russians; gave us... international prestige, spun off new consumer products...; and made us proud,... (now) Not only are we no longer scared of the Russians, but we also no longer feel rich."

One primary focus of the American Dream during the Cold War was preserving our freedom while securing our safety from annihilation. With the generous funding of science, however, many other advances and benefits fed our national and personal dreams. Improved health, safer work environments, and a higher standard of living for a larger segment of the population became possible. Science and the American Dream were unquestionably healthy!

When America called upon the science community to help protect us during the days of external enemies, we were asking for their knowledge and for their leadership. In those early years, the leadership expected from the scientific community was narrowly defined by the public and for the most part was confined to national labs and campuses. As Dale Jamieson said, "The research community lived up to its part of the bargain." I might add that society (mostly in the name of the government) lived up to its part of the bargain also. Science was funded with the generosity of a philanthropist and the faith of a devout parishioner.

What a difference five decades can make. Today, not only is the bargain in question, but different times call for different kinds of leadership. Global communications and transportation have made the world a village. Global markets have made it an intensely competitive circle of highly productive participants. In our own country, neglected social problems have become festering national issues. The ballooning of the budget deficit in the 1980s along with the economic drain from interest on the federal debt have energized the electorate to demand greater accountability of all government investment, including science and technology.

In this new environment, leadership from you, the science community, requires a much more public and civic persona. You are needed more than ever to be visible and vocal in your communities. This requires your presence, as scientists, outside the walls of your laboratories and the gates of your universities to a much greater extent than in the past.

Today, as always, science gets done in the lab, the office, and increasingly on workstations, supercomputers and the Web. Now, however, science can only be funded if the electorate and their representatives remain convinced of its value and contribution. These understandings and necessary explanations are not well suited to crash efforts in times of a budget crisis. They need to be routine parts of a community discourse on the goals and values of various investments that the nation could or should make. Only then will science and technology's fundamental contribution be inherently valued in today's climate of accountability. Without this understanding among citizens and policy makers, science and the American dream may only be a memory from the past and not a part of our future.

In the early years, science helped protect us from our enemies. But today when it comes to science, the American people could be their own worst enemy--a little like the old Pogo philosophy of "we have met the enemy and it is us." There is very limited public understanding of science and, more important, how science and technology contribute to our lives, our aspirations, and our national goals. Perhaps the public's lack of understanding says more about us than about them.

I believe that the new leadership needed from the research community is to carry our understanding of science and its value into the life of our own communities. We can help thereby to propel America toward those investments that are vital to a vibrant 21st century American dream.

I spent 35 wonderful years in academic science, and I hope to go back when my hitch in public service is over. I am aware that we scientists are motivated to teach and do research because it suits our intellectual appetites, our temperaments, and personalities. We are long on curiosity, independence, desire for intellectual rigor, and an all consuming passion for discovery.

So, you say, what good would such a person be going out into his or her community talking about how the latest fat-free foods, CD players, laser surgery, and the concept of "community policing" are all the products of research. Contrary to that possible self-image, scientists are the only genuinely credible people to deliver the message. I understand that some of you may have neither the desire nor will to do so, but I have little doubt that if you do, the experience will be fulfilling and the results successful. At the very least, providing encouragement and other kinds of support to your colleagues who do take on this noble challenge would be an important contribution in itself.

In Stephen Jay Gould's new book of essays, Dinosaur in a Haystack, he describes a compelling incident of the public's fascination with science, not their understanding necessarily but their fascination. He was in New York City on May 10, 1994, at the time of a partial eclipse. No surprise that Gould would stop to watch, but those New Yorkers, never. To his delight, "in midtown Manhattan, in the middle of a busy working day, New York stopped to watch the sun."

Gould was interviewed on National Public Radio about two weeks ago, and he spoke at length on popular excitement about all facets of science. In fact, NSF's surveys confirm that interest and fascination. Gould's story, however, posed a question for me. The public likes science, but do scientists like the public? I think we need to ask this question of ourselves as a community. We may then better comprehend the discrepancy between public interest and public understanding. As the Director of NSF, an institution that does a great deal of science out-reach, I do not have the explanation for this discrepancy, but I am committed to work together to find it.

I do know one thing; the science that, in large part, defined so much of the American Dream after World War II--that science was healthy, secure in its fruitful future. But the title of my remarks today is Science and the American Dream: Healthy or History. Will "science and the American Dream" be a legacy of our past, but not the promise of the future? You, the research and education community--a national stronghold,--I would even say a treasure--of intellect, creativity, and dogged determination--are an important key to answering that question.

I am sure that all of you are aware that federal funding for science comes out of the small portion of the budget known as "discretionary funds." This means exactly what it sounds like--up to the discretion of the President and Congress and very vulnerable. Entitlements make up half of the $1.6 trillion federal budget, interest on the national debt--15 percent, and defense--18 percent. And what's left? The civilian "discretionary budget" comprises only 17 percent of the total federal budget pie. In that limited discretionary slice of the pie, federal dollars for science and technology are not without stiff competition from other important national needs such as veterans hospitals and housing programs.

To be sure, science has some strong supporters on both sides of the aisle in Congress. This is reflected in the fact that research budgets (NIH, NSF and selected programs in other agencies) have fared relatively well, so far, in the FY 96 appropriations process. But that is not the case for non-defense R&D overall. And the situation gets tougher for FY 97 and the out-years, as downward pressure on the discretionary budget grows.

The AAAS has projected that in the seven year balanced budget scenario, non-defense R&D will decrease by approximately 33 percent in real terms by the year 2002. Also of great concern are the projected cuts for education.

Let me illuminate the federal role in research by only one example. According to David Goodstein, Vice Provost of the California Institute of Technology, federal funding accounts for over half of Caltech's budget. In fact, the figure is actually 60 percent or $156 million while tuition accounts for less than 10 percent. Now, not all universities are in the research business to that extent, but a 33% reduction in civilian R&D cannot go unnoticed in its national impact.

In essence, this nation is getting ready to run an experiment it has never done before--to see if we can reduce the federal investment in non-defense R&D by one-third and still be a world leader in the 21st century. Nobody knows with certainty what the outcome will be but it seems like a pretty risky experiment.

As Dale Jamieson tells us, "we... no longer feel rich." However, when Joe Stiglitz, Chairman of the President's Council of Economic Advisors, released the Council's R&D report in October, he explained that deficit reduction and balancing the budget were the means to an end goal of Economic Prosperity. But he also said, "Cutting investments in R&D run counter to that end goal; without protecting key investments you may end up with a balanced budget but slower economic growth."

The exercise to balance the budget in these seven years will be a test of national restraint and endurance under difficult circumstances--with or without cutting federal research and development. But cutting the very components that are growth creating and enhancing at such a time seems counterproductive.

When we dramatically reduce science, technology, and education, we are shaking the very underpinning of our societal structure. It is not hard to predict that there will be damage. Our current competitive progress has been the result of more than a decade's work to come from behind in many areas. This new strength that has enabled us to move ahead of Asian and European competitors is surely due in large part to our multifaceted science, technology, and educational system.

Damage or destruction to any part of this intricate system could eventually undermine the whole structure. It is the system in all of its complexity and uniqueness that generates knowledge and national wealth far greater than the sum of its parts.

I believe the American people and many of their elected representatives do not understand this complex R&D enterprise as a system. It is up to us to convey that concept, that understanding, and its value to America's progress and the American Dream.

In addition, the inability or unwillingness of parts of the enterprise to adapt to changing conditions will also damage the whole. Since it is our colleges and universities that educate and train the science and engineering workforce, they will be integral to all the adjustments and adaptations.

All institutions of higher education should examine their academic programs, including those in science and engineering, in the larger context of today's social needs and problems. The challenge is to prepare all students for adaptability in a dynamic and swiftly changing marketplace in industry, in government, and in the academy. Universities and colleges will need to be consistently alert to their uniquely important role in the functioning of the larger system.

Perhaps you are somewhat impatient with my message this evening. You may believe that I am overreacting to a short-term situation. Perhaps! But, my concern is that by the time the damage to our American R&D system is done, the moves to reverse it will be much more difficult, and in some cases impossible. The solution to the adage "Good judgment comes from experience, and experience comes from bad judgment" frequently narrows down to one ingredient--leadership. What we need is the science community's leadership to educate the nation about the value of science and technology to our national well-being. This may seem an impossible task!

I grant you that these things happen slowly and imperceptibly at the grassroots. They are not about staged visits to Washington representatives but rather about the collective influence of singular forays into local community life.

Just to give you a flavor of what I mean, the other day I spoke to a group of science faculty and administrators. Afterwards, a physicist came up to tell me of a series of local radio commentaries he had done on science and society over the last two years. Some topics were "Science for Society: the 1995 Nobel Prizes," "Undersea Exploration of the Arctic," "Exploring the Promise of Biomass Energy," and "The Crisis in Federal Support for Science."

Now I admit, not all of us want to do radio commentaries, but there are many ways to create the understanding and convey the value of science. Someone else mentioned to me teaching an adult education class on "science in your daily life." And there are already many examples of scientists working with teachers in the public and private elementary and secondary schools.

You might ask, what science discussion currently catches the public's attention? Carl Sagan's science articles for the general public have appeared in the "Parade" section of hundreds of newspapers. Both Discover magazine and the Discovery TV channel tell the science story and its contributions and applications. Science Fairs at local intermediate and high schools are not just for proud parents,--and grandparents, I might add--often they are genuine community events.

Science museums all across the country are often overwhelmed with visitors. They need support of all kinds...

An important part of our work as scientists is to present our findings in scientific papers for journals and conferences. At the other extreme, however, there are opportunities for talks at community meetings like the Kiwanis Club and the League of Women Voters.

I will argue that such meetings as these are increasingly important, even though I'm afraid they don't contribute significantly to tenure or other professional advancement, at lease not yet.

Two weeks ago, I gave a speech in Texas (at the AAS San Antonio meeting - ed.) in which I spoke of the perception in Congress of the science community's stony silence in the wake of major cuts, actual and projected, in R&D. This relative silence was taken as a negative sign for lawmakers who were fighting to hold the line on science spending. It provided ammunition for those policymakers intent on offering up "science funding" for budget-balancing. Perhaps it was just happenstance that my public remarks, which were circulated on the Internet, coincided with an avalanche of communication to House and Senate members. However you choose to interpret the situation, your substantial expression of concern was unquestionably effective. I'm sure the entire science and technology community, and NSF in particular, is grateful.

I also know that early-on there were voices raised in concern. This includes the hard work of the many individuals who toil day in and day out to represent the interests of your institutions and professional societies. However, a small number of voices--no matter how sincere or compelling--can be difficult to hear in the noise of the recent turmoil and debate.

There were also selective voices from industry raised in alarm. They were heard, and their efforts also are appreciated. Perhaps there will dome a time when selective becomes pervasive. This is not yet such a time!

But today I am speaking not of short-term visibility but of long-term leadership. I am speaking of the kind of leadership that only this community--which I am privileged to know so well--can deliver.

We have a civic role to play for the nation. Science and technology are integral to all our lives as citizens, perhaps so integral that we often take them for granted like sunlight or rain. However, nobody understands better than we who are scientists what it takes to build a strong science and technology presence. If we think about it, we might also realize how vulnerable that capacity can become in just a brief time.

In closing, I want to remind you that as scientists, you know from experience that being accountable and being creative and visionary are not mutually exclusive. Science and technology provide an open horizon into the remaining mysteries of the universe, the human mind, the planet's climate, all the potential of electronic computation and communication, and the list goes on. When I speak of the danger of the projected one-third cuts in R&D, I do not exclude the potential of healthy increases in R&D at some future time. Whether that happens, or more optimistically when that happens, will be determined by our engagement in a new dialogue with the American electorate.

I am not unaware of your reluctance and even feeling of awkwardness to step forward in a new and uncharacteristic pose--the civic scientist. That certainly is not a role I would have felt particularly comfortable with as a young or even not-so-young faculty member. But as I said earlier, different times call for different kinds of leadership.

I am reminded of some sage advice by Alexis de Tocqueville, the astute chronicler of American democracy. He said, "We succeed in enterprises which demand the positive qualities we possess, but we excel in those which can also make use of our defects." I would like to challenge all of us, myself included, to find our own personal path to bring this message to our citizenry. I do not suggest that progress will be either swift or easy. I am your colleague, ally, and friend in this endeavor and most proud of that association. I know that we are equal to the task.

Neal Lane, Director
National Science Foundation

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Using Binaries to Split the Age Dichotomy of the Universe (1Mar96)

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Using Binaries to Split the Age Dichotomy of the Universe (1Mar96)
(from NOAO HIGHLIGHTS!, NOAO Newsletter No. 45, March 1996)

An outstanding problem in modern cosmology is the persistent discrepancy between the absolute ages of globular clusters and the expansion age of the Universe. Recent ground and space-based measurements of the Hubble constant imply an expansion age of about 10 Gyr for the Universe, while the ages of globular clusters are typically estimated to be 12-16 Gyr. Although, much of the blame for this discrepancy has traditionally been attributed to systematic errors in the cosmological parameters, it is just as important to realize that the absolute cluster ages may also be in significant error. The globular cluster distance scale is crucial in properly defining the luminosities of turnoff stars in globulars and is therefore crucial in defining the age scale. Uncertainties in cluster ages derived from isochrone-fitting techniques scale approximately as Delta log(Age)/Delta log(D) ~ 2, where D is the distance. It is also important to realize that the apparent beautiful accord between stellar evolutionary theory and globular-cluster observations may be illusory. The best modern models are simultaneously complex, but yet in some ways significantly incomplete. New approaches to understanding the ages of clusters are thus more than welcome. Mario Mateo (Michigan) and Lin Yan (ESO) are working on this problem by using observations of binary stars in globular clusters in a unique approach to help tie down both the distances and ages of the systems.

Over the past few years, numerous groups have identified short-period binaries in globular clusters. In itself, this is a bit of a revolution since it was only a few years ago that the total number of known binaries in clusters was believed to be very small (see Hut et al. 1992, PASP, 104, 981 for a review of the field). In late 1994, Mateo and Yan reported the discovery of five short-period eclipsing binary stars located at or just below the main sequence turnoff in the nearby globular cluster M71 (see Figures 1 and 2). It was immediately apparent to the two investigators that these stars provide a unique opportunity to measure the distance to M71 independently of stellar evolutionary models. These stars can also be used to test the reliability of ages derived from stellar models.

One way to carry out the latter test was described by George Preston in the context of determining the age of the oldest population in the Galactic Bulge (1993, IAU 153, p. 101). Assuming only conservation of mass, he noted that the evolution of short-period binaries can be described with the equation M sub 1 + M sub 2 = M sub 1,0 + M sub 2,0 + M sub L. That is, the total mass of the present-day binary equals the mass of the initial binary plus any mass loss. This equation can be rewritten as M sub 1,0 = M sub 1 (1+q)/(1 + Q + L), where q is the present-day mass ratio, and Q, and L are the original mass ratio and mass loss in terms of the mass of the initial primary star, M sub 1,0. The most conservative assumption is L = 0 (no mass loss) and Q = 1.0 (equal-mass components initially) from which one can derive a lower limit of the zero-age mass of the present-day primary,
M sub 1,0 ~/= 0.5 M sub 1 (1+q). The test demands a good estimate of the present-day mass of the primary (M sub 1) and the mass ratio (q).

Four of the M71 binaries are located within 0.2 mag of the cluster turnoff. Spectroscopy of these stars could therefore directly provide a lower limit to the cluster turnoff mass, which can be critically compared with predictions from models. The test requires no knowledge of the cluster distance and is only weakly dependent on the reddening. Moreover, this test provides a new sort of comparison between models and observation: there is still no direct mass determination of any non-degenerate stars in globular clusters.

Last September, Mateo and Yan used the R-C spectrograph on the KPNO 4-m telescope to carry out time-resolved spectroscopy of the five M71 eclipsing binaries. This project proved to be practical because of the availability of multislits for the R-C spectrograph. Four of the five variables could be observed simultaneously, along with eight other cluster main-sequence stars, subgiants, and blue stragglers. They observed the fifth variable by positioning one of the multislits on it a few times per night. The non-variable 'check stars' in M71 provide invaluable information on the importance of slit errors as they monitored the binaries. The principal challenge was the faintness of the variables whose mean V-band magnitudes range from about 18-19 and have periods ranging from 0.35-0.56 days.

Using the KPC-24 grating in second order, Mateo and Yan were able to attain 5-8 km/s precision on these check stars per exposure. This is better than they had expected and more than adequate for their purposes (the expected velocity amplitudes are about 200 km/s, but these stars rotate rapidly, and they were interested in very small mass differences). They attained S/N of about 15 per resolution element for each of the M71 binaries on individual 20-minute exposures. Such short exposures were necessary to avoid significant phase smearing. Their success suggests that similar observations of main-sequence binaries in about 20-30 clusters could be done, rather than in just the 5-6 closest systems.

[Figure not included]

Figure 1. V-band light curves for the newly-discovered exlipsing binary stars in M71 (Yan and Mateo 1994).

Mateo and Yan obtained more than 30 epochs for four of the binaries, and 10 epochs for the fifth system. In every case, they obtained good data at the quadrature phases where the velocity amplitude--which defines the mass scale--is largest. All of the M71 binaries turned out to be double lined systems. One example of the cross-correlation profile for one of the binaries near quadrature is shown in Figure 3. Since there are excellent constraints on the orbital parameters (in particular, the inclination) from the light curves of these stars, it is possible to obtain reliable mass estimates of the individual components. A detailed analysis of these measurements is underway.

[Figure not included]

Figure 2. A color magnitude diagram of M71 showing the locations of the eclipsing binaries.

Mateo and Yan are now actively monitoring dozens of other globulars for both short-period and longer-period binaries at or below the main-sequence turnoff. Virtually every well-studied globular contains eclipsing systems. Their positive experience with M71 suggests that they should be able to do effective follow-up spectroscopy of many of these systems. Their ultimate goal is to test critically the reliability of the absolute ages implied by modern evolutionary models and, at the same time, provide a new distance scale for globulars based on the binaries themselves.

[Figure not included]

Figure 3. Cross-correlation profiles for the spectra of one of the M71 variables from a single night. The double-peaked profiles indicate that both stars are being measured; the variations in the peak positions as a function of time is evident. Along with the excellent inclination information from the light curves, Mateo and Yan will be able to derive unambiguous and precise masses for both stars in most of the M71 systems.

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The Faintest Known White Dwarf (1Mar96)

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The Faintest Known White Dwarf (1Mar96)
(from NOAO HIGHLIGHTS!, NOAO Newsletter No. 45, March 1996)

The white dwarf luminosity function incorporates information on the age and star formation history of the Galactic disk that is independent of other techniques. In particular, the least luminous white dwarfs set lower limits on the disk age, and thus the age of the Universe. The faintest known white dwarfs have Mv ~ 16.2. Age estimates for these stars are in the range 6.5-11 Gyr, with the variation largely due to uncertainty in the core composition. The white dwarf luminosity function declines abruptly at this absolute magnitude, which has been interpreted as being due to the age of the Galactic disk. The question remains, do even less luminous and older white dwarfs--however rare--exist? The search for very low luminosity white dwarfs is still very active. A concerted effort has been carried out for a number of years by Maria Teresa Ruiz and her colleagues at Cerro Calan Observatory (Chile). Selection of promising candidates is done with a classic technique, blinking plate pairs from the ESO Schmidt telescope to identify faint stars with substantial proper motion. The magnitude limit is about m sub R ~ 21 and motions as small as 0.1" yr sup -1 are detectable with a few years' time base. Followup observations at CTIO and other facilities in Chile help winnow the most interesting objects out of the hundreds found on a plate pair.

One such object is the cold DC type white dwarf ESO 439-26. Following its initial discovery in 1988, preliminary spectroscopic and astrometric data suggested it to be of very low luminosity. Several years' subsequent investigation at CTIO have now established this definitively. This result is based on another classic technique, the determination of trigonometric parallax, applied with modern CCD detectors in a program led by Claudio Anguita (Chile). Observations were carried out on the CTIO 1.5-m telescope over a five-year period, using initially a 312 x 508 RCA CCD and more recently a Tek 1K device. With 0.3" pixels and seeing at 1.2" or better, 40 frames yield a parallax of 0.024" +/- 0.003", or M sub V = 17.4--more than one magnitude fainter than the faintest previously known white dwarfs. The existence of such an extreme low-luminosity white dwarf may imply a very large value for the age of the local Galactic disk.

Alternatively, the low luminosity of ESO 439-26 could be accounted for if it is a massive white dwarf with a correspondingly small radius--also a rare beast, but not one implying great age. Only a detailed comparison of the observed absolute flux distribution with theoretical models can resolve the ambiguity. Ruiz and Anguita, together with S.K. Leggett (IRTF) and P. Bergeron (Montreal), have used BVRI photometry obtained on the CTIO 1.5-m and 0.9-m telescopes and model atmosphere calculations by Bergeron and colleagues to make this comparison. They find the high mass interpretation to be the correct one, independent of details of atmospheric composition. The best fit to the photometry gives T sub eff = 4560 K, log g = 9.0, and M = 1.2 M sub O--twice that of a typical white dwarf. Comparison with carbon core evolutionary models yield an upper age limit of 6.4 Gyr for the best fit solution. More complex interiors models would tend to reduce the age significantly, but are not yet available at appropriately cool temperatures.

Infrared JHK photometry, in progress, will help constrain the atmospheric composition. Interestingly, spectroscopy does not. Even though hydrogen can be detected in low mass white dwarfs of comparable effective temperature, the large surface gravity of this small, massive object collisionally broadens hydrogen lines to the level of undetectability. Although not of great age, the high mass of ESO 439-26 makes it unique in one respect. Comparison with model isochrones indicate it is in an advanced state of crystallization.

This work appeared in the 20 December 1995 Astrophysical Journal Letters.

[Figure not included]

ESO 439-26 in the V-I M sub V plane compared with previously known low luminosity white dwarfs (open circles) and photometric sequences by Bergeron et al. for several masses. T sub eff is marked by squares on each sequence at 5500, 5000, 4500, and 4000 K.

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CTIO/KPNO Users Committee Reprot (1Mar96)

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CTIO/KPNO Users Committee Reprot (1Mar96)
(from Director's Office, NOAO Newsletter No. 45, March 1996)

Introduction

The CTIO/KPNO Users Committee met in Tucson on 8-9 December 1995. Committee members present were Suzanne Hawley (Michigan State), Martha Haynes (Cornell), David Koo (Santa Cruz), Elizabeth Lada (Maryland), Robert Mathieu (Wisconsin), Patricio Ortiz (Chile), Marc Postman (STScI), John Salzer (Wesleyan), Kristen Sellgren (Ohio State), Stephen Shectman (Carnegie), Verne Smith (Texas), and George Wallerstein (Washington). Seth Tuttle (NSF - NOAO Program manager) also attended the sessions.

This marked the first time that the Users Committee met as a single, merged group. Following discussions at the 1994 committee meeting and recommendations made at the AURA sponsored Future of NOAO workshop last March, it was decided to combine the CTIO and KPNO Users Committees. The increased level of collaboration between CTIO and KPNO in many areas (most notably instrumentation), as well as the commonality of issues facing the two observatories, motivated the change. Of course, there are still site-specific issues that required discussion, so the joint committee split into CTIO and KPNO subcommittees for one session. The reports of the observatory subcommittees are included as part of this report.

The joint committee continued the practice established in the previous year of requesting that written summaries of all reports presented by the observatory staff be distributed prior to the meeting. This allowed the committee members to familiarize themselves with the issues ahead of time, and maximized the time available at the meeting for fruitful discussions between the committee and the administration and staff of NOAO. The committee heard reports from: Sidney Wolff on the state of NOAO and the status of the renewal proposal to the NSF; Malcolm Smith on the SOAR telescope project; Richard Green on the 2.4-meter telescope initiative and the NOAO Instrumentation program; Todd Boroson on Gemini and the US Project Office; Taft Armandroff on the Optical/UV instrumentation projects; Ian Gatley on IR instrumentation projects; George Jacoby on IRAF; Taft Armandroff and Dave De Young on plans for restructuring the NOAO TACs; and David Silva on the queue scheduling program at WIYN.

A important topic of discussion at the meeting was the feedback generated by the inaugural issue of the NOAO Electronic Forum, a joint project of the NOAO staff and the Users Committee. Many of the items presented below benefited from the input by the user community; this input helped to inform and shape our final recommendations.

NSF Renewal Proposal

The committee was asked to comment on the draft of the renewal proposal to the National Science Foundation. This became the central theme of the meeting, since many of the specific items discussed hinged upon the details of the renewal plan. It should be stressed that the committee was not given the draft proposal to read, but rather saw only the executive summary that was presented in the NOAO Electronic Forum. While the summary was adequate for debating the pros and cons of the general plan, it hindered our ability to weigh all of the considerations due to the lack of full financial information (costs versus savings for each element of the plan). However, the committee was still able to make a number of recommendations.

The main focus of the discussion was on the specific telescope configurations proposed for CTIO and KPNO, as well as the instrumentation plans for each telescope. Related items, such as operations and observing modes (e.g., queue scheduling) were also discussed and are mentioned in separate sections below.

The plan calls for NOAO to operate three telescopes at each site. KPNO would have the existing Mayall 4-meter, WIYN, and a new 2.4-meter reflector optimized for wide-field imaging. CTIO would continue to operate the Blanco 4-meter, and add the SOAR 4-meter and a 2.4-meter that would be designed to accommodate the equipment for the Sloan Digital Sky Survey should there be interest in continuing the survey in the southern sky. Further details are available in the Electronic Forum.

The committee endorsed the general outline of the renewal plan. However, we did not feel that we had enough information about the financial details to support the specifics of the current plan at this time. In addition, we have some reservations about the mix of science capabilities implied by the proposed plan; these are listed below.

We wish to stress that, while we feel that improvements could be made to this specific plan, we are strongly in favor of the general approach it presents. We believe that:

(1) NOAO needs to operate at least 3 or 4 telescopes at both CTIO and KPNO to properly support the telescope-access requirements of the US community.

(2) A mix of aperture sizes ranging from small (1-2 meter) to large (4-meter, Gemini) is vital and scientifically well justified.

(3) The older existing telescopes at both sites will become increasingly less competitive in the coming decade, and current planning should include new telescope initiatives to replace them.

(4) Shutting down the smaller telescopes to reduce operating expenses is, by itself, not a cost-effective measure, and would cripple the ability of NOAO to carry out what its users perceive as its primary mission: providing access to telescopes.

We believe that the renewal plan attempts to address these issues. The input from the community, and our recommendations below, suggest ways that the draft proposal can be modified to better serve the users.

A key scientific capability that appears to be missing in the future NOAO envisioned in the draft proposal is wide-field IR imaging. There is a clear need for the capacity to carry out sensitive, large-scale IR surveys which in turn will allow for the full utilization of the IR capabilities of Gemini. The new 2.4-meter telescopes are not planned to support IR imaging due to their fast focal configuration. NOAO needs to address this issue, by either rethinking the design specifications for the 2.4-meter telescopes, or retaining the services of one of their existing telescopes at each site (e.g., 2.1-meter at KPNO, 1.5-meter at CTIO) as a dedicated IR imaging facility.

IR imaging capability is essential to support and complement the Gemini telescopes. Nevertheless, the 2.4-meter telescopes should not simply be switched entirely from optical imaging to IR imaging. The user community desperately needs and wants improved access to wide-field optical imaging as well. The committee was not sold on the need for making the southern 2.4-meter telescope "Sloan capable." Although the idea is certainly worth considering, the increased costs must be balanced against the prospects for actually carrying out a southern version of the survey. More investigation must be done on this issue.

Another capability that was mentioned frequently in the community responses to the electronic forum was that of high-dispersion spectroscopy for bright objects (a niche currently filled by the coude feed at KPNO and the 1.5-m bench echelle at CTIO). The proposed plan does in fact provide substantial access to this capability, since much of the bright time on the new 2.4-meter telescopes is earmarked for this type of observing. In the plan, the existing spectrographs (the coude at KPNO and bench echelle at CTIO) would be illuminated by optical fibers located at the cassegrain foci of the new telescopes. This point was not made clear in the version of the plan presented to the users.

Finally, we suggest that NOAO could respond to the criticisms made about the lack of small telescopes in the renewal plan by making provisions to offer continued access to one of the small telescopes on each site (e.g., the 0.9-meters). Outfitted with a dedicated CCD imager, they could be run in a nearly zero-maintenance, zero-support mode so as to provide access for those projects that are not feasible with the proposed 2.4-meter telescopes. This low-cost addition to the proposed three telescope model would be welcomed by the user community.

We urge the NOAO staff to continue to explore options that will lead to the strongest possible renewal plan, one which the user community can embrace and support.

Instrumentation

NOAO's nighttime instrumentation program was another major topic of the meeting. The current status of the program was reviewed (see the December 1995 NOAO Newsletter for a summary), and various options for future instruments were discussed. The committee makes the following recommendations:

(1) We endorse the current instrumentation plan as presented. Our highest priorities for major instrument starts are the high-throughput optical spectrograph for KPNO (for the Mayall 4-meter) and the near-IR spectrograph (a clone of the Gemini North spectrograph) for CTIO. We encourage the instrumentation group to seek community input for the optical spectrograph design.

(2) We support the plan by NOAO to look into building the GRASP four-channel IR imager/spectrograph as a collaboration with Ohio State University.

(3) As stressed above, we see wide-field IR imaging as a priority for NOAO that is currently not being met. Upgrading SQIID with four 512 square InSb arrays should be pursued as a stop-gap measure until GRASP is completed.

(4) We are concerned with the lack of usable CCD chips for the Mosaic imager. The current plan is to use thick chips during the initial deployment of the mosaic, then upgrade to science-grade thin chips as they become available. We would like to see the mosaic in use with quality thinned CCDs as early as possible, and therefore recommend looking into purchasing the necessary chips off the shelf. In addition, the committee wants to stress the need for completing the mini-mosaic camera and installing it at the imaging port on WIYN as soon as possible.

Items (3) and (4) were given equal priority by the committee as the most important of the "smaller" projects for the coming year. If resources allow, we would also encourage further investigation into getting a low-order adaptive optics system for WIYN. We believe that building a clone of the Mosaic Imager should be a high priority, but that the current lack of CCDs made it a lower priority for the current year. Ultimately, however, NOAO must have two mosaic cameras, one for each of KPNO and CTIO. Finally, the committee strongly supports the current ALADDIN array program, and feels that the detector development for GRASP should be given priority in future years as resources become available.

Observatory Operations

This is a period of change for NOAO--restructuring is necessary and, in the eyes of many, even desirable. But as plans for the future take shape, the committee feels an obligation to remind NOAO (as well as AURA and the NSF) of the primary need of the core constituents of NOAO facilities: access to telescopes and state-of-the-art instrumentation. Therefore, we summarize our main point in one simple statement: Do whatever it takes to keep the existing telescopes open for as long as they are scientifically viable and in demand. We hope that the budget situation, while bleak, will be positive enough to enable the renewal plan to be carried out. But until the new facilities are in place, every effort must be made to maintain the current capabilities and access for the users who rely on the national observatories.

We encourage NOAO to pursue vigorously university partnerships and collaborations for new telescope and instrumentation projects. The WIYN telescope project and the MACHO collaboration are positive examples of how joint ventures can benefit the whole community. We hope that the SOAR telescope and GRASP IR imager/spectrograph become additional examples of the advantages of cooperative programs.

The current need for wide-field IR imaging has already been stressed. In addition to modifying the renewal plan to include this important capability, we urge NOAO to look into providing a short-term solution. One option is to upgrade SQIID with InSb arrays and new controllers, and then reopen the 1.3-meter at KPNO for part-time, single-instrument use. The substantially higher sensitivity of the new arrays would make this a unique facility.

The committee would also like to recognize the importance of continued support for the IRAF group by NOAO. Although IRAF may not fall within the category of an "observatory operation," it is a very visible and vital service provided by NOAO. We reaffirm our support for this indispensable part of the overall NOAO program.

Queue Scheduling

The user community spoke out loudly on the issue of queue scheduling in the Electronic Forum. Many relevant points were expressed, and the feedback had a significant impact on the thinking of the committee members as well as the NOAO staff. It should be pointed out that, despite the wording of the Forum with regard to queue scheduling, there was never a plan to run the new telescopes in a fully queue-scheduled mode. Although this confusion led to a more spirited response than was perhaps necessary, the points raised by the users were excellent. The committee agrees with the assessment that certain types of projects are best done in traditional observing mode, while other projects can be carried out more efficiently in queue mode.

Many Forum respondents pointed out that queue observing is an untried method and therefore a risky endeavor. The queue observing experiment on the WIYN telescope is being carried out with the idea of learning how to run a queue program successfully. The results from the first (partial) semester show that, while this mode is promising, there are still a number of issues that must be addressed to optimize the method. Since WIYN itself is still going through its initial shakedown, both the telescope and the queue procedure must mature before the success or failure of the experiment can be determined.

The committee encourages NOAO to continue the queue experiment on WIYN with the following specific recommendations for improving science throughput and user satisfaction.

(1) Modify the current "queue rule" whereby once a project gets started, it remains active until the requested observations are completed, regardless of how long it takes. The committee felt strongly that the time spent observing on a given project should be limited to the time actually allocated by the TAC. This would reduce the effective turn-down rate (i.e., the percentage of projects that are rejected by the TAC plus those placed in the queue but not observed).

(2) Provide better feedback to the users by providing electronic access to a queue status report.

(3) Revise the proposal submission process to do away with the Queue form before time is allocated. This form requires significant effort for all proposers, many of whom will ultimately be turned down by the TAC. The Queue form should be requested in a phase 2 process after the proposal has been accepted.

(4) Develop and implement the so-called Pole Watch camera to provide a quantifiable estimate of the quality of the night. This is important for all programs involving photometry.

Access to Private Observatories Initiative

The report written by the Panel on Ground-based Optical and Infrared Astronomy (the "OIR report") suggested that the NSF institute a new program to fund instrumentation development at private observatories in return for widespread community access to telescope time at those observatories. This was suggested as a way for the NSF to leverage the large amounts of money from private sources invested in large, new telescopes, making them more scientifically fruitful. At the same time, the community would gain access to a larger pool of telescope time.

We feel that it is important for NOAO to play a leading role in the planning and implementation of such a program. At this point it is not clear whether the NSF will be able to initiate such a program, but if it does, NOAO should be heavily involved in establishing the guidelines for community access. It should also serve as the interface between the community and the private observatories, coordinating the program on behalf of the US community.

The private observatory access program, however, can not and should not be perceived as a way to replace the community's need for access to NOAO facilities. One of the motivations for the program, as presented in the OIR report, is to provide access to telescopes for the ~50% of optical and IR astronomers who currently rely solely on NOAO telescopes. However, it should be pointed out that the program will likely provide no access to small telescopes for the general community, since the instrumentation money provided by the NSF would almost certainly be used to build equipment for the largest of the private telescopes. Many astronomers who currently rely on NOAO telescopes for their research will not be accommodated under the program. We urge the NSF, NOAO, and representatives of the private observatories to work together in cooperation to formulate a plan that benefits all members of the community.

TAC Reorganization

As NOAO enters the Gemini era, it will have to take on a number of new responsibilities. One of these will be setting up a proposal review process for the US portion of Gemini. In addition, if the proposed program for community access to private observatories goes into effect, NOAO would be the most likely candidate for handling the incoming proposals. With this in mind, NOAO has been considering options for ways to accommodate future telescope time applications and allocations. One obvious point which has guided their plans: try to make the process as simple as possible for the proposers. For example, having a single proposal form for all telescopes (CTIO, KPNO, Gemini, community access to private observatories) and a common submission deadline would be highly desirable.

The committee was asked to comment on various suggestions made by the staff and the current TACs about how the proposal process and future TACs should be reorganized. In general, it was felt that the current TAC process and divisions (CTIO and KPNO, bright and dark) works fairly well. However, the anticipated influx of new proposals with the advent of Gemini will require some changes. The committee discussed many options, including how the TAC process works at other observatories (including radio and space facilities). We recommend that NOAO maintain a TAC system similar to the current one, with modest changes:

(1) Retain the separate TACs for the northern and southern hemispheres.

(2) Split proposals by "Galactic" (including the solar system) and "extragalactic" rather than bright and dark. TACs defined along discipline lines (albeit very broad lines) make more sense for IR observing.

(3) Have separate TACs for Gemini and non-Gemini telescopes. Proposals requesting time on more than one telescope (e.g., the current

"key projects") would go to the panel responsible for the largest telescope in the proposal.

This reorganization changes the current TAC structure very little while allowing for the necessary growth required by the Gemini telescopes. There would be eight panels rather than the current four, which would keep the level of work roughly the same. We strongly endorse the idea of unifying the proposal process as much as possible.

NOAO Management Structure

Following the unsuccessful search for a new director for KPNO, the search committee recommended that NOAO reorganize its top-level management structure to better reflect the current needs of the organization. The committee asked to hear what progress had been made in identifying the appropriate structure. The plan is not yet finalized, but the current proposal is to reshape the NOAO management along functional lines (as opposed to observatory sites). There would be three Associate Directors below the NOAO Director, one for the instrumentation program (KPNO, CTIO, Gemini), one for operations of northern hemisphere facilities (KPNO, US Gemini Project Office, etc.), and one for operations in the southern hemisphere (essentially the same as the current CTIO Director). It was envisioned that an Assistant Director for KPNO would be named and be under the direction of the second of these Associate Directors.

The proposed management plan was not embraced unanimously by the committee, but after much discussion we failed to arrive at a better plan. Our biggest concern was the apparent lack of parity between CTIO and KPNO. We feel that both KPNO and CTIO need strong advocates in the management structure. This plan makes it unclear whether the appropriate level of advocacy for KPNO will exist in the future.

Community Input

The Users Committee gives the Electronic Forum a very positive endorsement. This new vehicle for feedback and debate provides a much needed way for interested members of the astronomical community to voice an opinion on potential changes that effect their national observatory. In a sense, the Electronic Forum creates an extended Users Committee. NOAO should make every effort to continue the Forum. We note that not all issues confronting NOAO are appropriate for the Forum, and it should not be used as a substitute for the NOAO Newsletter. Suggestions for future topics include: details of the proposed 2.4-meter telescopes, pros and cons of queue scheduling, future instrumentation plans, and revisions to the TAC organization and procedures.

KPNO Subcommittee

The KPNO subcommittee was made up of the following Users Committee members: Haynes, Koo, Lada, Mathieu, Salzer (Chair), and Smith. The subcommittee met for one session during the meeting to hear presentations and discuss issues that were specific to the operations of KPNO. We heard reports by David Silva on the performance of WIYN, from Bruce Bohannan on mountain operations and improve-ments, from Taft Armandroff on instrumentation, and from Sidney Wolff (acting KPNO Director) on the general status and outlook for KPNO.

Many of the recommendations the committee made regarding KPNO have already been included in the NOAO-wide items. Therefore, we add only a few additional points here.

We are extremely pleased to see WIYN coming online, and commend David Silva and rest of the staff for bringing the project to such a successful conclusion. While there is still work to be done, it appears that WIYN will ultimately be a huge success. Likewise, we were happy to hear about the improvements made at the 4-meter to improve the image quality there, and we look forward to having the 4-meter prime focus corrector and the new GoldCam camera finished and in use by the end of 1996.

Some members of the committee were worried about the high rate of turnover among the telescope operators on Kitt Peak. They expressed concern over the lack of continuity in these vital positions, and urged that steps be taken to enhance the job quality and growth opportunities for the operators to help reverse this trend.

We support the new Graduate Student in Residency program, which provides opportunities for students to make extended visits to KPNO to both carry out observations for their theses and to work on the mountain in order to gain experience with the equipment and day-to-day operations. This is a great way for students to both learn and to be able to contribute something (their time, energy and ideas) in return.

Finally, the committee is deeply concerned with the budget situation and its impact on KPNO over the next few years. Although no crisis is forecast for the current year (due to a fortuitous number of staff retirements), the future prospects remain gloomy. We urge the director to continue to look for ways to support the telescopes and avoid further shutdowns even as the budget continues to shrink. A number of suggestions were outlined in last years report that should be reconsidered. We emphasize strongly that closing the small telescopes in a moment of budget crisis is inappropriate. Rather, NOAO should develop a plan now to operate the mountain with fewer staff, so that when the budget crunch comes the plan can be implemented without cutting more telescopes.

CTIO Subcommittee

The CTIO subcommittee consisted of Hawley (Chair), Ortiz, Postman, Sellgren, Shectman, and Wallerstein. It heard from CTIO director Malcolm Smith during the subcommittee session.

A recurring theme at CTIO is the small size of the scientific staff and the resulting burdensome workload for each staff member. The committee recognizes that the budget situation is difficult, but urges that NOAO and the NSF find a solution that will provide some relief for the scientific staff. The current situation is unstable and valuable people and knowledge may be lost if something is not done soon.

Excellent progress has been made in promoting public awareness of light pollution in the cities near CTIO. We applaud the CTIO staff efforts and encourage further vigilance in this area.

We were pleased to hear that discussions with both Yale and Michigan are underway concerning the future of the 1-meter and Curtis Schmidt telescopes. A possible collaboration between Yale and Portugal to upgrade the 1-meter and take over operations in the next few years was enthusiastically endorsed. The continuing MACHO collaboration was also discussed and given a strong statement of support. Funds available from the MACHO project have provided for much needed upgrades to the small telescopes at CTIO.

The 4-meter image quality project has now resulted in greatly improved median seeing and we acknowledge the hard work of the CTIO staff in carrying out these improvements. Implementation of a tip/tilt system is the next highest priority project for the coming year.

Discussion about specific CTIO instrumentation needs led to the recommendation that an IR camera is a top priority, and also that it is vital to get Phoenix to the south as soon as possible, and to share it equally with KPNO. The Arcon development program was discussed, and concern expressed over the expense of this effort. The program is now ramping down, pending a final decision by Gemini--as of August 1995, Gemini had decided to explore other controller options.

Ortiz presented the views of the Chilean astronomers about the renewal plan. The committee was pleased to hear that their views were very similar to those of the US community (as discussed elsewhere in this report) and that the Chilean and US astronomers share the same concerns about closing small telescopes, while also endorsing in principle the idea of renewing and replacing aging facilities. The 10% of telescope time allocated from each telescope to Chilean astronomers was not seen as a major stumbling block to the renewal proposal as long as continued access to several telescopes and excellent instrumentation was assured. Cooperation between the Chilean and US communities will be a vital component to the continued success of CTIO.

In response to continuing budget shortfalls, travel support within Chile will no longer be offered except for thesis students, and various other cost cutting measures may have to be taken (raising rents, raising motel rates, laying off staff, etc.). The committee strongly endorsed the plan to cut everything else first, before closing telescopes. The committee also urges the NSF to acknowledge the current strength of the Chilean economy which is resulting in increased costs within Chile, and to budget for the projected exchange rates well in advance.

Concluding Remarks

Astronomers today live in a privileged time. We are in the midst of the greatest explosion in major new optical and IR facilities in the history of the science. In five to ten years, the number of telescopes with apertures greater than 6-meters in diameter will be of order 15! Yet the members of the US community who rely on the national observatories will have access to the equivalent of only one of these telescopes. In a time when the growth in both facilities and technology will lead to outstanding opportunities for many astronomers, the budgetary problems facing NOAO threaten to hold many more back. We feel that this is bad for the entire community and for astronomy as a whole. The Users Committee members would like to stress to all members of the US community the need to work together to ensure a healthy future for our field.

As always, the users of NOAO are urged to speak out, both as advocates for your facilities and as a source of suggestions for improvements to NOAO. The Users Committee members seek your input. We hope that as many of you as possible will participate in future Electronic Forum issues. Your input does make a difference--the results have certainly influenced our thinking as well as that of the NOAO staff and administration. To subscribe to the Forum, simply send a blank e-mail message to forum-subscribe@noao.edu. The Users Committee represents a direct link between the individual NOAO users and the management of the observatories. Please contact next year's Chair, Suzanne Hawley (slh@pillan.pa.msu.edu) with your comments and ideas.

John Salzer (Wesleyan University, Chair)

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NOAO Educational Outreach (1Mar96)

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NOAO Educational Outreach (1Mar96)
(from Director's Office, NOAO Newsletter No. 45, March 1996)

The NOAO has established an advisory board to assist with its expanding educational outreach activities. This Outreach Advisory Board (OAB) includes fifteen middle and high school teachers selected from school districts in the vicinity of Tucson, Arizona. The OAB will advise NOAO on a range of outreach activities, initially and primarily, our Educational Outreach Program. We continue to be interested in hosting a series of summer workshops for teachers using the facilities of Kitt Peak National Observatory, providing real astronomical data on a regular basis in support of open-ended, research-based projects in middle and high school classrooms.

To provide informed feedback to NOAO, the OAB was given access to NOAO in the form of three one-day workshops. The first of these workshops took place on 28 November 1995 at the NOAO downtown headquarters in Tucson, Arizona. NOAO staff members Karen Harvey, Beatrice Mueller, and George Jacoby spoke about their current astronomical research; the teachers also heard about existing outreach activities and were given a tour of the extensive facilities of the NOAO downtown headquarters. On 5 January and 20 January the second workshop took place, as OAB teachers spent 24 hours on Kitt Peak, visiting the various telescopes and learning how the Observatories serve the professional astronomical community. Special thanks to the observers those nights who shared their domes, science, and career paths with the group: Ian Gatley and Mike Merrill, Richard Green and Buell Jannuzi (all NOAO), Paul Green (CfA), Norbert Zacharias and Marion Zacharias (USNO), Laurence Jones (NASA/GSFC), and James Brown (Toronto). In February, The OAB met again to discuss how the resources of NOAO could be put to effective use in the science classrooms, locally and nationally, and to set the agenda for future OAB activities.

Suzanne H. Jacoby, NOAO Education Officer

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NSF Provides Travel Support for Observing at Major Foreign Optical Telescopes(1Mar96)

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NSF Provides Travel Support for Observing at...(1Mar96)
Major Foreign Optical Telescopes
(from Director's Office, NOAO Newsletter No. 45, March 1996)

For several years the National Science Foundation has provided funding, administered by NOAO, to support travel to large or unique foreign optical telescopes. The telescopes normally covered by this policy include:

- Anglo-Australian Telescope (Australia)
- European Southern Observatory (Chile)
- Canada-France-Hawaii Telescope (Hawaii)
- United Kingdom Infrared Telescope (Hawaii)
- Las Campanas 2.5-m Telescope (Chile)
- La Palma Observatory (Spain)
- Special Astrophysical Observatory (Russia)

The proposal for foreign telescope time should be initiated by the PI, who must be a US-based astronomer. Generally, the foreign observatory should not require a local collaborator as a condition for telescope time, and the presence of the US-based PI should be essential for the successful pursuit of the research program. Reimbursement under this program is not available to staff employed at national observatories.

Reimbursement covers round-trip airfare only. Subsistence and incidental expenses are not covered. Normally only one trip per fiscal year per investigator can be supported (our fiscal year begins 1 October).

To apply, send a letter requesting support and explaining why your presence is essential, together with a copy of your proposal and a copy of the letter or observing schedule that indicates you have been granted observing time on one of the above telescopes to:

Richard Green
National Optical Astronomy Observatories
PO Box 26732
Tucson, AZ 85726-6732

Applications should be received at least one month before travel commences. Travel must be on a US carrier if available.

Sidney Wolff

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Comet Hale-Bopp at NOAO (1Mar96)

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Comet Hale-Bopp at NOAO (1Mar96)
(from Director's Office, NOAO Newsletter No. 45, March 1996)

Noting the scientific importance of comet Hale-Bopp, NOAO welcomes applications for observing time to study this comet. A Hale-Bopp steering group has recommended particularly the period 29 September to 19 October as a prime time for getting observations with as many different techniques as possible. Scheduling different techniques on different telescopes at the same time will minimize the confusion in comparing different types of observations obtained at different epochs for an object that is likely to vary significantly.

Proposals to study Hale-Bopp will be reviewed through the normal TAC process, and by outside reviewers with expertise on solar system astronomy. Those that are successful will, to the extent possible and to the extent that it makes scientific sense, be scheduled during this key period. The normal deadline for proposals will apply.

Michael Belton, Sidney Wolff

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NOAO Preprint Series (1Mar96)

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NOAO Preprint Series (1Mar96)
(from Director's Office, NOAO Newsletter No. 45, March 1996)

The following preprints were submitted during the period 1 August 1995 to 31 October 1995. Please direct all requests for copies of preprints to the NOAO author marked with an asterisk.

676 *Silva, D.R., Wise, M.W., "Interpreting Central Surface Brightness and Color Profiles in Elliptical Galaxies"

677 Wise, M.W., *Silva, D.R., "The Effects of Dust on Broad-Band Color Gradients in Elliptical Galaxies"

678 *Silva, D.R., "When Do Near-IR Colors Help in Studying Stellar Populations?"

679 *Hinkle, K.H., Barnbaum, C., "Infrared Velocities of Long Period Variables: the Carbon Mira S CEP"

680 *November, L., "Dark-Thread Thermo-dynamics and the Coronal Temperature Structure"

681 *Ajhar, E.A., Grillmair, C.J., Lauer, T.R., Baum, W.A., Faber, S.M., Holtzman, J.A., Light, R.M., Lynds, R., O'Neil, E.J., "Hubble Space Telescope Observations of Globular Clusters in M31 I: Color-Magnitude Diagrams, Horizontal Branch Metallicity Dependence, and the Distance to M31"

682 *Elston, R., Bechtold, J., Hill, G.J., Ge, J., "A Redshift 4.38 Mg II Absorber Toward BR 1202-0725"

683 *Keller, C.U. Smartt, R.N., "Imaging Coronal Emission Lines Under High Sky-Background Conditions"

684 *Fan, Y., Fisher, G.H. "Radiative Heating and the Buoyant Rise of Magnetic Flux Tubes in the Solar Interior"

685 *Courteau, S., de Jong, R.S., Broeils, A.H. "Evidence for

Secular Evolution in Late-Type Spirals"

686 *Keller, C.U., Bernasconi, P.N., Egger, U., Povel, H.P., Steiner, P. "Hidden Magnetic Fields on the Sun"

687 *Giampapa, M.S., Rosner, R., Kashyap, V., Fleming, T.A., Schmitt, J.H.M.M., Bookbinder, J.A. "The Coronae of Low Mass Dwarf Stars"

688 *Samarasinha, N.H., Mueller, B.E.A., Belton, M.J.S. "Comments on the Rotational State and Non-Gravitational Forces of Comet 46/Wirtanen"

689 *Pilachowski, C.A., Armandroff, T.E. "The Average Oxygen Abundance in the Globular Cluster M13"

690 *D'Silva, S. "Measuring the Solar Internal Rotation Using Time-Distance Helio-seismology: the Forward Approach"

691 *November, L.J., Koutchmy, S. "White-Light Coronal Dark Threads and Density Fine Structure"

692 *November, L.J. "Rotation and Lorentz Transformations in 2 x 2 and 4 x 4 Complex Matrices and in Polarized Light Physics"

693 *Giampapa, M.S. "Advances in Solar-Stellar Physics I: Optical and Infrared Studies"

694 *Pilachowski, C.A., Sneden, C., Kraft, R.P. "Sodium Abundances in Field Metal-Poor Stars"

695 *Suntzeff, N.B., Walker, A.R. "The CTIO Prime Focus CCD: System Characteristics from 1982-1988"

696 *Suntzeff, N.B., Kraft, R.P. "The Abundance Spread Among Giants and Subgiants in the Globular Cluster w Centauri"

697 *Kinman, T.D., Allen, C. "The Horizontal Branch Morphology of Halo Field Stars"

Bragaglia, A., Cacciari, C., Harmer, D., *Kinman, T.D., Valdes, F. "Definition of a Pure Sample of Nearby BHB Stars"

698 *Livingston, W., Barr, L. "McMath-Pierce Upgrade: Achieving Stealth Optics to Yield a Thermally Invisible Telescope"

699 *Kinman, T.D., Pier, J.R., Suntzeff, N.B., Harmer, D.L., Valdes, F., Hanson, R.B., Klemola, A.R., Kraft, R.P. "A Preliminary Discussion of the Kinematics of BHB and RR Lyrae Stars Near the North Galactic Pole"

700 *Geisler, D., Lee, M.G., Kim, E. "Washington Photometry of the Globular Cluster System of NGC 4472 I. Analysis of the Metallicities"

701 *Howard, R.F. "Tilt-Angle Variations of Active Regions"

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Other NOAO Papers (1Mar96)

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Other NOAO Papers (1Mar96)
(from Director's Office, NOAO Newsletter No. 45, March 1996)

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

*Abt, H.A., Zhou, H. "What Fraction of Astronomers Become Relatively Inactive in Research after Receiving Tenure?"

*Altrock, R.C., Henry, T.W. "Prediction of Coronal-Hole Solar Wind Velocities at Ulysses From NSO/SP Coronal Data"

*Balasubramaniam, K.S., Keil, S.L. "A Search for Large-Scale Photospheric Flows as Drivers of Mass Ejections"

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

*Baldwin, J.A., Ferland, G.F., Korista, K.T., Carswell, R.F., Hamann, F.H., Phillips, M.M., Verner, D., Wilkes, B.J., Williams, R.E. "Very High Density Clumps and Outflowing Winds in QSO Broad-Line Regions"

*Beckers, J. "Adaptive Optics for Solar Astronomy"

*Beckers, J. "Techniques for High Angular Resolution Astronomical Imaging"

*D'Silva, S. "Theoretical Foundations of Time-Distance Helioseismology"

*D'Silva, S., Duvall, T.L., Jefferies, S.M., Harvey, J.W. "Helioseismic Tomography"

Duvall, T.L., *D'Silva, S., Jefferies, S.M., Harvey, J.W., Schou, J. "Downflows Under Sunspots Detected by Helioseismic Tomography"

Dyck, H.M., Benson, J.A., van Belle, G.T., *Ridgway, S.T. "Radii and Effective Temperatures for K and M Giants and Supergiants"

*Eggen, O.J. "The Stellar Content of Star Stream I"

Ferland, G.F., *Baldwin, J.A., Korista, K.T., Haman, F., Carswell, R.F., Phillips, M., Wilkes, B., Williams, R.E. "High Metal Enrichments in Luminous Quasars"

Grossmann-Doerth, U., *Keller, C.U., Schussler, M. "Observations of the Quiet Sun's Magnetic Field"

Hall, P.B., Osmer, P.S., *Green, R.F., Porter, A.C., Warren, S.J.,"A Deep Multicolor Survey I. Imaging Observations and Catalog of Stellar Objects"

Hall, P.B., Osmer, P.S., *Green, R.F., Porter, A.C., Warren, S.J. "A Deep Multicolor Survey II. Initial Spectroscopy and Comparison with Expected Quasar Number Counts"

*Harvey, K.L. "Coronal Structures Deduced from Photospheric Magnetic Field and He I 1083 Observations"

*Harvey, K.L., McAllister, A., Hudson, H., Alexander, D., Lemen, J.R., Jones, H.P. "Comparison and Relation of He I 1083 nm Two-Ribbon Flares and Large-Scale Coronal Arcades Observed by Yohkoh"

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Blanco 4-m Active Optics System Done! (1Mar96)

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Blanco 4-m Active Optics System Done! (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

The Image Analyzer

The "IMAN" Shack-Hartmann image analyzer is now in routine use at the Blanco Telescope. This was the final step in a three-year series of projects to retrofit a modern active-optics system onto this telescope. The active optics system is used to correct static and slowly-varying alignment and support errors.

The image analyzer is used to measure the low-order aberrations in the optical system. The analyzer is incorporated into the Cassegrain offset guider probe. To use it, the night assistant clicks on a menu command to move the guide probe to the optical axis, centers a ~10 mag star in the guider field, and then clicks on another menu command to initiate a series of three 30-second measurements. Exposures of this length average out the atmospheric seeing, but are still affected by slowly varying components of dome seeing. The result of these measurements is a table of corrections for spherical, coma, astigmatism, trefoil and quadrafoil aberrations.

The Active Optics System

The full active optics system also includes the 4-m active primary mirror control system, and the f/8 and f/14 secondary mirror control systems. The active primary system was installed 1 1/2 years ago, and the f/8 secondary system has been in use for over two years. The f/14 secondary control system is finished and installed on the telescope, but the f/14 mirror will not be delivered before February.

These various systems are all fully integrated into the 4-m Telescope Control System. The image analyzer writes all of its results into a log file. The night assistant can then click on menu commands to take the desired corrections from this log file and pass them on to the mirror control systems.

There are basically three different modes for using the active optics system:

(1) Automatic correction of the optics as a function of the telescope's hour angle and declination, using a lookup table. The lookup table is generated about every three months by using the image analyzer to map the aberrations all over the sky (this takes 1/2 night of engineering time). This mode has actually been in use for the past year, using lookup tables generated with a Hartman screen. The advent of the image analyzer just makes this process easier.

(2) Routine checking of the optics. The image analyzer will routinely be used at the start of each f/8 and f/14 observing run, to check the collimation. This takes about 15 minutes.

(3) Real time correction of the optics, using a mag 10 star near

the object to be observed. We call this "tweaking up" the optics. The telescope operators can do this for you on demand. It takes about 10-15 minutes, so we do not expect people to want to use it except on the best nights, where there is the most to be gained.

Figure 1 shows an example of the output that the operator saw last November when we used the active optics system to recollimate the telescope, in a test of the tweak correction technique.

[Figure not included]

Figure 1. Two successive runs with the image analyzer. The first set of three measurements shows large coma, which would contribute 1.77" to the 80% encircled energy diameter. There is also modest astigmatism (0.19" d80). The line starting with "Tweak?" shows the software's recommendations about whether or not the individual aberrations should be corrected. The second block of information shows the result of applying the corrections indicated in the first block. The columns headed "d80 init" in the two blocks show the total 80% encircled image diameter including the low-order aberrations: this dropped from 1.9" in the upper block to 0.6" in the lower block.

Overall Results

Our goal over the past five years has been to improve the image quality at this 20-year-old telescope in a cost-effective way. Along with the installation of the active optics system, we have had the f/8 secondary repolished and have made many improvements to the thermal environment of the telescope. The thermal improvements have been described in earlier Newsletters; they include dome vent doors, oil cooler, mirror cooler, moving the console room, largely vacating the building, and extensive insulation and air conditioning improvements.

The results, in terms of delivered image quality, are shown in Figure 2. The Blanco telescope now gets subarcsecond images on almost 2/3 of the nights.

[Figure not included]

Figure 2. Comparison of seeing measurements made during the summer of 1992/1993 (summer is CTIO's period of best seeing), and of measurements for the full year ending 16 November 1995. The dashed curve in each panel shows the standard CTIO site seeing results, made several years ago using an image motion monitor at ground level.

The total direct costs to CTIO (including payroll and non-payroll) were $310K for the active optics projects, $100K to refigure the f/8 secondary, and $400K for the full package of thermal improvements. The total is $810K in direct costs, or about $1.4M fully burdened. We believe that this is a reasonable price to pay for the results that have been realized.

As always in a description of this work, we must convey our great appreciation to a number of people from other institutions who have given us vital help and guidance, especially Ray Wilson, Lothar Noethe and Alain Gilliotte of ESO, and Claude Roddier of the University of Hawaii.

Where From Here?

During the coming year, we will be working on improvements in three different areas of the Blanco Telescope. These are development and installation of an f/14 tip-tilt secondary, improvements to the telescope control system and servos, and continuing work on the optics.

Under Richard Elston's guidance, the new f/14 IR secondary will be commissioned in March, and its tip-tilt capabilities will be gradually brought on line through the year. Ricardo Schmidt, Eduardo Mondaca, and German Schumacher are the CTIO engineers involved in this project.

Steve Heathcote will provide the scientific leadership for the work on the 4-m control system, in collaboration with German Schumacher and Rolando Rogers. Our plans have evolved. We now intend to devote a short-term effort to improving the actual performance of the telescope by upgrades to the Telescope Control Software and pulse mixing hardware. This will lead to more accurate offsetting and improved efficiency of use, hopefully by the end of the year. Over a longer term, as a reliability issue, we plan to replace the existing servos with Delta-Tau controllers of the same type that are being used by Gemini.

The general program of continuing optics improvements will shift emphasis from the Cassegrain to the prime focus. Alistair Walker will be the scientist responsible for this area plus the overall health of the telescope. Significant improvements were made at prime focus over the past year just by aligning the optics, but it is now time to try using the active optics system to get the optimum possible performance. This will mesh with the arrival of Tony Tyson's Large Area CCD mosaic imager part way through the year.

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Sharing Time on the Blanco 4-m and the ESO 3.6-m Telescopes (1Mar96)

Sharing Time on the Blanco 4-m and the ESO 3.6-m Telescopes (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

To make more efficient use of the astronomical observing potential of our two institutions, as well as to foster closer cooperation, CTIO and ESO are beginning an experiment to exchange 4-m class telescope time. The exchange will start with the next proposal period (CTIO, second semester 1996, ESO period 58). The instruments available for the use of the US community on the ESO 3.6-m are:

(1) ADONIS: An adaptive optics system for 1-5 m.

(2) TIMMI: A thermal infrared imager and spectrometer.

(3) EFOSC: An optical multi-slit spectrograph, imaging polarimeter, spectropolarimeter and imaging coronagraph.

This array of instrumental options provides our user community with capabilities not yet offered on CTIO telescopes. A brief outline of the performance of each of these ESO instruments follows. Prospective users are encouraged to refer to the documentation on the ESO WWW pages for more details (see references below).

Users from the ESO community have asked for access to our infrared spectrograph (IRS). We have tentatively agreed to "swap" 12 nights per semester, and envision this initial attempt to run for three semesters. The exact number of nights will be determined by scientific merit and proposal pressure.

Proposers from the NOAO/CTIO community who wish to use these ESO instruments should submit a proposal to CTIO on our normal telescope request form, but indicate clearly on the front page which ESO instrument is requested. Proposals will be rated by the CTIO TAC based on scientific merit, and then passed to the ESO scheduler, and vice versa. Input to the TAC from the appropriate technical reviewers of the instrument host institution will be sought.

Note that because of differences between semesters, the time being sought for the ESO instruments will only be 1 October 1996 to 31 March 1997. ESO use of the Blanco 4-m instruments will occur in the 1 August 1996 to 31 January 1997 period. Also, prospective users of EFOSC should note that the available nights will be limited to bright or gray (7 to 10 nights from new moon) lunar phases.

ADONIS

This is a near-infrared adaptive optics system. It uses an optical wave-front sensor to control both a tip-tilt mirror and a deformable mirror that correct for both tilt and higher spatial frequencies. The wavefront sensor requires a reference object smaller than 2" to 3" in diameter and brighter than V = 13 to be located within 40" of program object; the program object itself may be used as the reference object if it is sufficiently bright. ADONIS has produced K-band images with a FWHM of 0.2" which approaches the diffraction limit of the 3.6-m at 2.2um (0.12"). Although ADONIS is available to observers now, it will not be fully commissioned until the end of 1996. In the meantime, the instrument is offered on a shared-risk basis.

Two IR cameras are available:

SHARP II 256 x 256 HgCdTe array (NICMOS 3) 1-2.5 um, filters for J, H, K , K' + narrow bands; RON 40 e-; full well 200,000 e- scales; 0.035"/pixel, 0.050"/pixel and 0.100"/pixel; sensitivity: J/H/K 22.1/22.2/20.1 (1 hour, S/N = 5, 0.1"/pixel)

COMIC 128 x 128 HgCdTe array 1-5 um, filters for J, H, K, K', L, M + narrow bands; RON 400 e-; full well 6.8 x 10 sup 6 e-; scale: 0.035"/ pixel (J,H,K); 0.100"/pixel (L,M); sensitivity: J/H/K 18.3/18.2/17.2 (1 hour, S/N=5), L/M 14.8/12.5 (10 minutes, S/N=5).

No experience with AO or IR arrays is required to use ADONIS. Illustrated results can be found in ESO Messenger 75, p.33, and ESO Messenger 79, p.23. Reference: http://www.hq.eso.org/proposals/adonis.html

TIMMI

This is a mid-infrared imager/spectrometer, optimized for the 10 um window. It uses a 64 x 64 Ga:Si photo-conductor array, cut-off wavelength of ~ 17.8 um.

imager -
scales: 0.34"/pixel, 0.50"/pixel and 0.66"/pixel

sensitivity: M = 9.5, N = 7.2 (10 sigma, 4 hours, 0.36"/pixel) For

narrow band imaging, an integrated line flux density of
~ 1 x 10 sup -16 W m sup -2 arcsec sup -2 can be detected in 1 hour.

spectrometer -
choice of three grisms covering the wavelength range of 7.70-13.15 um

slit: 0.9" x 35" (0.66"/pixel) resolution: R ~ 200

sensitivity: S/N = 10 in 1 hour for a flux density of
0.6 x 10 sup -14 W m sup -2 arcsec sup -2 in the [Ne II] line
(12.8 um); S/N = 10 in 1 hour for a continuum source of
400-800 mJy (N ~ 4.5).

Reference: http://www.hq.eso.org/proposals/timmi.html

EFOSC1

This is an optical imager/spectrometer. It uses a Tektronix 512 x 512
CCD with 27 um pixels and 10 e- RON.

scale: 0.61"/pixel, 5.2' x 5.2' fov, choice of grisms providing
dispersions between 25 Angstroms/pixel and 3.3 Angstroms/pixel plus
an R ~ 2000 cross-dispersed "echellette" mode.

Only a limited number (maximum of 6) nights of grey time (7-10 days
past new moon) will be available. EFOSC1 operating modes not available
at CTIO:

(1) Aperture plate spectroscopy, room for up to 20 objects with 15"
long slitlets.

(2) Polarimeter mode (imager and spectrometer) using a 20"
Wollaston prism and rotating half-wave plate.

(3) Coronagraphic imager.

Mark Phillips, Michael Keane, Bob Schommer

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Argus Spectroscopy Update (1Mar96)

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Argus Spectroscopy Update (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

The bench spectrograph that is used with the Argus fiber positioning instrument at the CTIO 4-m telescope is now set up with the facility Blue Air Schmidt camera (229 mm focal length) and the Loral 3K x 1K CCD. This camera/CCD is the general-use camera for the 4-m telescope R-C spectrograph, the 4-m telescope echelle camera, and the Argus bench spectrograph. The properties of the camera/CCD are described in the June 1995 NOAO Newsletter No. 42, p.29. Since the Argus bench spectrograph uses the same gratings and camera as the R-C spectrograph, the dispersion and wavelength coverages are the same for the two spectrographs. A table of gratings, dispersions, and wavelength coverages for the R-C mode are given in the table in NOAO Newsletter No. 42, p.30.

As with the R-C and echelle spectrographs, there is no longer any "red" camera. The Blue Air Schmidt with the Loral CCD is our only camera for Argus. The two-layer AR coating on the Loral CCD will fringe longward of 7500 Angstroms. The fringing properties of the camera are given in the December 1995 NOAO Newsletter No. 44, p.25. At present, we have no engineering data about the specific effects of the fringing in the Argus setup, but it is not expected to be very much different than the data given in the cited Newsletter.

The fiber separation at the focus of the collimator has been increased to take advantage of the large format CCD. The fiber separation projects to a 20.6 pixel separation on the CCD, and the 48 spectra now have no overlap perpendicular to the dispersion: the inter-orders go "black." The 100 um fibers de-project by a factor of 2.2 to about a 3.1 pixel spot perpendicular to the dispersion. For faint objects where modest S/N is expected, most observers will want to bin the CCD by a factor of 2 perpendicular to the dispersion to reduce the effect of the read noise. The typical resolution along the dispersion is about 3.3 pixels. The actual spectral resolution for a given setup can be calculated from the grating dispersion listed in the table in NOAO Newsletter No. 42, p.30 where the dispersions in Angstrom/pixel are given for all the gratings.

The Argus echelle mode is still available. In this mode, single orders from the finely-ruled echelle (316 groove/mm) are isolated using order-separating filters. The grating is used in order 56120/Angstroms, e.g. 10th order near 5600 Angstroms. The 3 pixel resolution is about 17,000. The wavelength coverage is about Delta Lambda = Lambda/50 which is about 30% of the bandpass of the typical order-separating filter and is also much smaller than the free spectral range. The wavelength coverage of the Argus/echelle mode is effectively limited by the CCD size. A summary of the Argus echelle mode can be found in the CTIO WWW pages or the March 1991 NOAO Newsletter No. 25 p.23.

The larger beam size, due to the increased fiber separation in the spectrograph, means that the echelle mode (where the collimator/camera angle is only 15 degrees) will have vignetting perpendicular to the dispersion. The first and last fibers have about 60% the intensity of the central fibers. A new spectrograph camera, which will operate in quasi-Littrow mode, is presently being designed for the Argus spectrograph (and the future CTIO Hydra fiber positioning instrument), which will reduce the vignetting problem. The WWW pages (http://www.ctio.noao.edu/argus/argus.html) for Argus, which include the Argus technical and user's manuals, have been completely updated.

N. Suntzeff, T. Ingerson, R. Schommer

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Commissioning of the Loral 1200 x 800 CCD on the 1.5-m Cass Spectrograph (1Mar96)

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Commissioning of the Loral 1200 x 800 CCD on the... (1Mar96)
1.5-m Cass Spectrograph
(from CTIO, NOAO Newsletter No. 45, March 1996)

Final commissioning of the Loral 1200 x 800 CCD (hereinafter Loral 1K CCD) plus 1.5-m spectrograph combination was carried out during two engineering nights on 15-16 November 1995. A previous engineering run in May (reported in NOAO Newsletter No. 43, p.25) had allowed an initial evaluation of the image quality, throughput, fringing characteristics and flexure of the system at the telescope. The encouraging results of that engineering night were amply confirmed on the two commissioning nights in November--the performance of the Loral 1K CCD is superior in all aspects to that of the front-illuminated GEC CCD used for so many years with the 1.5-m spectrograph, offering 40% greater wavelength coverage (at the same resolution) and 2-3 times the quantum efficiency.

Within the next few months we will attempt to have a new user manual for the 1.5-m spectrograph + Loral 1K CCD available on the CTIO WWW pages. Twelve gratings are available, which give the following wavelength resolution and coverage with the Loral 1K:

Gtg	l/mm	blaze(a)	FWHM Resolution (Angstrom)	Wavelength Coverage (Angstrom)
13	150	5000	17.2	6900
11(b)	158	8000	16.4	6550
09	300	4000	8.6	3450
32	300	6750	8.6	3450
22(b)	300	10000	8.6	3450
58	400	8000	6.5	2590
16	527	5500	4.8	1965
26	600	4000	4.3	1725
35	600	6750	4.3	1725
56	600	11000	4.3	1725
47	831	8000	3.1	1245
36(c)	1200	7500	2.2	860

(a) Blaze is first order Littrow blaze. Effective blaze wavelength when used in the 1.5-m spectrograph is 0.89 of the Littrow value.

(b) Silver coated does not reflect light below ~4000 Angstroms.

(c) Cannot be tilted far enough to be used in II order.

The Loral CCD has 15 um pixels and a slit width of 143 um (2.6") projects to 2 pixels. In practice, however, the focus of arc lines is observed to range between 2-3 pixels (FWHM) due to the camera optics and charge diffusion within the CCD (for more details, see the article in NOAO Newsletter No. 43). The wavelength resolution figures in the above table are calculated for a FWHM of 3 pixels.

Efficiency measurements of the total telescope/spectrograph/CCD combination were obtained with gratings 09 and 32 during the November engineering nights. The results are given in the following table in terms of the percentage of photons striking the telescope primary mirror which are eventually detected by the CCD. Note that these numbers are still not definitive due to uncertainties in the precise value of the CCD gain on the engineering night; however they should be accurate in a relative sense. We hope to be able to provide final numbers within the next six months.

Grating 09 Lambda	QE (%)	Grating 32 Lambda	(QE) %
3500	7.5	6500	14.8
4000	13.5	7000	13.6
4500	6.5	7500	11.8
5000	17.0	8000	8.5
5500	16.0	8500	6.5
6000	13.5	9000	5.0
6500	10.0	9500	2.9

The upper right amplifier does not perform satisfactorily, therefore the CDD is read in single-channel mode (through the lower left amplifier). As part of the commissioning process, a reduction of 10 ms per pixel was achieved. The resulting gains, read noises, and readout times are:

1/Gain (e-/ADU)	Read Noise (e-)	Read Time (seconds)
4.11	7.71	15.6
2.87	7.11	19.7
2.05	6.50	25.8
1.42	6.13	34.0
0.96	5.88	46.3

Full well of the Loral 1K CCD is 118,000 e-. Over this range, the CCD delivers excellent linearity (gain variation = 0.26% peak-to-peak).

As reported in NOAO Newsletter No. 43, the Loral 1K CCD fringes with substantial amplitude at wavelengths redward of 7500 Angstroms. However, thanks to the lack of significant flexure in the 1.5-m spectrograph and camera, it is possible to remove nearly all of the fringing using normal dome flats.

The accompanying figure shows spectra of two type II supernovae obtained with the 1.5-m + Loral 1K combination. These spectra are the sum of separate blue and red observations obtained at ~8.5 resolution with gratings 09 and 32. Total integration time for SN 1995ad was 30 minutes in the blue and 30 minutes in the red, while SN 1995v was observed for 90 minutes in the blue and 45 minutes in the red. Approximate magnitudes measured from the spectra are B = 16.8 and V = 15.7 for SN 1995ad and B = 18.7 and V = 17.6 for SN 1995v. Note the lack of obvious residual fringing at red wavelengths. In the case of SN 1995ad, a signal-to-noise value of 35:1 was obtained at a wavelength of 9250 Angstroms where the CCD fringing amplitude reaches 20%. (The signal-to-noise in the these spectra is limited more by photon statistics than any residual fringing.)

[Figure not included]

With the successful commissioning of the Loral 1K CCD which is controlled by an Arcon, the last VEB controller in service on Tololo has now been officially retired! Que descanse en paz.

Mark Phillips, Steve Heathcote, Roger Smith

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4-m Echelle Spectrograph Update (1Mar96)

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4-m Echelle Spectrograph Update (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

Measurements of standard stars with the echelle spectrograph and its long cameras were made under photometric conditions on the nights of 5 September 1995 and 10 October 1995. The figure shows the overall system efficiency (defined as the fraction of photons hitting the primary, that are detected by the CCD) derived from these observations. The quantity plotted is the system efficiency at the peak of the echelle blaze function in each order. Note, that these measurements were made with a wide (10") spectrograph slit.

The throughput was measured in the two configurations of the spectrograph most requested by visitors for use with the long cameras. The 79 l/mm echelle and a 316 l/mm cross disperser blazed at 4400 Angstroms in first order (KPGL-2) were used for the measurements in the blue; the 31.6 l/mm echelle and a 226 l/mm cross disperser blazed at 6300 Angstroms (G226-3) in first order were used in the red. Appropriate order blocking filters were employed when necessary to prevent contamination by higher orders from the cross dispersing gratings.

[Figure not included]

Overall system efficiency for the 4-m Echelle spectrograph with the long focal length cameras and Tektronix CCD (Tek 2048 #4). Curves are shown for two echelle plus cross disperser combinations: KPGL2 316 l/mm blazed at 4400 Angstroms with the 79 l/mm echelle and G226-3 226 l/mm blazed at 6300 Angstroms with the 31.6 l/mm echelle.

These efficiency measurements form a portion of the calibration database for an echelle exposure time calculator. The current version of this calculator is available for use by observers and proposers via the WWW from the echelle spectrograph's on-line manual (http://www.ctio.noao.edu/4m_echelle/4m_echelle.html).

Michael Keane

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Lowell 0.6-m Telescope to be Mothballed (1Mar96)

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Lowell 0.6-m Telescope to be Mothballed (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

For many years now, the Lowell 0.6-m telescope at CTIO has seen very limited use. Over the last three years, the average number of proposals received for this telescope has been two per semester, and the total number of nights scheduled by the TAC has been 20 per semester (i.e., only 11% of the total number of nights available). The Lowell is one of two telescopes at CTIO dedicated to single-channel photoelectric photometry--the other being the 1.0-m Yale telescope. Since the Yale telescope typically is also undersubscribed (the ratio of nights requested to the total available has averaged 0.8 over the last three years), there seems little point in continuing to maintain both telescopes in operation--especially in view of the ever-increasing pressure on the CTIO operations budget. Hence, as of 1 February of this year, the Lowell telescope will be officially put into mothballs. This means that the telescope will no longer be open for use by the general community. Proposals that would have requested the Lowell should in the future be written for the Yale telescope. Consistent with our original agreement with Lowell Observatory, CTIO will continue to support operation of the 0.6-m for occasional observing runs by Lowell Observatory staff using their own instruments.

Malcolm Smith, Mark Phillips

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Controlling Light Pollution (1Mar96)

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Controlling Light Pollution (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

Although Cerro Tololo and Cerro Pachon are still very dark sites, CTIO has become increasingly concerned in recent years with the growing threat of light pollution from neighboring cities and towns. Thus we have begun to collaborate with local officials as well as private industry to insure that future lighting installations are as "astronomy-friendly" as possible. This program is being carried out on several different fronts.

Public Information

One of the basic problems facing us is a lack of awareness of the damaging impact of light pollution on astronomy. The people of the Fourth Region of Chile are very proud of the presence of Cerro Tololo and the other astronomical observatories in this area--indeed, Cerro Tololo has long been one of the most popular tourist destinations in this part of Chile. We have found that once the problem of light pollution has been explained, local officials, merchants, and residents have been quite willing to work with us to improve lighting standards. To reach even more people, we have provided information and interviews to local and national newspapers and television stations and given talks to various civic groups to publicize the problem. We plan to continue our efforts in this area during FY 1996 with the organization of a symposium in La Serena for businessmen and local government officials designed both to explain the problem and to provide practical solutions that will benefit everyone.

Street Lighting Installations in Local Towns

As part of a nation-wide program sponsored by Chile's National Energy Commission, the cities of Vicua and La Serena have embarked on a project this year to replace their old, energy-wasteful mercury vapor street lights with more efficient high-pressure sodium lighting. Although we would have preferred that the local towns adopt low-pressure sodium lights, this is not practical due the lack of suppliers in Chile. However, much can still be gained by replacing the old mercury vapor fixtures with fully-shielded high-pressure sodium lights. Vicuna (pop. 15,000) is the closest (12 miles) town to Tololo, and therefore potentially one of the most serious concerns for the Observatory. Fortunately, the town leaders have shown considerable interest in working with CTIO to improve existing street lighting, and to insure that future lighting installations are "astronomy-friendly."

On their own, they contacted CTIO in the early stages of their project to seek advice on how best to insure that the new street lights would not significantly affect the telescopes on Tololo. This was just the opportunity that we had been looking for to work with a local town on implementing lighting ordinances that would more effectively control the problem of light pollution. Hence, CTIO has been providing the necessary technical assistance to the Vicuna city officials to insure that the change from mercury vapor to high-pressure sodium lights is carried out in a cost-effective manner that will result in better street lighting for Vicua and lead to an actual decrease in the light pollution affecting Tololo and Pachon. The successful completion of this project will serve as an important example to the other neighboring communities.

Already, as a result of the publicity surrounding the Vicuna project, the city of La Serena (pop. 120,000) recently opted to install "astronomy-friendly" lighting as they also replace their old mercury vapor lights with high-pressure sodium. In this case as well, we have worked directly with city officials to insure that they have technical assistance necessary to achieve this goal.

Light Pollution Ordinances

City officials have told us that it would be easier for them to work with us in controlling light pollution if there were a national or regional norm for nighttime lighting that dealt specifically with the problem. After consulting members of both the executive and legislative branches of the Chilean government, we were advised that the best approach would be to work through the newly-created Comision Nacional de Medio Ambiente (CONAMA), which has been charged with creating and monitoring environmental law in Chile. Hence, we are presently working with the Director of the Fourth Region CONAMA office on a draft of an environmental norm aimed at controlling light pollution in the vicinity of the existing astronomical observatories in Chile. We have been very pleased with the support for this project shown by the CONAMA officials, and have been told that there is a good chance that this might be one of the first environmental norms to be considered by the Commission. We are currently working to finish the draft norm (which is modeled after outdoor lighting standards in Hawaii and the Canary Islands) so that it can be submitted to the CONAMA before the end of January. Once approved, the next step will be to work with the individual cities to create lighting ordinances that are consistent with the general specifications of the CONAMA norm.

Mark Phillips, Ricardo Schmidt

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CTIO Visitors: We'd Love to Hear from You (1Mar96)

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CTIO Visitors: We'd Love to Hear from You (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

CTIO attempts to maintain an active colloquium series. Our primary source for potential speakers continues to be the steady stream of visiting astronomers passing through La Serena on their way to and from observing runs. We would like to extend an invitation to each of our visitors to consider being the speaker for a CTIO colloquium and sharing some of your latest, interesting results with us, even if you didn't obtain them at CTIO! If you are interested in giving a talk the next time you are in La Serena, please contact the undersigned CTIO colloquium chairman.

Michael Keane

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Availability of IRS for August-January: Good News, Bad News (1Mar96)

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Availability of IRS for August-January: Good News, Bad News (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

As announced in NOAO Newsletter No. 44, the CTIO infrared spectrometer IRS will be optically upgraded to work with the new 4-m f/14 secondary and the existing 1.5-m f/13 secondary. This will provide improved performance at the 4-m and eliminate a time-consuming top end change at the 1.5-m. This is primarily a change in cold foreoptics. The image scale at the slit will remain unchanged, with the a two pixel slit size at the 4-m being 0.6". With the implementation of tip-tilt image stabilization, slit losses should be greatly reduced. The project schedule has been moved forward from our previous expectations. The IRS will be out of service October-November 1996 for this upgrade. This means an abbreviated schedule for the IRS in the upcoming semester: late August and September at f/30, December and January at f/14. The good news is that this effort will produce a better instrument well matched to an improved telescope.

Richard Elston, Gabriel Perez

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COB Moves to the Blanco 4-m Telescope (1Mar96)

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COB Moves to the Blanco 4-m Telescope (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

The NOAO Cryogenic Optical Bench (COB) will be moving from KPNO to CTIO in October 1996, following a detector upgrade to a 512 x 512 Aladdin InSb array in July-September. We are offering it for use at the 4-m beginning in November 1996. Image scale with the f/14 secondary will be 0.1" per pixel, producing a 50" field of view.

This scale has been chosen to exploit tip-tilt image stabilization at the 4-m. However, tip-tilt capability will NOT yet be available next semester. Hence COB's temporary ecological niche is for programs which benefit from oversampling the seeing limited image (typically 0.4"-0.7" FWHM at K) in a restricted field of view. Operationally, optimum use will be for broad and narrow band imaging and polarimetry, including use of focal plane occulting spots with bright sources. A wide assortment of filters is provided. While COB has a tunable Fabry-Perot filter for imaging in the two micron window, and low resolution spectroscopic capability using grisms, performance in these low-background modes at this plate scale is likely to be unimpressive without tip-tilt image sharpening. Spectroscopic proposals will be better served by the upgraded IRS spectrometer, the subject of a separate note in this Newsletter. We also discourage use beyond 2.5 um until we have characterized system performance with the Wildfire controller and larger array under CTIO background conditions.

Briefly, COB's capabilities include broadband imaging at 1.0 um, J, H, K, K' (2.0-2.3 um), L, and L'; narrowband imaging at 1-4 um, including 1-2% filters at 1.08, 1.25, 1.28, 1.64, 1.99, 2.12, 2.14, 2.16, 2.22 (4%), 2.36, 2.38, 3.08, 3.30, 3.35, 3.40, 3.60, 4.00, 4.05 um; polarimetry in broadband filters and 2 m narrowband filters; occultation of a central bright source for imaging and polarimetry, with focal plane spots occulting 2"-6" diameter on the 4-m; imaging at resolution ~500 in the 2 um window using a tunable Fabry-Perot and the narrowband filters as order sorters; spectroscopy at resolution ~300 in the J, H, and K bands with a grism and focal plane slit.

Further information and performance estimates for COB can be found in the CTIO Web pages, or from one of us.

Richard Elston, Ron Probst

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CCD News (1Mar96)

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CCD News (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

The Loral 1K CCD was successfully used for a month-long block (14 November-13 December) with the 1.5-m spectrograph, and has allowed us to retire definitely the small EEV CCD previously used for this application. With this upgrade, we are now scheduling a total of six CCDs (four Tek's and two Loral's). The two Loral CCDs are dedicated: the 3K (3072 x 1024) is in an Air Schmidt camera, which is used with the 4-m spectrographs (R-C, Echelle, Argus), while the 1K (1200 x 800) is used only with the 1.5-m spectrograph. Two of the four Tek (SITe) 2048 x 2048 CCDs are normally dedicated to imaging, the Tek/STIS 2K at the Schmidt and the Tek 2K #3 at the 0.9-m. Tek 2K #4 is used for imaging at the 4-m and 1.5-m, with the 4-m Echelle long camera, and with the 1.5-m bench echelle, while the Tek 1K (1024 x 1024) is used with the Rutgers Fabry-Perot (RFP) Interferometer and for some 1.5-m imaging applications.

Very recently we purchased another SITe 2K, from SITE's year-end half-price (!) sale. This is a grade 1 CCD with two amplifiers operative, and is intended for use in a new spectrograph camera that will be used with the fiber spectrograph Argus and eventually with Hydra. In the meantime, we will install the new CCD in a direct dewar; its availability will ease the job of scheduling. The RFP will likely use a Tek 2K in future, since read noise is lower than for our Tek 1K, even though the large format is not needed. The Tek 1K should be scheduled only infrequently.

Here is a brief summary of the CCDs presently scheduled. Visit the CCD section via WWW to find out further information, or contact the under-signed.

CCD	Type	Pix	N	RON	QE (%)				
					0.3	0.4	0.6	0.8	0.9
Tek 2K #3	B	24	4	2-4	20	60	75	60	35
Tek 2K #4	B	24	4	2-4	20	60	75	60	35
Tek/STIS 2K	F	21	4	2-4	20	18	40	35	14
Tek 1K	B	24	4	2-4	0	35	70	60	35
Loral 3K	B	15	1	7-9	70	75	90	75	40
Loral 1K	B	15	2	7-9	20	60	95	80	50

Type: B = back-illuminated, F = front-illuminated + Metachrome.
Pix: Pixel size in um.
N: Number of operative amplifiers. The Tek 2K's are normally read out using all amplifiers, typical read time is 30-40 seconds depending on gain setting.
RON: Read noise (e- rms) for the typical range of gains used.
QE: Wavelengths are in m. The Loral CCDs are UV-flooded, there is some concern at present that the QE of the Loral 3K CCD in the UV may not be as high as stated.

Alistair Walker

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CTIO Telescope/Instrument Combinations (1Mar96)

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CTIO Telescope/Instrument Combinations* (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

4-m Telescope:

ARGUS Fiber-Fed Spectrograph + Blue Air Schmidt Camera + Loral 3K [40,41,42,45]
ARGUS Echelle FF. Spect. + Blue Air Schmidt Camera + Loral 3K [40,41,42,45]
R-C Spectrograph + Blue Air Schmidt Camera + Loral 3K[40,41,42]
Echelle Spectrograph + Blue Air Schmidt Camera + Loral 3K[40,41,42]
        "   + Folded Schmidt + Tek 1K CCD [22,23,25,26]
        "   + Long Cameras + Tek 2K CCD [23,25,26,39,45]

Prime Focus Camera + Tek 2K CCD [36,39]
" + Photographic Plates [23,38,41] (User must supply plates)
Cass Direct + Tek 2K CCD [39]
Rutgers Imaging Fabry-Perot + Tek 1K CCD [25,26,42]
CTIO IR Imager + 2562 HgCdTe [40,41]
CTIO IR Spectrometer + 2562 InSb [37,39,41,45]

1.5-m Telescope:

Cass Spectrograph + Loral 1200 x 800 CCD
Bench-Mounted Echelle Spectrograph + BME Camera + Tek 2K CCD [22,23,39,42]
Cass Direct + Tek 1K CCD, Tek 2K CCD [39]
Rutgers Imaging Fabry-Perot + Tek 1K CCD [25,26,42]
ASCAP Photometer [24,25,28,43]
CTIO IR Imager + 256 sup 2 HgCdTe [40,41]
CTIO IR Spectrometer + 256 sup 2 InSb [37,39,41,45]

1-m Telescope: ASCAP Photometer [24,25,28,43]

0.9-m Telescope: Cass Direct + Tek 2K CCD [39]

0.6-m Telescope: Closed [45]

Curtis Schmidt: STIS 2K CCD (Direct or Prism)[42]

* Numbers in boldface following an instrument indicate the most recent Newsletter(s) containing relevant articles. If there is no number, the 1990 edition of the Facilities Manual is fully up to date. The most recent general summary of CCD characteristics is in 45; see also 33, 26 and 28. Information on telescope control guiders is in 21, 22, 24, 32.

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Requests for CTIO Telescope Time: February - July 1996 (1Mar96)

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Requests for CTIO Telescope Time: February - July 1996 (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

Telescope		Nights Req.	Nights Sched.	#Req./ #Sched.	#Vis. Nights	%Vis. Nights	#Staff Nights	%Staff Nights	#Eng.& Maint.
4-m	Dark	176	76	2.3	57	75	19	25	26
	Bright	178	54	3.3	49	91	5	9	29
1.5-m	Dark	93	95	1.0	91	96	4	4	6
	Bright	172	74	2.3	64	86	10	14	2
2 1-m	Dark	89	84	1.0	84	100	--	--	1
	Bright	102	18	5.6	18	100	--	--	--
0.9-m	Dark	16	100	1.6	98	98	2	2	--
	Bright	37	51	0.7	48	94	3	6	8
Schmidt		125	100	1.2	89	89	11	11	6

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Mayall 4-m Back On-line After Shutter Failure (1Mar96)

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Mayall 4-m Back On-line After Shutter Failure (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

In mid-October 1995 the gearbox that drives the dome shutter of the Mayall telescope was found to have damaged gears, and we were forced to suspend observing at the 4-m while we repaired it. Nightly operations resumed on 28 December 1995. We would like to describe the nature of the failure, the repair itself, and how the loss of observing opportunity was addressed.

On 18 October, while searching for a noise that the dome shutter was making as it closed, the shutter gearbox was found to have damaged gears. The gears were damaged to such an extent that we judged it unsafe to continue to operate the shutter on a daily basis, as further use could have led to complete breakage of the gearbox and significant damage to the shutter. We decided to keep the 4-m dome open until the manufacturer was ready to repair the gearbox, or until we were forced to close the shutter because of threatening weather. After twelve nights--ten clear--our luck ran out. The night of 29/30 October saw the first storm of fall arrive on the tropical jet stream. After riding out a few drizzles during the night and morning--the Cassegrain cage was wrapped in a tarp and the top-end sheltered under the dome--the storm intensified, with embedded thunderstorms showing up on weather radar. We decided just before noon on 30 October to close. That afternoon the mountain received a strong rainstorm with the promised thunder and lightning; significant water damage would have resulted had the 4-m dome not been closed when it was.

[Photo not included]

While we were open, arrangements for the repair were made. As soon as we closed the shutter, removal of the gearbox began. Not suprisingly, the gearbox itself defined the critical path of the repair schedule. The manufacturer estimated eight weeks to fabricate new gears, which seemed like a long time until we learned that a complete gearbox would have taken five months to be manufactured. While the gearbox was off for repair, the motors, clutch and brake assemblies in the shutter mechanism were refurbished, and the shutter drive was carefully inspected and lubricated. Despite the usual surprises that come up in undertaking a project of this magnitude--e.g., the gearbox went out weighing 1100 lbs and came back weighing 650 lbs. more, requiring that we re-do our rigging to lift the gearbox into place--we met our goal of opening by year's end.

The root cause of the failure appears simply to be due to wear over the nearly thirty years of use. The original gears were cast-iron with a hardened surface. When the hardening wears through, rapid wearing of the gears occurs with the teeth then easily breaking (see figure). All of the gears showed pitting from wear, an indication of surface fatigue failure, but without signs of scoring, which would indicate oil film failure due to excessive loads or aging lubricant. All of the bearings in the gearbox were worn out and were replaced at this time as well. The new gears are made of solid steel with superior wear properties. In addition, the two old motors--one for slow speed and one for fast--have been replaced with a single DC motor that ramps up to the set speed, thus placing less load on the gearbox when starting and stopping. The entire shutter system is under review to ensure that any potential failure modes that we have been unknowingly living with for decades will be corrected.

Astronomers scheduled during the time that we expected to be closed were informed of the extraordinary circumstances. All were offered reimbursement of any direct expenses (such as non-refundable air-fare) that they had made in advance of their runs. They were asked if they would be available should we be finished before our projected opening date, and if they would like to be re-scheduled in spring 1996. Ultimately, by shortening the block assigned for DLIRIM proposals to five nights, we were able to fit in two programs from earlier in the semester. Five proposals canceled at the 4-m in fall 1995 have been scheduled in early spring 1996 after due consideration by the TAC when they met in November.

Ironically, the noise that was heard that led us to take a careful look at the gearbox was still there when we were able to move the shutter again. The noise turned out to come from a piece of sheet-metal from one of the seals that had started to rub against the dome skin. That has been taken care of as well.

A large number of personnel--both Kitt Peak and Tucson based--were involved in this repair. Thanks to their hard work and teamwork the telescope was ready for use by visiting astronomers essentially on the day projected back in October when we shipped the gearbox off for repair. They were also responsible for a significant amount of additional work done to the dome shutter while the gearbox was away to ensure reliable operation for years to come. We sincerely thank them for all of their efforts.

Bruce Bohannan, Tony Abraham

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WIYN Queue Observing Experiment: A Progress Report (1Mar96)

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WIYN Queue Observing Experiment: A Progress Report (1Mar96)
(from CTIO, NOAO Newsletter No. 45, March 1996)

The first semester of the WIYN queue observing experiment has just been completed and it's safe to say it was a learning experience for all involved. We are in the process of compiling observing statistics for the fall 1995 semester and will report them on our WWW page (http://www.noao.edu/wiyn/queue) by 1 March 1996. A few general remarks about the lessons we have learned during fall 1995, and how we plan to continue the experiment in the spring 1996 semester follow.

The technical triumph of WIYN has naturally led to an enthusiastic outpouring of observing proposals. Unfortunately, this has produced a level of oversubscription that is frustrating to all of us. For the spring 1996 observing semester, KPNO received 58 WIYN observing proposals, compared with 83 for the Mayall 4-m. However, KPNO is allocated only 40% of the observing time at WIYN by the WIYN Consortium. This translated into a roughly 2.5:1 WIYN requested/available nights ratio, but the equivalent dark-time oversubscription (roughly 4:1) is even worse.

The main goal of the WIYN queue observing experiment is to test empirically the hypothesis that in the face of a high oversubscription rate, the science throughput of WIYN can be maximized by executing the most highly ranked science programs first, completing datasets in a timely manner, allowing a larger range of program lengths, and matching the observing program to the observing conditions on an observation-by-observation basis. In fall 1995, we further held to the idea that once programs were initiated, high weight should be given to completing them. Moreover, because fall 1995 proposals were submitted before we could give users a good idea of observing overheads and instrument efficiencies, our goal was to give projects the actual time required to complete the TAC reviewed science program, rather than the TAC recommended time allocations.

These latter constraints naturally led to two outcomes that may or may not have been desirable. First, because good observing overhead estimates were not initially available, many programs took much longer (by factors of 2-4) to execute than estimated by the program PI. Since the highest TAC ranked programs were also fairly large projects, this effectively minimized the number of programs initiated at WIYN during fall 1995. Second, by insisting that the highest ranked program be completed first whenever possible, programs were often executed under better observing conditions than they actually required. This led, for example, to spectroscopic programs being executed on nights of very good seeing because they were more highly ranked by the TAC than more lower ranked imaging projects that required the good seeing to be completed successfully. At some level this is undesirable since it mitigates what should be one of the strengths of queue observing, namely the ability to take advantage of rarer observing conditions.

For spring 1996, we have fine-tuned the experiment in several ways to increase the number of programs serviced and to better match observing programs to observing conditions. First, larger survey projects that appeared to require more immediate PI interaction were "classically" scheduled; i.e., they were given specific nights. Often such projects do not require 100% completion to answer their science question. By scheduling them classically, the burden of deciding which fields to observe in what order is shifted to the PIs, while allowing the TAC to re-evaluate the program on a semester-by-semeter basis if the program is not completed. Roughly half of dark time and a third of bright time were scheduled classically in spring 1996. The amount of fall 1996 time scheduled classically will be determined after the TAC reviews fall 1996 proposals. This change from 100% queue scheduling to a mix of "classical" and queue is result of our continuing efforts to maximize the quality and quantity of scientific results from this telescope. This change also reflects many of the views expressed about the implementation of queue scheduling that were written to us in the NOAO electronic forum.

Second, programs scheduled in the queue will be held to their TAC recommended time allocation. Realistic observing overheads and instrument throughput have now been widely enough disseminated that proposers appear to be making good estimates of total program execution time. This constraint should increase the number of programs initiated in spring 1996. Prospective WIYN proposers should see the WIYN queue program Web page (http://www.noao.edu/wiyn/queue) for further information about estimating program execution times.

Third, we have reduced the initial queue pool. At the start of fall 1995, we entered roughly two-thirds of the TAC reviewed programs into the queue pool because we wanted to be assured of having something to observe under all reasonable observing conditions at all available celestial coordinates. This meant, however, that the ratio of "approved" queue time to available queue time was roughly 4:1 before weather, better observing overhead estimates, and facility downtime is considered. With those factors accounted for, the effective ratio by the end of fall 1995 was closer to 6:1. As a consequence, many users who were told they were in the queue never received any WIYN data and were naturally very frustrated. Rather than disappoint people at the end of the semester, it was decided to raise the initial TAC grade threshold for getting into the queue, give more users a definitive "no" answer up-front, and aim for a approved/available ratio of roughly 2:1. Note that we still have to over-schedule the queue to assure that we can span sufficient observing condition parameter space during the entire semester. Also, the pool must be large enough to cover the situation where all nights available to WIYN have favorable observing conditions and no equipment failures.

Lastly, we will relax the "100% completion" goal in favor of more optimal matching of observing conditions to observing program. Effectively, this means that on nights with good seeing we will execute imaging programs that require good seeing, and on photometric nights we will execute programs that require photometric conditions, rather than just continuing to execute a higher ranked spectroscopic program. There is at present no set rule as to how far "down" in the TAC gradelist we will go to acquire a program to fit the current conditions; this is clearly a function of the particular program mix. However, we do not anticipate deviating from the TAC ordered list by more than a few tenths of a grade point. This change will increase the number of programs that get some data, while lowering the number of programs that are essentially completed.

During spring 1996, we will attempt to issue more timely queue progress reports via the WIYN queue program Web page (see the URL above). Furthermore, we will continue to answer any questions sent to wiynq@noao.edu in as timely a manner as possible, especially questions related to programs being executed at the time we receive the question. Of course, we remain committed to delivering the highest possible quality data.

We appreciate your continuing patience as this experiment evolves. Please continue to send us your feedback; we are listening and implementing changes to make this a more successful and satisfying program.

Dave Silva, Dave De Young

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WIYN Project Report (1Mar96)

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WIYN Project Report (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

The WIYN Project, the entity formed to construct and commission the WIYN Observatory, continues to march steadily towards a formal conclusion sometime during spring 1996. Residual Project responsibilities include completing delivery of the Instrument Adaptor Sub-system (IAS), conducting an Operations Readiness Review (ORR), and completing a variety of Project close-out tasks.

IAS installation and commissioning has been mostly completed. The IAS has been in regular use since September 1995. Only one significant problem has been uncovered during IAS commissioning: the stages used to position the guide probe assemblies "stall" when run at too high a speed. Currently, the allowable probe speeds are a factor of 4-8 times slower than our original goal. This has the obvious effect of decreasing observing efficiency when acquiring new guide stars, although at worst the increased overhead is several minutes. As we did not see this problem when lab testing the IAS, we are trying to diagnose why this is a problem on the telescope, so it can be rectified and the probe speed increased to our original goal.

Remaining IAS delivery tasks include installation of the Comparison Lamp Assembly (CLA) and Atmospheric Dispersion Corrector (ADC) lenses and associated control software. Mechanical work on the CLA is completed, but completion of the electrical work has been delayed by the electrical work needed to rectify the secondary limit switch situation. CLA installation and testing should be completed by 1 March 1996. The ADC lenses, originally scheduled for delivery in July 1995, has been delivered in early February 1996. Despite the delivery delay, testing during fabrication suggests that the lenses will be very good. After the lenses are delivered and acceptance tested, they must still be AR-coated, bonded, and installed in their cells, a process requiring several weeks. We hope to install these lenses and test the ADC on-site in early April 1996. This would officially complete delivery of the IAS by the Project.

Additional IAS related tasks include implementation of a more efficient, semi-automated wavefront measurement and active optics update process, and implementation of closed-loop focus correction (based on a simple Shack-Hartmann scheme). The IAS already contains all the hardware needed for these tasks. Completion of the more efficient wavefront/AO update pipeline is straightforward and should be done by 1 April 1996. A more efficient pipeline would save at least 30-45 mins every night WIYN is operating. The planned closed-loop focus correction scheme, on the other hand, is more experimental in nature and thus its delivery schedule is uncertain. These tasks will be completed by some combination of Project and Operations resources.

The ORR rationale was discussed in the December 1995 NOAO Newsletter No. 44 and will not be repeated here. The ORR was held 1-3 February 1996 in Tucson at NOAO Headquarters.

Project close-out activities include organizing and storing Project documentation, transitioning management responsibilities from the Project to the Site Manager, and closing out the financial books. All this should be completed by 1 April 1996, subject to the review and approval of the ORR outcome by the WIYN Board on 1 March 1996.

Dave Silva

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Multi-slit Improvements and Other Cryogenic Camera News (1Mar96)

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Multi-slit Improvements and Other Cryogenic Camera News (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

An option for multi-object spectroscopy at the 4-m telescope has been the Cryogenic Camera or R-C Spectrograph with multi-slit entrance masks. For many years we have been using masks made from photographic film.

Cryogenic Camera Grisms

Grism No.	650	770	810	730	780-1	780-1	780-2
Order	1	1	1	1	1	2	1
l/mm	400	300	150	300	300	300	300
UDCW*(Angstrom)	4950	5970	6360	8010	9700	4850	7100
Spectral Range	4000 -6900	4000 -8400	4000 -10500	5600 -10400	7200 -10300	4000 -6300	4900 -9700
Resolution (in Angstroms)	12	15	30	15	15	8	15
Angstroms/pixel	3.2	4.3	9.1	4.3	4.3	2.2	4.3

* Undeviated central wavelength

We have now developed a new technique using thin etched stainless steel for the mask material. This offers several improvements over the old film method. The chief detraction of the photographic masks was a 10% throughput loss in the film base material. Other problems, now alleviated, were occasional scale errors due to drifts in the film recorder electronics and internal fringing in the film base. All of these deficiencies are now removed with the new blackened metal masks. The only downside factor is cost and lead time. The new masks will cost several hundred dollars for a typical observing run. For most runs, with a reasonable number of masks, KPNO will absorb this cost. If more masks for a run than the norm are requested, the observer may be asked to share the cost. Since an outside vendor is doing the etching, the lead time for receipt of the final mask patterns from the observer will be increased to three weeks. There have been two successful runs using the new material. Photographic masks will no longer be available. Potential users are referred to the manual "Multi-Slits at Kitt Peak" available via anonymous ftp from ftp.noao.edu or from the KPNO Home Page http://www.noao.edu.

During recent runs the CryoCam has performed well and the reliability has been excellent. The current chip, a Ford/Loral 800 x 1200 pixel device with 15 um pixel size, offers good cosmetics with a readout noise of ~15e-rms. Past instabilities in the readout noise characteristics have been fixed. Above is a table giving the instrumental specifications for the various grisms. Some grisms can cover more than one harmonic in wavelength and users must choose their order blocking filters with care.

Jim De Veny, Buell Jannuzi

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Phoenix Commissioning Begins! (1Mar96)

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Phoenix Commissioning Begins! (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

We have received a number of inquiries about using Phoenix in the fall semester. As discussed below, its sensitivity will clearly not be known until after the 31 March proposal deadline. Until first results are received there is neither a basis for writing proposals nor a basis for us to evaluate the merits of the proposals. For Phoenix we will have a special scheduling process for the fall 1996 semester. Several blocks of 2.1-m time will be set aside for Phoenix late in the semester. The Phoenix proposal deadline for the fall semester will be announced on the KPNO Web site, or you can be notified personally by sending e-mail to hinkle@noao.edu. Proposals for Phoenix received by the normal proposal deadline of 31 March will be held for this later scheduling session. All Phoenix proposals scheduled in fall 1996, will be shared risk.

At the time of the publication of this Newsletter, we are taking care of the final details for fitting together the Phoenix mechanical assemblies; e.g., holes are being drilled in the radiation shields for the detector wiring, mounting holes for the electronic boxes are being tapped into the mounting plate on the dewar, and temperature sensor diodes are being installed in the collimator. By the time this is printed, the entire mechanical assembly will have been disassembled, cleaned, and reassembled in the clean room for final installation in the dewar. Simultaneously, work has been proceeding on the electronics. The printed circuit cards have been received and populated, and the electronics boxes have been fabricated. The backplane and heat sink have just been received, and will be installed in the electronics box in the next week.

[Photos not included]

Craig Danielson (Mechanical Technician) and Ken Hinkle (Phoenix Project Scientist) with the Phoenix dewar. The radiation sheilds and internal dewar supports are suspended by a crane over the dewar prior to being installed for a mechanical test fit of all the components.

Ken Hinkle is shown with the Phoenix dewar. The stepper motors and closed cycle refigerators have been installed on the outside of the dewar. Inside the dewar, the mounting surface for the foreoptics can be seen. On the mounting surface the filter/Lyot wheel and slit/CVF wheels are visible. The cabling visible in the dewar is for the wheel position sensors and the temperature sensors.

Phoenix now appears on the telescope schedule. 1 April is the first night on a telescope, but no data will be taken. This 24 hour block on the 2.1-m is to check the mechanical fit of the instrument and mechanical interface units to the telescope. We will try out all the handling equipment, connect all the required cables and cooler lines, and exercise as many functions of the instrument as are possible without having the instrument cold. For the large instruments cooled with closed cycle coolers (COB, SQIID, Phoenix), the instrument must be moved from the standby cooling station to the telescope in less than one hour. For the Phoenix test fit night we will learn how to get Phoenix on the telescope in the required time.

Extensive laboratory testing will be taking place in April after the mechanical fit run. First light is scheduled for 6-8 May. A second test run is scheduled in June. The major goal of these runs is system mechanical and optical testing. Assuming that no major problems are encountered, we should be able to produce sensitivity curves for the instrument by late June or early July. We are in the process of installing a Phoenix Web site available from the KPNO home page http://www.noao.edu/kpno/kpno.html. As calibration and test results are available, these, along with sample spectra, will be available on this Web site.

Phoenix Design Parameters

Telescope:	2.1-m only for fall semester 1996
Wavelength range:	1-5 um
Resolution:	2 pixel R = 100,000
Slit widths:	2 pixel = 0.74"
	3 pixel = 1.10"
	4 pixel = 1.46"
Slit length:	1' = 170 pixels
Slit orientation:	N-S, slit rotation not available with Phoenix on the 2.1-m.
Spectral coverage:	1024 pixels in the dispersion direction (no cross dispersion) = 0.0118 um at 2.3 um (22 cm sup -1 at 4350 cm sup -1)
Imaging mode:	available for acquisition, fov = 1' diameter
Guiding:	dichroic sends visible light to guide camera.

Offset guider will not be available on the 2.1-m.

Ken Hinkle

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IRIM Manual Updated (1Mar96)

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IRIM Manual Updated (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

The operating manual for IRIM has been expanded and updated to include more extensive descriptions of the instrument and operating procedures. Tracings for the filters are also included as an Appendix. This version 2.0 is presently available by anonymous ftp from ftp.noao.edu in the kpno/manuals subdirectory as irim.2.ps.Z. A small number of hardcopy manuals will be printed for use in the telescope domes.

Presently, the CRSP and IRIM manuals are available remotely only by anonymous ftp. They may be viewed on the WWW http://www.noao.edu/kpno/docs.html in PostScript format. We are in the process of converting these manuals to html format as well.

Dick Joyce

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Direct Imaging at the 2.1-m Returns (1Mar96)

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Direct Imaging at the 2.1-m Returns (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

[Figure not included]

Figure caption: This R band exposure shows an OB association in the nearby galaxy M 33; the images have a FWHM of 0.85". The data were obtained to distinguish red supergiants from foreground dwarfs using accurate broad-band colors.

Heavy oversubscription at the 4-m and WIYN has shut out many potential users interested in moderately high resolution imaging. Consequently, KPNO will again accept proposals for imaging at the 2.1-m telescope beginning with proposals (due 31 March 1996) for the fall 1996 semester. The equipment available will be exactly what was available in the past: the Tektronix 1024 x 1024 CCD (T1KA) plus an eight-position filter wheel for 2" x 2" filters. This CCD is probably the best CCD ever seen at KPNO, although the 1K format limits the field to 5' on a side.

The 2.1-m/T1KA offers a scale of 0.3"/pixel and good seeing, often subarcsecond (see image of M33 taken by Phil Massey). Contact us for further details about this system.

George Jacoby, Phil Massey

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Alternate Observing Update (1Mar96)

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Alternate Observing Update (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

Two new observing services were announced in the June 1995 NOAO Newsletter: an autoFTP queue for quickly distributing newly observed data across the Internet, and a remote observing console that provides access to audio, video, and computer based information while duplicating the IRAF/ICE observing environment that is used at the KPNO telescopes.

Since the start of the fall 1995 observing semester, six observing runs involving three separate observing proposals have benefited from using the autoFTP queue. Data from some of these runs were included in astronomical telegrams very soon after the runs were finished. If your observing program requires timely data analysis, or if you just want to streamline your observing operation, keep the autoFTP option in mind.

One observing team made use of the remote observing facilities last semester. These are based on normal Internet rlogin access, as well as on the MBONE multicasting clients 'vat' and 'nv', which provide audio and video access over a normal Internet connection. These tools can be used with others such as CU-SeeMe to provide scientific or educational conferencing connections to remote locations. While bandwidth is an increasing concern on the Internet, you may be surprised how little bandwidth is actually required.

During the spring 1996 semester, a staff team used IRAF/ICE remote observing over a five night period from the Kitt Peak 2.1-meter to the Coude Feed telescope in the same dome. These dual runs benefited from the simplified procedures and the reduced staffing that were permitted. This surely represents the shortest distance remote observing run in history!

As you fill out the observing run preparation form for upcoming runs, please take a moment to read through the alternate observing mode information that will also have been included in your packet. Consider whether the described services, or variations of these, may be of use to you in getting your science done. Contact rseaman@noao.edu with any questions.

Rob Seaman, Bruce Bohannan

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A New TAC Process (1Mar96)

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A New TAC Process (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

Several years ago the demand for dark time was largely composed of proposals for observations of faint extragalactic objects, while the bright time was primarily used for galactic objects and stellar evolution programs. Since a separation by lunar phase also separated the overall scientific areas of interest, KPNO convened two committees, the "Bright" TAC and the "Dark" TAC with different areas of scientific expertise to reflect this difference in demand.

The development of infrared arrays changed all this. We are now seeing many proposals in bright time that require expertise in extragalactic astronomy for proper evaluation. Similarly, the advent of wide field CCD detectors gave rise to programs in dark time that addressed problems in stellar populations in our own and nearby galaxies. The composition of the two committees rapidly changed to reflect this new demand, and both committees now have expertise in galactic and extragalactic astronomy. However, the two committees still retain the "Bright" and "Dark" names, and for the larger aperture telescopes the proposals seen by each committee are still sorted by lunar phase. This can cause some problems, particularly when a given program asks for dark time on one telescope and bright time on another. Moreover, having both galactic and extragalactic expertise on both committees means that this expertise must be spread rather thinly if each committee is to be an optimal size.

We have been aware of these problems caused by the evolution of the TAC process and have been exploring options for addressing them. An additional complication arises from the need to consider future demands on the TAC process, such as inclusion of Gemini programs and review of programs that may involve time at private observatories. Discussions on this complex topic have been held at a special AURA workshop last spring, with the combined KPNO/CTIO Users Committees during their fall 1995 meeting, and with each of the standing KPNO TACs. Options discussed ranged from maintaining the status quo to establishing many narrowly focused discipline-specific panels.

The general outcome of these discussions is one of evolutionary change with an eye to future demands. Thus for the fall 1996 semester there will again be two KPNO TACs, but they will be named "Galactic" and "Extragalactic," with expertise concentrated in the appropriate areas. The division between "Galactic" and "Extragalactic" is not always clear. In general "Galactic" will include objects in our galaxy and the Local Group. However, the Galactic committee will have general expertise in stellar evolution and stellar populations, so proposals that explore the evolution of stellar populations in distant galaxies, if done spectroscopically, could go to the "Galactic" TAC. However, stellar population studies at very high redshift that use wideband photometry with multiple bandpasses would probably go to the "Extragalactic" TAC. In order to assist us in sorting the proposals, the proposal form will be revised to allow you to pick the category in which you wish your proposal to reside. This change will not only allow for a better match of expertise to programs for each TAC, it will also allow one TAC to evaluate completely complex programs that require several telescopes at different lunar phases.

After the TAC review, the telescopes will be scheduled as before. We anticipate that the extragalactic programs will still demand most of the dark time, and that this lunar phase will, for most telescopes, be more heavily oversubscribed than bright time. Proposals with the highest TAC grade will be given preference in terms of lunar phase.

We hope this change in the TAC procedure will produce an improved review process. Please send us your comments on any aspect of our proposal review program. We will continue to monitor its performance and will make further changes in response to your comments and to changes in our users' needs.

David De Young

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Electronic Proposal Submission--The Latest Scoop (1Mar96)

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Electronic Proposal Submission--The Latest Scoop (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

As usual, we are encouraging all proposals for the upcoming semester to be submitted electronically, although (unlike HST) we are not actually requiring this. Last semester 90% of the proposals we received were sent via e-mail, and most users seemed to find this fun and convenient. On this end, we've encountered few problems, with the largest time waster being fixing the handful of proposals which were apparently never run through LaTeX and printed at the user's end. We do not guarantee to do this in the future, so make sure the proposal looks the way you want the TAC to see it before submitting it!

To submit an observing proposal here's all you have to do:

(1) Obtain the observing proposal package by e-mailing kpnoprop-request@noao.edu. You will have to fill out the LaTeX observing proposal template. Alternatively, these forms are available via anonymous ftp to ftp.noao.edu in the subdirectory kpno/kpnoforms/. You can similarly obtain the files via the World Wide Web. (The NOAO home page is: http://www.noao.edu). Examples of completed observing proposals and sample figures are also available at the WWW site as a guide.

(2) Fill out the LaTeX observing proposal template with a scientifically exciting, well-reasoned, and clear program. Include whatever figures are needed to make your case in the form of Encapsulated PostScript files. (See the example provided as part of the package.)

(3) If you are applying for WIYN time you will also need to fill out the queue-observing form, which specifies all the parameters necessary to carry out the observations (analogous to HST's Phase II proposal).

(4) Submit the observing form to kpnoprop-submit@noao.edu. You should immediately receive an acknowledgment message telling you what your proposal ID is. (If you don't, send e-mail to kpnoprop-help@noao.edu or give Judy Prosser a call at (520) 318-8279.) Included will be instructions for submitting the figures and/or queue observing form.

(5) Submit the figures and/or WIYN queue form following the instructions received in the acknowledgment. You should also receive acknowledgments for each of these.

(6) In the case of thesis students, the advisor should send the "thesis letter" via e-mail (also to kpnoprop-submit@noao.edu) explaining how the present proposal fits into the overall scheme of the thesis, what other observing time might be required, and so on. It would help if the proposal number given in the acknowledgment message above were mentioned.

Electronic submission of observing proposals has made our lives easier as well as making it easier for observers to submit their requests. We encourage everyone to submit their proposals in this way. Questions or suggestions for improving the process can be directed to: kpnoprop-help@noao.edu, or pmassey@noao.edu.

Phil Massey, Jeannette Barnes, David Bell,
Pat Patterson, Judy Prosser, Judy Roberts

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Submitting WIYN Observing Proposals: Updated Instructions (1Mar96)

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Submitting WIYN Observing Proposals: Updated Instructions (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

We are currently revising information about applying for WIYN observing time. Updates include: (1) revised information about estimating total program execution time, including observing overheads; (2) information about the new all-transmissive Bench Spectrograph (Red) Camera, currently being commissioned; and (3) more detailed instructions on specifying your target list on the WIYN queue observing (WIYNQ) form, which we hope will make this process easier, less time-consuming, and more flexible.

The new Bench Spectrograph Camera has significantly higher throughput than the Simmons camera when used with fibers at non-UV wavelengths, which should reduce required exposure times for many programs.

Given the WIYN oversubscription rate, prospective WIYN users considering submitting imaging proposals should consider whether applying for 2.1-m or 4-m time would be more appropriate. After a brief hiatus, CCD imaging at the 2.1-m will be offered again for the fall 1996 semester.

Further revised information will be available by 1 March 1996 on the WIYN queue observing program Web page (http://www.noao.edu/wiyn/queue). All prospective WIYN proposers are strongly urged to review this information before submitting WIYN proposals.

Dave Silva

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Simplifying the WIYN Queue Form (1Mar96)

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Simplifying the WIYN Queue Form (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

Since the spring 1995 semester, we have required that all WIYN proposals include a WIYN queue observing form. This form asks for a description of the proposed observing program, including variations from the published standard observing procedure. This information is intended to help us during the TAC process and while executing the queue.

Elsewhere in this Newsletter, you will read that the User's Committee has recommended that WIYN proposers do not submit their WIYN queue forms until after the TAC has met and ranked observing proposals. After careful consideration, we have decided that we cannot fully implement this recommendation--information contained on the queue forms is essential for evaluation of proposals by the TAC. However, as described below, we have tried to reduce the amount of requested information in order to minimize the effort involved.

The reasons that we need detailed information about the proposed observations during the TAC process are:

(1) having queue forms for all proposed programs allows us to resolve sample conflicts (e.g., multiple programs that want to observe the same fields using the similar Hydra configurations);

(2) we can avoid over-scheduling any given range of right ascension range and can populate the initial queue with programs requiring a range of observing conditions, with the result that on any given queue operations night we can use WIYN optimally relative to the actual conditions.

As the semester goes on, we construct estimated queue schedules for 4-6 weeks ahead and give PIs whose programs we might execute during that period a chance to update their queue forms. However, while observing, we have sometimes activated a lower ranked Imager program without interacting with the PI first simply by using the queue form initially submitted with the proposal. This has happened when we've had an unexpected technical problem at night which has disrupted our spectroscopic observing plan.

Despite these benefits, we recognize that some WIYN proposers feel that submitting a WIYN queue form is an unreasonable burden, especially given the large over-subscription rate. We hope the following instructions will lessen this burden:

(1) Please keep the benefits stated above in mind when filling out the form: we need enough information to evaluate your program fairly during the TAC process. But also keep in mind that, if you are allocated queue time, you will get the chance to revise your WIYN queue observing form, giving more information if necessary. So be as brief as possible without selling your program short.

(2) Explicit and detailed instructions on how to execute your program are not needed initially. Programs which adhere to the published standard observing plan do not have to provide additional commentary in the Observing Program section of the WIYN queue observing form. If you are allocated queue observing time, we will request a revised WIYN queue form later. However, if executing your envisioned program deviates enough from the standard observing plan that the time required to execute your program will be significantly increased, please explain that in the Observing Program section of the queue form. For more information about the standard observing plan and estimating observing overheads, please see our WWW queue experiment WWW page (http://www.noao.edu/wiyn/queue).

(3) If your program requires a specific set of objects, you must clearly justify this in the Science Justification section of the main proposal form. For example, you may need to observe M15 to test your hypothesis, and no other globular cluster will do. However, if you are awarded time in the queue but with relatively low grade, your objects may set before we make enough progress on higher ranked programs to schedule your program.

(4) On the other hand, many programs do not require specific objects but want to observe a representative set. For example, you might like to observe four Abell clusters but it doesn't matter which four clusters are observed. An example of a sample (e.g. "Cluster A, Cluster B, Cluster C, etc.") complete with typical instrument configuration information (filters, gratings, required exposure times, number of exposures, etc.) must be specified on the WIYN queue form. You should state clearly in the Scientific Justification and/or the Technical and Scientific sections of the main KPNO proposal form why your sample needs to be the size you propose. If you are allocated queue observing time, you will be asked to submit your real sample when (and if) your program is scheduled. However, if your modified object selection conflicts with objects and instrument configurations in a different program already reviewed by the TAC, you will be asked to select a different target or justify why we should repeat the observation for your program. Note that some sample flexibility will increase the probability that programs with lower TAC grades will be executed since they must be sheduled around programs with higher grades.

(5) A note to Hydra proposers: you do not have to specify the celestial coordinates of every object in every configuration on your WIYN queue observing form. You merely have to tell us the approximate celestial coordinates of the field centers of each proposed configuration.

Examples of simple but acceptable WIYN queue observing forms may be found on the WIYN queue observing experiment WWW page (http://www.noao.edu/wiyn/queue).

Dave Silva, Dave De Young, Dianne Harmer

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Instruments Available on Kitt Peak Telescopes: Fall 1996 (1Mar96)

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Instruments Available on Kitt Peak Telescopes: Fall 1996 (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

The instruments listed below will be available for visitor use on KPNO telescopes during the August 1996-January 1997 observing semester. Proposals for this period are due 31 March 1996. Visitor instrumentation is welcome at KPNO and can be scheduled if the instrument: 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.

```
4-m Telescope:
        R-C Spectrograph + CCD (T2KB)
        Echelle + UVFast, Red Long, or Blue Long Camera + CCD (T2KB)
        PF Camera + direct CCD (T2KB)
        IR Cryogenic Spectrometer (CRSP)
        IR Imager (IRIM)
        CryoCam (with 800 x 1200 Loral chip)
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WIYN Telescope:
        Hydra + Bench Spectrograph (T2KC)
        CCD Imager (S2KB)

2.1-m Telescope:
        Direct Camera + CCD (T1KA)
        GoldCam CCD Spectrometer (F3KA)
        IR Cryogenic Spectrometer (CRSP)
        IR Imager (IRIM)

Coude Feed:
        Coude Spectrograph + Camera (5 or 6) + CCD (F3KB)
        NICMASS HgCdTe Array + Camera 5 (Shared Risk)

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

Burrell Schmidt:
        Direct or Objective Prism + CCD (S2KA)

Sidney Wolff

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Photometric Calibration Program (1Mar96)

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Photometric Calibration Program (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

Have you recently used one of our telescopes to collect data that was compromised by non-photometric conditions? If so, there is an experimental program to have those fields calibrated for you.

Ralph Shuping (University of Colorado, Boulder student) will be observing for one week (1-7 April) at the KPNO 0.9-m telescope to provide service observing strictly for the purpose of post-calibrating KPNO data. We see this as an effective use of a small telescope whereby the value of large (or small) telescope data becomes greatly enhanced when photometrically calibrated. We also will consider post-calibrating non-NOAO data as well, but at a lower priority.

If you wish to take advantage of this program, please send a letter or e-mail message to Sidney Wolff swolff@noao.edu briefly describing your original program and your photometric requirements. Ralph will contact you later to obtain details of the project.

George Jacoby, Bruce Bohannan,
John Stocke (Colorado)

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Trillions and Trillions Saved (1Mar96)

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Trillions and Trillions Saved (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

The NOAO Save the Bits archive passed the one Terabyte milestone on 4 December 1995 at 23:47 MST. The lucky observer was Brian Rachford (Wyoming) who was observing an H II region at the Coude Feed with a grism cross disperser, camera 5 and F3KB.

KPNO archiving began on 20 July 1993 with the pilot queue observing program at the 2.1-m telescope. Data from 8 separate telescopes and 12 different data acquisition computers have been multiplexed over the network onto a single archive medium in the Kitt Peak Administration building. Dual exabyte 8505 format copies are recorded of data from KPNO, WIYN, and NSO nighttime instruments. FITS header information is separately recorded and cross referenced to the data tapes allowing a simple retrieval program to access any archived image within about ten minutes.

Image statistics for 1995 are provided in the table with the 1994 and grand totals for comparison. The addition of WIYN data to the archive data stream (partially offset by the removal of 1.3-m and nighttime McMath-Pierce data) should raise the science total for 1996 alone past the 1/2 Terabyte level. A few calculations may help visualize the size of this number:

(1) 1/2 Terabyte = 1/4 trillion pixels = one image 500,000 pixels square.

(2) A 500,000 square CCD chip with 21 um pixels would be 10 meters on a side.

(3) If it takes 2 minutes to read out a 2048 x 2048 CCD at a nominal gain through one amplifier, it would take 80 days to read out a CCD this size.

(4) 1/2 Terabyte/year = 16 Kilobytes/second. The archive could keep eleven 14400 baud modems busy 24 hours a day, 365 days a year.

Over the last two years, about two dozen requests for archive data have been received. The majority of these come from observers who have suffered data disasters of various sorts and need to recover the original data from their observing runs. A growing fraction of the requests support science that is independent of the original observing proposal (at the Director's or original observer's discretion).

Save the Bits is an ongoing project. The software is simple to install and is available to outside sites (e-mail rseaman@noao.edu for details). The W.M. Keck Observatory has been relying on their own Save the Bits installation since February 1995. An installation is pending shortly at CTIO. The next phase of the project at KPNO is to ingest the FITS header catalog (currently itself about 2 Gigabytes in size) into a relational database with a Web browser front end (using the WDB interface from CADC/ESO).

NOAO Archive Statistics by Telescope for 1995

Telescope	Total Images		Object Exposures		Calibrations	
	Number	Mbytes	Number	Mbytes	Number	Mbytes
Mayall 4-m	58,530	64,982	49,559	31,843	8,971	33,141
WIYN	11,854	70,960	5,211	22,939	6,643	48,022
2.1-meter	71,802	43,283	54,352	23,108	17,450	20,177
Coude Feed	27,223	28,454	12,871	11,932	14,352	16,525
McMath	25,364	2,622	10,005	1,199	15,359	1,421
*1.3-meter	20,842	5,308	18,436	4,687	2,406	621
0.9-meter	21,843	124,323	12,201	66,906	9,642	57,415
Schmidt	23,520	129,720	13,813	64,008	9,707	65,713
1995 Total	260,978	469,652	176,448	226,622	84,530	243,035
1994 Tota	275,850	442,023	173,903	223,121	101,947	218,915
Nightly	650	1,166	413	567	237	599
Total to Date	581,584	1,042,040	369,059	506,662	212,525	535,397

* The Kitt Peak 1.3-m IR telescope was retired in May 1995. Final data were archived on 28 March 1995.
o Nightly and total to date represent 894 calendar days between 20 July 1993 and 31 December 1995.
o WIYN archiving began officially on 9 August 1995.
o About 45,000 GOES weather pictures and 10,000 WIYN commissioning images are not shown here.
o By number, 63% of the images are object exposures. By data volume in Mbytes, 49% are objects.
o IR data are about 50% of the exposures, but 5% of the data volume.
o The smallest image archived is 0.01 Mbytes, the largest 72.52 Mbytes.
o The 1,000,000,000,000th byte was archived at 11:47 pm on 4 December 1995.

Rob Seaman

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Bring an Undergraduate to Observe at Kitt Peak! (1Mar96)

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Bring an Undergraduate to Observe at Kitt Peak! (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

The National Science Foundation has provided funding to NOAO/KPNO to support travel and room and board for undergraduate students to participate on observing runs at Kitt Peak. Education, particularly science education, is an important national priority, and astronomy is of special interest in the context of science education because it quickly captures the imagination of students and draws them in to the study of science. Observing trips to Kitt Peak during the academic year provide an exciting opportunity to involve students in research. There is no better way than a visit to a working observatory to interest and encourage undergraduate students to appreciate and to study science. This opportunity is not limited to physics or astronomy students; capable and interested students from all disciplines are welcome.

If you would like to bring an undergraduate student along on your observing run to Kitt Peak, please send a letter to me when you submit your Observing Run Preparation Form, or send e-mail to kpno@noao.edu. The letter should describe the student and his or her involvement or interest in astronomy, and should request travel support, if needed. The NSF funds should be sufficient to support approximately 10 students during the 1995-96 academic year.

Sidney Wolff

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Increase in Kitt Peak Lodging (1Mar96)

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Increase in Kitt Peak Lodging (1Mar96)
(from KPNO, NOAO Newsletter No. 45, March 1996)

Effective 1 February 1996, the price for lodging and meals on Kitt Peak has been increased from $50.00 per night (single occupancy) to $55.00 per night. A double room is $53.00 per person per night. This information was included in letters to the principal investigators allocated observing time in the spring 1996 semester.

The cost of providing meals and lodging to our visitors has been steadily increasing since they were last raised on 1 October 1992, and we are, unfortunately, forced to raise our rates.

The new dorm and meals charges are as follows:

Dormitory Rooms (price includes all meals)

Single Occupancy	$55.00 per night
Double Occupancy	$53.00 per night

Meals Only (for those not requiring lodging)

Breakfast	$ 5.50
Lunch	$ 8.00
Dinner	$10.00
Night Lunch	$ 6.50

Sidney Wolff

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From the NSO Director's Office (1Mar96)

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From the NSO Director's Office (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

Jack Zirker, Astronomer Emeritus

Jack B. Zirker donned the robes of astronomer emeritus on 1 January 1996. In addition to his prominent scientific career, Jack played a pivotal role in the evolution of the solar facilities on Sacramento Peak and in the formation of the National Solar Observatory.

Jack first came to Sunspot in 1954 as a summer student. He received his PhD from Harvard in 1956 for investigations in collaboration with R.N. Thomas and R.G. Athay on the temperature structure of the chromosphere and lower corona derived from non-LTE analysis. During the years 1956-1964 at Sacramento Peak, Jack's work included elucidating the properties of photospheric filigree, a fine-scale magnetic structure discovered by R.B. Dunn. Between 1964 and 1976, Zirker was a professor at the University of Hawaii and participated in the development of Mauna Kea as an observing site.

Jack returned to Sunspot in 1976 to assume the directorship of the Sacramento Peak Observatory, which had just been transferred from the US Air Force to the National Science Foundation. His leadership was strongly felt during those years of transition and re-orientation. In the early 1980s, Jack was instrumental in the formation of the National Solar Observatory as a consolidation of SPO with the solar section of the Kitt Peak National Observatory and, shortly thereafter, as a division of NOAO.

Jack Zirker's broad scientific interests are reflected in over a hundred scientific papers and several books, including a well-known monograph on solar eclipses and a recently-completed biography of Robert Dicke. His research has included mechanisms of coronal heating, the physics of prominences and their fine structure, flare mechanisms and energy distribution, and the use of non-redundant arrays for high-resolution imaging.

We'll miss Jack's energetic leadership within NSO, but we look forward to the continuing opportunity to benefit from his scientific insight and enthusiasm.

Other Transitions

John Varsik joined NSO on 1 October 1995 as a Research Associate at Sacramento Peak. John's mini-bio is included below in the "Who's Who among the NSO Postdocs."

Trudy Tilleman has executed a nimble lateral move within NSO. Following the conclusion of her observing responsibilities for the synoptic solar-stellar program at the McMath-Pierce Telescope, Trudy signed on as an observer at the Orbital Debris Observatory in Cloudcroft, which NSO/SP is operating for NASA.

Senior engineer Glenn Spence has renewed his association with NSO/SP on a part-time basis. In a sign of the times, computer specialist Neil Jones is working part-time on some of the NSO Web pages completely over the network from his base at Caltech.

Nonprogrammatic Observing at NSO Telescopes

The McMath-Pierce solar-stellar program closed as of 1 January 1996 and is no longer part of the overall NSO program. Some members of the solar-stellar community have asked whether limited observing opportunities can still be made available. The answer is that, as with other nonprogrammatic observing, application may be made to the NSO Telescope Allocation Committees. However, because nonprogrammatic observations have no NSO operators, technical support, or money normally assigned to them, the TAC will only consider proposals that identify an extraordinary scientific opportunity that can only be exploited at an NSO telescope.

Lodging and Meals on Kitt Peak

Please note that the price of lodging and meals on Kitt Peak has been increased (the last increase was in 1992). Details are given in the KPNO section of this Newsletter.

Doug Rabin, Acting Director

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Report of the NSO Users' Committee (1Mar96)

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Report of the NSO Users' Committee (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

Introduction

The committee met at Sacramento Peak on 2 and 3 November. Attendees were Drake Deming, Bruce Lites, Dick White, Ernie Hildner, Steve Keil (for Rita Sagalyn), Seth Tuttle, Jacques Beckers (NSO Director), Steve Saar, David Rust (Chair), Tuck Stebbins, and Doug Rabin (Acting NSO Director). Dick Fisher was unable to attend. Presentations were made by Doug Rabin (Director's report), John Leibacher (Extended GONG, Global Oscillation Network Group), Christoph Keller (SOLIS, Synoptic Optical Long-term Investigations of the Sun), Haosheng Lin (PSPT, Precision Solar Photometric Telescope), Jacques Beckers (CLEAR, Coronagraphic and Low Emissivity Astronomical Reflector), and Jeremy Wagner and Rex Hunter (current projects). The focus of the meeting was on planning for future scientific work in a period of declining budgets. Background reading for the meeting included the NSO "Outline of a Program for the Understanding and Prediction of Solar Variability" (the Future Directions Plan), the NOAO Long Range Plan, and the draft SOLIS proposal. The committee feels that NSO is at a crossroads where it must decide on its priorities for the future. Should there be a big, general-purpose telescope, a global network and an array of monitoring instrument? Can we have all these? Do we need all these? Also, because of the indefinite delay of the Large Earth-based Solar Telescope, the threatened closure of the Big Bear Solar Observatory, and planned or in-progress studies of NSO' future by AURA and the National Academy, we felt it was imperative to review proposed NSO initiatives and to put the Users' Committee's views on record. Since it seems unlikely that all the proposed programs can be implemented in the near future, the committee made several recommendations that are intended to help the NSO management satisfy the needs of most of its users.

Kudos

We commend the NSO staff for its creativity and energy in developing exciting new instrumentation during these difficult times. We also commend the GONG project team for the exemplary construction, deployment and successful initial operation of the Network. We feel that the work of the Sacramento Peak staff to digitize the SP spectroheliograms represents a valuable contribution to the study of solar variability. The work of J. Elrod, T. Brown, L. November, R. McGraw and T. Henry has created a digitized data base of high-resolution Ca II K full-disk images, and these efforts are very much appreciated. We were pleased with the greater effort being made by the Project Review Committee to set realistic goals and to monitor progress in the many projects under way.

Findings

We find that there is a continued, strong interest by a wide range of users in very high resolution observations at the Vacuum Tower Telescope. The committee strongly endorses the recent broadening of approaches to image quality improvement there and at the McMath-Pierce Telescope, and it reiterates its long-standing interest in seeing the adaptive optics project pursued intensively.

We find that the science objectives of the SOLIS proposal to modernize and greatly upgrade the synoptic observations program are an excellent response to the goals of NSO users. We recommend that sources of funding be sought aggressively so that SOLIS can be started. NOAO restructuring funds from NSF and support from other agencies should be sought in the immediate future so that SOLIS will be operational by the next solar maximum.

We find that the science justification for CLEAR has not been made compelling. Any eventual proposal to build the next generation telescope should be based on a well-developed science plan and should be integrated with other NSO initiatives. NSO should concentrate on studying the technical challenges of the next generation multi-purpose solar telescope. Currently identified technical challenges include adaptive optics, superpolished mirrors, temperature and dust control, and infrared techniques. Current NSO assets should serve as test beds to demonstrate the needed technologies.

The McMath-Pierce Telescope can serve as an IR and temperature control testbed, the AO program at the VTT should demonstrate the feasibility of adaptive optics, and the Mirror Advanced Coronagraph (MAC) should be used to demonstrate dust control and superpolishing technology. An operational MAC could also help clarify science issues surrounding the scientific objectives for CLEAR as a solar coronagraph.

The Committee understands that the one-year effort, led by Jacques Beckers while on leave from the NSO Director's post to study CLEAR, will result in assessments of the technical feasibility, the desired characteristics of the instrument, and the scientific justifications driving the choice of the telescope's parameters.

We are not sure that all the proposed and ongoing projects can be started and/or completed in the near future, so we suggest that NSO management develop timelines for current and future project implementation that will accurately reflect not only the fiscal realities and manpower available but also the scientific priorities of the NSO users and staff.

Recognizing the present difficult fiscal climate, but cognizant of the strong synergy between solar and stellar physics and the importance of the stellar community's support for the next generation solar telescope, we recommend that the NSO continue to engage the stellar community, help work towards finding alternate means for reinvigorating the successful solar-stellar program at the McMath-Pierce Telescope, and continue cooperation on future telescope projects.

Conclusion

We urge the solar community to help us and the NSO management plan for the future. In light of the on-going AURA scientific advisory committee ("Walker committee") study and a possible NAS study of ground-based solar physics, it is particularly important to develop ideas and try to attain a consensus on the future scientific goals and activities of the NSO. We urge you to review NSO's plans (available from the NSO WWW pages or from the NSO Director) and let us and/or the NSO management hear your views.

D. M. Rust, Chair

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Who's Who Among the NSO Postdocs (1Mar96)

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Who's Who Among the NSO Postdocs (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

Sydney D'Silva received his PhD from the Indian Institute of Science in Bangalore, India. His thesis topic was on the "Dynamics of Rising Magnetic Flux Tubes in the Convection Zone of the Sun." Sydney is a theorist, working in Tucson, who is currently devoting his efforts toward a deeper understanding of the structure and formation of magnetic fields in the deep interior of the Sun, through magnetohydrodynamic and helioseismic studies. His work has included explaining the dynamics of sunspots and studying the accretion of magnetic flux tubes within accretion disks around black holes; his recent work is on the theoretical aspects of time-distance helioseismology and helioseismic tomography. These represent new approaches to the study of the solar interior that complement conventional helioseismology.

Yuhong Fan received her PhD in Astronomy in October 1993 at the Institute for Astronomy, University of Hawaii. Her dissertation was on the numerical simulations of the dynamic evolution of emerging magnetic flux tubes in the solar convection zone. As a postdoc at NSO/Tucson, Yuhong has continued her collaboration with G. Fisher (UC Berkeley) to carry out theoretical modeling of the buoyant rise of thin magnetic flux tubes from the base of the solar convection zone to the solar surface, and to compare the properties of the emerging flux tubes with the observed properties of sunspot groups and active regions. In addition, Yuhong is collaborating with D. Braun (SPRC/NSO) and D.-Y. Chou (National Tsing-Hua Univ., Taiwan) in the modeling of the scattering of solar acoustic waves by localized magnetic inhomogeneities (such as sunspot flux tubes). The primary goal of this effort is to interpret the observational results of acoustic scattering by sunspots and hence to infer the subsurface conditions of these magnetic structures.

Yeming Gu received his PhD at the Physics Department of the University of Arizona in 1992. His thesis topic in solar seismology was entitled "Inverse Problem with Continuous Parameters for Solar Oscillations." Yeming's current research interests include stochastic radiative transfer and its applications to the solar atmosphere, solar seismology and data analysis. In collaboration with John Jefferies, Charles Lindsey, and E. H. Avrett, he is currently working in Tucson on the interpretation of continuous infrared and microwave data from the Sun using a stochastic two-component model for the solar atmosphere. The work is a new approach to solar atmospheric modeling. It utilizes the center-to-limb data in the spectral range 2-1200 um as a powerful diagnostic tool for inhomogeneous structures in the low solar atmosphere.

Haosheng Lin received his PhD from Michigan State University, working with Jeff Kuhn on problems related to solar irradiance variability, solar vector magnetic field measurements, photometric detection schemes, and IR array instrumentation. Haosheng spent two years at Caltech and Big Bear before coming to NSO/SP. He is presently supported by the RISE project and maintains active observing programs at the VTT (IR measurements of the photospheric magnetic field) and the Evans Facility (coronal spectral observations).

Louis Strous received his PhD from Utrecht University in 1994. He developed new methods for the measurement of horizontal flows in the solar atmosphere and applied his measurements to the identification and interpretation of magnetic-flux emergence and evolution. Louis worked in collaboration with Kees Zwaan, his thesis advisor, and with the Lockheed Palo Alto Research Laboratory. Presently resident at Sacramento Peak and supported by the New Jersey Institute of Technology, Louis is working with Phil Goode and Tuck Stebbins on observations that try to identify the sources of acoustic flux responsible for the global helioseismic p-modes.

John Varsik received his PhD from the University of Hawaii in 1987, working with Jim Heasley on variability in the K-line in F stars. For his thesis he studied stellar activity versus age in F and G stars. After receiving his PhD, he went to Big Bear Solar Observatory as instrumentation scientist. There he obtained expertise in the operation, calibration, and scientific interpretation of solar vector magnetic field measurements. John's observational interests include solar oscillations in the K-line and chromospheric acoustic waves, and solar polar magnetic fields. His activities at NSO/SP include quantitative measurements of airborne particulates in support of the CLEAR study.

[Photos not included]

Tucson Postdocs Yeming Gu, Sydney D'Silva, Yuhong Fan

Sacramento Peak Postdocs Haosheng Lin and John Varsik

Mark Giampapa, Larry November

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Window Cooling Improves Optical Performance of the Sac Peak VTT (1Mar96)

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Window Cooling Improves Optical Performance of the Sac Peak VTT (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

Over the past two years a series of experiments has demonstrated conclusively that temperature variations across the entrance window of the VTT seriously degrade its imaging performance. These optical aberrations arise from temperature-induced changes in the index of refraction in the fused quartz window, and are particularly severe around its edge. During the past several months a new system for controlling these temperature variations has been installed and tested. This system includes five temperature sensors, a high-capacity cooling loop, and a sophisticated control concept, all of which represent a significant advance over previous attempts to control the optical figure of the window. A series of interferograms recorded recently over several days and a variety of conditions show that the uniformity of the temperature across the window is now maintained to a few tenths of a degree, whereas the variation in the uncontrolled window can amount to several degrees. A preliminary examination of these interferograms shows that the residual wavefront errors are now a fraction of a wave, compared to several waves in the uncontrolled window.

Dick Dunn, Richard Radick, Thomas Rimmele

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Fourier Transform Spectrometer Update (1Mar96)

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Fourier Transform Spectrometer Update (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

The NSO Fourier Transform Spectrometer (FTS) is a 1-meter path difference folded Michelson interference spectrometer that can provide spectral wavenumber resolution of 0.005 Kayser (wavenumber) in single-pass mode, or 0.0025 Kayser in double-pass mode. The usable spectral range is 220 nm to 18 um, and the instrument can be used in conjunction with either the McMath-Pierce solar telescope main beam, east auxiliary telescope, or laboratory sources. This versatile instrument contributes substantially in the areas of solar physics, terrestrial atmospheric chemistry, and atomic/molecular physics. The breadth of the FTS is illustrated by the following list of observing runs for the January-March 1996 quarter:

"Prominence Electric Field Measurements in H I 10.503 um," P. Foukal

"Laboratory Spectroscopy of Molecules Found In The Sun," P. Bernath

"Long-Path Laboratory Measurments of Infrared Spectra of CO sub 2 and H sub 2 O" M.A. Smith

"Monitoring of Long-Term Trends in the Concentrations of Atmospheric gases from McMath FTS Solar Spectra," C. Rinsland

"Infrared Half-Widths and Shifts of Methane," J. Margolis

"Temperature Dependence of Oxygen Broadening of Nitric Oxide HNO sub 2 Line Intensities," C. Chakerian

"Laboratory Measurements of Diatomic Metal Oxides and Metal Hydrides," L. O'Brien

"Laboratory Infrared Spectroscopy," L. Brown

"Laboratory Spectroscopy," R. Toth

In April, the FTS will be upgraded with a modern A/D converter. This will replace an aging electronic component that is becoming difficult to maintain, and will improve the data by reducing the amplitude of "ghost" fringes. In addition, the A/D will be coupled with a PC and a DSP (Digital Signal Processing) board that will enable a larger suite of electronic filters to be applied to the data stream.

Recently, NSO (along with a group of FTS users) was successful in proposing to the NSF chemistry division for support of the FTS laboratory program. One result has been the hiring of Michael Dulick, an experienced FTS scientist who will provide support for observing runs as well as further develop the McMath-Pierce FTS and strengthen its scientific program.

We welcome the submission of proposals to use the unique capabilities of the FTS.

Frank Hill

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A New Guider and Control System for the Kitt Peak Vacuum Telescope (1Mar96)

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A New Guider and Control System for the Kitt Peak Vacuum Telescope (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

As part of an NSO-wide program to improve image quality, the replacement of the 22-year old control and guiding system of the NSO/KP Vacuum Telescope is underway. The maintenance of the current system has become difficult, and the guider no longer functions properly in some operational modes or in light clouds. Recent magnetograph comparisons indicate that spurious image motion is a serious problem for overall magnetic calibration and highlight the importance of accurate polarimetry. Thus the new system will also include a fast guider mirror to remove image jitter from wind vibration and mechanical sources. The software, data control computer, and ancillary electronic systems will be completely replaced to eliminate the ancient PDP 11/73/FORTH/CAMAC system.

The conceptual design calls for replacing the existing limb guider/translation stage system at the KPVT with a modern system coupled to a fast guider mirror. Image motion compensation will be done by remounting the #4 mirror so that it can be tilted rapidly. The error signal for control of the mirror will be derived from motion of the guider image. The servo loop will be closed by means of an existing laser system that locks the main and guider beams together. The motion compensation phase of the KPVT upgrade is partially supported by NASA.

Engineering tests to confirm the feasibility of the jitter compensation design were completed in early FY 1995. The first construction phase of the project was to upgrade the mechanical drive assemblies at the #2 mirror and was completed in November 1995. The fabrication of the mechanical components of the #4 mirror mount is nearly complete. Installation of the new mount is planned for early spring 1996. The electrical, mechanical, and software designs for the guider are expected to be complete and ready for fabrication and coding by early summer 1996.

Jack Harvey, Harry Jones, Jeremy Wagner

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NSO Telescope/Instrument Combinations (1Mar96)

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NSO Telescope/Instrument Combinations (1Mar96)
(from NSO, NOAO Newsletter No. 45, March 1996)

Vacuum Tower Telescope (SP):
- Echelle Spectrograph
- Universal Spectrograph
- Horizontal Spectrograph
- Universal Birefringent Filter
- Fabry-Perot Interferometer Filter System
- Advanced Stokes Polarimeter
- Slit-Jaw Camera System
- Correlation Tracker
- Branch Feed Camera System
- Horizontal and Vertical Optical Benches for visitor equipment

Optical Test Room

Evans Solar Facility (SP):
40-cm Coronagraphs (2)
30-cm Coelostat
40-cm Telescope
Littrow Spectrograph
Universal Spectrograph
Spectroheliograph
Coronal Photometer
Dual Camera System

Hilltop Dome Facility (SP):
H Alpha Flare Monitor
White-Light Telescope
20-cm Full-Limb Coronagraph
White-Light Flare-Patrol Telescope (Mk II)
Sunspot Telescope
Fabry-Perot Etalon Vector Magnetograph
Mirror-Objective Coronagraph (5 cm)
Mirror-Objective Coronagraph (15 cm)

McMath-Pierce Solar Telescope Facility (KP):
160-cm Main Unobstructed Telescope
76-cm East Auxiliary Telescope
76-cm West Auxiliary Telescope
Vertical Spectrograph: IR and visible gratings
Infrared Imager
Near Infrared Magnetograph
1-m Fourier Transform Spectrometer
3 Semi-Permanent Observing Stations for visitor equipment

Vacuum Telescope (KP):
Spectromagnetograph
High-l Helioseismograph

Razdow (KP):
H Alpha patrol instrument

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Global Oscillation Network Group (1Mar96)

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Global Oscillation Network Group (1Mar96)
(from GONG, NOAO Newsletter No. 45, March 1996)

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

[Figures not included]

The principal technical objective of GONG is to obtain high fidelity measurements of the globally resonant pressure mode oscillations, which are corrupted by the day-night cycle from single-site observations. The artifacts from these nightly data drop outs are apparent as sidelobes in the temporal power spectrum at multiples of 1/day (~ 11.5 mu hz) surrounding each of the 10 solar frequencies.

The left panel shows the temporal power spectrum of the observing window (set to 1 when the Sun was visible, and 0 when it was not) from a single GONG site for the first three months of full six-site observations. The noxious sidelobes are readily apparent. The right panel shows the spectrum of the observing window for the full network. The height of the first sidelobe is reduced by more than a factor of 4000. It's hard to say, as they are invisible! The overall background is substantially reduced as well and, at least for the network's first quarter, our hopes have been realized.

Overview

All six of the field stations have been operational since early October. The Sun is shining on GONG well in excess of 90% of the time, and the instruments have been remarkably trouble free. Routine preventative maintenance is underway, and the support from our hosts at the sites has been truly superb. Thank you one and all!

The prototype instrument has moved into its role as a ground simulator to facilitate the training of staff for field maintenance activities, the testing of improved hardware and software, and bug fixes. It is being used for preliminary seeing tests to evaluate the feasibility of utilizing a 1024 x 1024 pixel format camera. Plans are continuing to work toward developing this system as a retrofit to the field stations, as are the efforts to extend the observing run to include an 11-year solar cycle--which has been recommended as a high priority by a recent NAS report.

The network operations and data management groups are working into the routine of collecting and processing data at the rate of over a gigabyte a day. While each day turns up some new challenge, the work is going well and the network is returning excellent data. We are basically keeping up with the flow of operational issues, and the data flood. The fifth month of network data is currently being merged. There have already been 155 distributions of mode frequencies, and other data products, to the community.

The Inversions, Models, and Nearly Steady Flows and Magnetic Fields Teams met for a week in Tucson, in December. The Inversions and Models Teams will meet again in Boulder in February, preparing the first results for publication and presentation at the Annual GONG Meeting, which is to take place just following the AAS and Solar Physics Division meetings in Madison in June.

Network Operations

As of late January, the full GONG network had been operational for nearly four months, with one station approaching its first anniversary. The operations group is splitting its attention between day-to-day monitoring of the network, preventive maintenance trips, and minor "system improvements," which a truly cynical reader might choose to interpret as "bug fixes." All in all, we are very pleased with the maintainability of the network at this early date. As always, we owe much of our success--and none of our performance short-comings--to the dedicated folks at our host sites around the world.

Duty Cycle and Down Time

The first 95 days of network operations have produced a duty cycle for the combined network that is right in line with the predictions of the site survey, with little instrumental down time. This is an excellent season for the network, however, with the solid weather and long austral summer days at CTIO and Learmonth, Australia carrying much of the load while the rest of us plod through our typically cloudy winter season. The down-time statistics so far seem almost too good to be true; we know we are always one good disaster away from a big swing in our fortunes.

From the operations point of view, the best (and most readily available) parameter for determining whether an instrument was observing or not is the "guider on flag." This flag will be true whenever an instrument is locked on the Sun, and false otherwise. These flags (and many other instrument parameters) are recorded at one-minute intervals for each station in the network. From this information we are able to compile a table for the entire network showing minute by minute whether at least one of the six instruments is observing the Sun. For the first 95 days of full-network operations, the duty cycle thus obtained is just under 96%. The longest uninterrupted interval is 186 hours, and the longest dark interval is a bit over nine hours. These numbers are probably a bit overly optimistic because some images that were taken under marginal conditions may yet be rejected in the merge process. As more data are reduced, we will probably have a better idea what sort of statistical correction factor should be applied to the guide flag results.

The guide flag does not distinguish between the various reasons for an unlocked guider, however. A particular instrument may be inoperative, the sky may be cloudy, "telemetry" may be temporarily missing from the Tucson database, or it might just be dark outside. Although the network duty cycle is of paramount importance to the science being done with these images, the team charged with running the network is most interested in the fraction of our down time caused specifically by instrumental problems. They can't fix the weather, but we still labor under the assumption that we can affect instrument reliability. In order to come at the reliability issue, they currently depend on our service log. Every anomaly noted in the operation of the network causes a numbered service entry to be generated, and all correspondence relating to that problem is filed under that designation. Service entries might be generated as a result of electronic mail or phone calls from the on-site personnel, from our daily site checks, from review of the current or previous day's "telemetry," or from the data reduction people. The first 95 days of full network operations produced 107 such entries, though the vast majority of these were not associated with any actual loss of data. (This works out to about one a day, although any of us who have ever worked the duty responder's desk knows that the distribution of trouble calls is far from uniform; some days are better than others!) From a careful review of this information source, it seems that--in round numbers--we have lost about 2500 images due to instrumental problems out of a possible 300,000. (The accompanying table breaks this down in more detail.) This works out to less than one percent loss due to instrumental down time, and many of these gaps were likely filled by other sites able to observ the Sun during those periods. We do not have a good estimate at this time of how often the whole network was compromised by the failure of one or more instruments, but the result will be smaller still.

It should be noted that these figures do not include scheduled down time for preventive maintenance (every six months for a week to ten days). Further, other data has been compromised, notably the Mauna Loa data, which were taken at reduced intensity over the past few months because of an aging prefilter (see Chronic Problems below). It remains possible that some or all of these images will yet be rejected in the merge process.

Lost images (approximate)	Cause
60	Hung data computer and shelter network.
360	Late starts in the morning due to intensity threshold problems, in turn caused by a prefilter drifting slowly off band.
60	Magnetogram timing bug (occurring intermittently at all sites).
90	Hung bus (occurring intermittently at all sites).
1200	Late starts due to bad configuration parameters in the acquisition algorithm.
20	Roll-turret oscillations after late afternoon magnetograms.
180	Wave-plate re-synchronization (occurring intermittently at all sites).
120	Window-cleaning bug (software didn't anticipate people who work after dark).
240	Waiting for the Lyot/Michelson oven to heat up after an extended shutdown during bad weather.

Chronic Problems

Careful analysis of the service records also shows a number of chronic problems with the instrument that, although they are not causing large blocks of lost data, are a major annoyance to the operations staff and to our friends in the field. First among these continues to be problems relating to the Exabyte tape drives. Our current strategy treats the four tape drives as two banks of two drives each, designated "primary bank" and "secondary bank." Under normal conditions the primary bank writes two tapes in parallel, one of which will be mailed to Tucson at week's end, with the other stored on site in case of problems shipping or reading the first. If either of the drives in the primary bank encounters a problem, the entire bank is marked inoperative, and the secondary pair is brought into service. This happens somewhere in the network about once a week on average. The advantage to this approach is that tapes always exist in identical pairs, greatly reducing the confusion factor both for ourselves and for the people in the field. The disadvantage is that a second failure will now render us dataless, even though there are likely two good drives in some combination available in the rack. We have had one double failure so far, but "doomsday" occurred before first lighit the next day. It is just a matter of time, however.

Another chronic problem relates to our 5 Angstrom prefilters. Three of the filters currently in service are state-of-the-art, ion-assisted filters that are proving to be very stable, with passbands that are virtually independent of operating temperature within reasonable operating parameters. Three other filters, however, are still of the conventional type of two-cavity interference filter, which have a tendency to absorb moisture and drift inexorably blueward. Although operating the filter at a higher temperature can temporarily bring it back on band, this only accelerates the aging process in the long run. We have just received more ion-assisted filters. In the mean time, two of the instruments--Mauna Loa and CTIO--have suffered to some degree from this malady. The net result is a decrease in over-all intensity, a reduction in modulation efficiency, and a likely increase in sensitivity to spurious velocity signals as our absorption line finds itself on the sloping wing of the passband.

We are also struggling to refine some operational procedures relating to foul weather. We have now suffered a direct hit from a cyclone at one site, and several bouts with ice storms at a second. The current procedure calls for the powering off the instrument under these conditions so that the turret can be secured under a protective cover until the danger has passed. Our original procedures called for the power to most elements of the instrument to remain off for the duration of the storm. In one case this caused a prolonged warmup delay after the weather had cleared, prompting us to change the procedure to keep the filter oven powered up on the reserve battery system (UPS) until commercial power can be restored. In all cases, our current "heavy weather" procedure still calls for steps which disable the weather station, denying us this important information just when it is of prime interest! We hope to resolve this so that next time we can know the exact moment and wind speed when the anemometer is finally destroyed. Inquiring minds want to know.

Preventive Maintenance

The project's baseline plan calls for preventive maintenance trips to each site at six-month intervals. In the normal course of events we have already visited the first four sites to be deployed, performing routine replacement, restocking, and a general inspection of all critical instrument elements. The backup Exabyte tape banks are moved into the primary role during these trips, and the primaries are removed from service and replaced by new or refurbished drives brought from Tucson. All power supplies are checked, and replacements installed if they fall outside of the manufacturer's specifications. The most recent software release is also installed at this opportunity. The whole process takes two or three people between a week to ten days to accomplish, depending somewhat on the vagaries of the weather. There have been no surprises so far. The paint on the light feed turrets is not holding up to the elements as well than we might have hoped, and as noted above, the conventional interference prefilters still in service at three sites seem to have a disappointingly short lifetime.

Data Analysis

Considerable effort has been expended to refine our analysis techniques in several areas, such as mode frequency determination, camera rotation orientation, treatment of the low-degrees, and improving the spherical harmonic transform.

Mode Frequency Determination

The parameters describing the normal modes of the solar oscillations are our principal data products: central frequency, line width, amplitude, and background. So far, the spectrum from the first GONG month (3 sites, 7 May to 11 June 1995) has been fitted twice. The first pass contained a large proportion of bad fits caused by a too-sparse table of first guesses. The second pass used a much more populated first guess table, and it was greatly improved. In addition, the first-pass fits showed a systematic jump in the rotational splittings at l = 150. At that degree, there is a rather abrupt transition in the lifetimes of the solar modes, and a corresponding one in our algorithms for fitting the modes. Below that value, we explicitly fit several spatial sidelobes, and above it we fit a single peak to the composite ridge. For the second pass, we restricted the fitting to l values below 150, and frequencies below 5 mHz. In addition, the second pass incorporated a better calculation of the error estimate, and provided rotational splitting coefficients.

The main areas of development in the peak finding include: fit-rejection criteria, methods of inspecting the fits to find problem areas, speeding up the minimization procedure, incorporation of the spatial leakage matrix into the fit, and further refinement of the first guess table. These activities have greatly benefited from the contributions of H.M. Antia, visiting us from the Tata Institute for Fundamental Research in Bombay, India. We have just completed fitting the fourth GONG month (5 sites, 23 August to 27 September 1995) in preparation for the Science articles.

Camera Rotator Angle Offset Determination

One major factor affecting our ability to merge the GONG data from the different sites is the knowledge of the relative angular offset of the solar image on each camera. An error of 0.1 degree will reduce the amplitude of the l = 200, m = 0 mode by 10%, so we need to keep the image oriented on each camera to that level. Small errors in the optical alignment can easily produce offsets of nearly 1 degree. To correct this, a drift scan over the course of a day is obtained at each site during deployment and during each preventative maintenance visit. This provides a zero-point offset, which is then entered into the camera rotator software to remove the bulk of the error. In addition, a time-dependent behavior can be determined that is applied during the data reduction to further reduce the error. However, as the declination of the Sun changes, the angular orientation of the image on the camera slowly changes. Thus the parameters derived from the drift scan become invalid as time goes on. This reduces the quality of the merged data.

We have developed a procedure to determine the relative angular offsets for all of the sites after the data have been returned to Tucson. The method performs an angular cross-correlation between all available simultaneous images, and then fits polynomials in time to the observed residual errors. A self-consistent set of equations can be determined that will reconcile all sites to each other. Finally, a drift scan at one site (most likely the Tucson engineering instrument) will provide the absolute reference for the entire network. With this method, we can determine the angular position of the solar image to the required level of less than 0.1 degree.

Improving Low-Degree Spectra

The low-degree spectra (l &lt 5) in the GONG data are generally noisier than the higher-degree data. Since these modes are important for studying the deep solar interior, we have been working on ways to improve the low-degree signal. Two methods are under active development: "cloud busting" and explicit removal of the relative Earth-Sun velocity. In cloud busting, the Modulation Transfer Functions (MTFs) of each image are examined at low l (&lt 20) for small variations below a threshold. These variations indicate increased scattering due to transparency variations, particularly clouds. When identified, the time series for the low degrees is zeroed out at the appropriate time sample. This has proved to be very effective in reducing the noise in the low-degree sectoral spectra, which have the lowest signal-to-noise ratio. However, since the MTFs are normalized to 1 at l = 0, the method cannot improve the l = 0 signal. This task is done by despiking the l = 0 time series to remove spikes with amplitudes greater than 5 times the standard deviation of the time series realization.

Another contribution to the noise in the low-degree spectra is the residual of the Earth-Sun velocity passed through our temporal detrending. Since the detrending is a two-point backwards difference, it leaves a 1 m/s per minute gradient in the l = 0 signal, as well as some smaller residuals in the l = 1 and 2 signals. We are currently developing a processing step that will compute the Earth-Sun velocity from the ephemeris and remove it from the data before the temporal detrending step. This will further improve the low-degree signal, particularly at lower frequencies.

Improving the Spherical Harmonic Transform
It has been noticed that, at low frequencies, the amplitude of the target peak at a degree l in the spectrum is systematically lower than the amplitude of the spatial leak at the next higher degree l + 1. It has been suggested that this is due to neglecting the horizontal components of the Spherical Harmonic Transform (SHT), which can have substantial amplitudes relative to the vertical component at low frequencies (and is actually equal to the vertical component for the f mode). We have thus begun to develop an SHT that will incorporate the two additional terms.

Data Processing

The Field Tape Reader (FTR) (the subsystem that receives the raw data cartridges from the observing sites) operated routinely and with little backlog. The FTR processed 96 cartridges containing 580 site-days from the seven instruments.Only one tape has been significantly delayed in the mail, and a copy of this cartridge was delivered to the DMAC by the instrument team after a regularly-scheduled preventive maintenance visit to that site.

The calibration stage (VMICAL) operated routinely. However, the backlog increased from about 50 site-days at the beginning of the quarter to about 200 site-days at the end. This was caused by a minor change in the reduction strategy aimed at increasing the amount of calibrated data stored on each cartridge, and to holidays, vacations, and illness. The backlog should decrease to about 100 site-days by the end of the next quarter.

The other upstream data reduction stages that perform site-dependent processing (GEOMPIPE, DNSPIPE, AVER) maintained backlogs between 20 and 100 days. A problem was encountered with the camera rotator correction angle formula for Udaipur. The correction derived from the drift scan data acquired during the deployment did not yield registered images that were consistent with contemporaneous images from the adjacent sites (Learmonth and Teide). Subsequently, a correlation technique was used to estimate statistically a correction formula. This delayed the reduction of the Udaipur data through DNSPIPE for about three weeks.

The fourth GONG month was merged. After the discovery of a problem with some of the input time series, a correction to the merge algorithm, and a discussion with the Data Reduction and Analysis Team, the fourth GONG month was remerged. The month long time series were assembled and the month power spectra were produced. The fifth month, which ends on 2 November, should be completed shortly.

Along with extensive analysis of the mode frequencies by the Data Reduction and Analysis Team and the Inversions Team, this product for the first GONG month (three-site network) were refit several times. In addition to this product which fits individual mode coefficient power spectra, the DMAC has also added three new mode frequency products that are produced by fitting various m-averaged versions of the mode coefficient power spectra.

Magnetograms from the fourth and fifth GONG months were edited and registered to a common shape, size, orientation, and polarity. Dave Hathaway (MSFC) produced workstation and VHS movies of these time series of magnetogram images. Since the community has expressed an interest in these images, the DMAC will begin producing registered magnetograms as a standard data product.

Data Storage and Distributing Systems

The DSDS operated routinely during the past quarter. The peak in demand from the pipeline occurred early in the quarter. The peak in demand from the scientific community for distributed data products is expected to occur during the first half of 1996. During the past quarter the DSDS serviced 34 data distribution requests that comprised 53 Gigabytes of data. Copies of catalogued cartridges that are stored at the off-site storage facility are now produced almost immediately after the original cartridge is catalogued in the DSDS. All cartridges in the DSDS library that have not been read or written for over one year are routinely tested to be readable. Soon, a similar cartridge testing program will be put in place to test the cartridges stored at the off-site storage facility.

John Leibacher

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US Gemini Program (1Mar96)

US Gemini Program (1Mar96)
(from USGP, NOAO Newsletter No. 45, March 1996)

How Will You Get Time on Gemini?

The US Gemini Program, a division of NOAO, will continue to be the US community's interface to the Gemini telescopes after construction is completed and scientific observing begins. The USGP will have the following responsibilities in the operations phase of Gemini:

- Distribute information to the US community about Gemini facilities and instrumentation.
- Supply expert advice/support for observing proposal preparation.
- Solicit observing proposals and perform first pass technical evaluation.
- Organize and run a national Time Allocation Committee and organize US participation in an international TAC.
- Organize and run a national Gemini Users committee and organize US participation in an international Gemini Users committee.
- Supply data reduction software and data reduction support to the US community for all Gemini instruments.
- Supplement Gemini's support for observing programs through "instrument specialists," especially for US-built instruments.
- Provide or facilitate US community access to the Gemini data archive.
- Investigate the feasibility and desirability of operating a remote observing station connected by high-bandwidth links to the two Gemini sites.
- Provide assistance to Gemini and the US community for queue-scheduled observations.
- Perform public relations and outreach involving Gemini facilities and science.
- Coordinate and manage the US-allocated Gemini instruments. This includes developing community participation in defining new instrumental capabilities.

The USGP will thus have most of the responsibilities that go along with operating a national facility aside from the actual operation and maintenance of the site itself. The USGP will continue to operate from Tucson; high-bandwidth links to the sites will permit frequent interaction with the international Gemini staff of both scientific and engineering natures.

The balance among US community interests, those of the other partner countries, and those of Gemini as a whole make the operation of this facility and US interaction different from any other aspect of NOAO's program. Despite the apparent commonality between many of the US Gemini responsibilities and similar activities which KPNO and CTIO perform for their own telescopes, this balance provides constraints that will affect how these responsibilities are carried out. For instance, the Gemini Science Committee has resolved that at least half of the time on the Gemini telescopes will be queue scheduled, but each country will maintain its own ranked list of programs for the queue. Thus, decisions about which programs are queue-scheduled, what the distribution of program sizes is, and even the frequency with which the ranked list is updated are left to each country to decide for the benefit of its own community.

Over the next year, the USGP will be starting to develop detailed plans for implementing the various parts of its operations phase mission. Some of the decisions will involve experiments under way at NOAO, such as the WIYN queue. Some of them will involve direct feedback solicited from the community, such as the plan for defining the Phase 2 instrumentation, mentioned in the accompanying article. In all cases, community participation and discussion are essential.

Fred Gillett Appointed Gemini Project Scientist

The Gemini Project recently announced that Fred Gillett has been appointed Gemini Project Scientist. Fred has served as the Interim Project Scientist for a year following the move of Matt Mountain from Project Scientist to Project Director. Prior to directly working for the Gemini Project, Fred was a member of the international Gemini Science Committee and Associate Project Scientist in the US Gemini Program.

US Gemini Instrumentation Status

The US Gemini Program has recently accepted the task of managing the Near- and Mid-Infrared Instrument Programs for the international Gemini Project. Scientific instrumentation remains a responsibility and budgetary item of the Gemini Project but US Gemini Program personnel will support the Project by working directly with the instrument teams to coordinate the many design and interface issues common to these instruments as well as to help resolve conflicts with instrument schedules, budgets and performance. The optical instrumentation for Gemini is provided by the United Kingdom and Canada. Progress on these programs was discussed in the December issue of the Gemini Newsletter available on the World Wide Web at http://www.gemini.edu/.

Near Infrared Imager: The University of Hawaii work on the imager, under the direction of Klaus Hodapp, continues to press on towards a preliminary design review scheduled for June of this year. Inclusion of an on-instrument wavefront sensor is being investigated.

Near Infrared Spectrograph: The NOAO team started last October and are working towards a conceptual design review in March of this year. The optical and mechanical design activity is nearly complete. Jay Elias moved to Tucson from CTIO to take responsibility for the scientific performance of the instrument and Dan Vukobratovich joined NOAO from Optical Sciences/University of Arizona to lead the engineering effort.

Mid Infrared Imager: The plans to procure this instrument have been developed and an initial announcement of opportunity was released in January at the AAS meeting in San Antonio and mailed to those who had expressed an interest. Anyone else interested in receiving the announcement should contact Kathy Wood by e-mail to wood@noao.edu or call (520)318-8175. The announcement states that all interested parties wishing to receive the Request for Proposal submit their name to the US Gemini Program by 7 March 1996. Proposals will be solicited in the spring of this year to perform conceptual design studies of the instrument. Following the conceptual design studies, a second and separate solicitation will be made to select an institution to perform the final design and instrument fabrication.

Next Generation Instrumentation: In spite of the fact that we are still initiating many of the Phase 1 instrument procurement activities, we are beginning to think seriously about the following generations of instruments. Within the proposed Gemini operations budget is a substantial amount of funding aimed at instrument and telescope upgrades and new instruments. We are concerned that the process should be one in which the communities initiate the ideas, not merely respond to requests to build instruments with given specifications. Our plan, still preliminary, for how this will happen includes an opportunity for anyone in the community to propose any instrument, together with an annual meeting to discuss the scientific motivations for additions to the instrument complement. We are trying to formulate a process which is both responsive to the desires of the community and encourages innovative and creative ideas in instrumentation. Announcements about how you can participate in this program will be forthcoming in the NOAO Newsletter and through other channels.

Kathy Wood, Todd Boroson

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Gemini Project Status (1Mar96)

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Gemini Project Status (1Mar96)
(from USGP, NOAO Newsletter No. 45, March 1996)

It's a very exciting time for Gemini. There are many people working around the world to make this a successful project. Two areas that most seem to capture our excitement are the construction at the sites and the progress of the primary mirrors. We all enjoy pulling up the WWW Gemini homepage (http://www.gemini.edu/) and checking the daily progress of the Mauna Kea site construction. That will be particularly fun this spring when the enclosure is being erected. A recent photo of the site construction at Cerro Pachn is shown here as it may surprise you to know that the foundation work has come along so quickly since it began in October. Foundation work there will be completed by this summer.

The primary mirrors continue to make headlines. The first blank was successfully transported across the Atlantic in December. This was watched anxiously by a number of interested parties since it represents the first time an 8-meter mirror has shipped across the open ocean. The blank is waiting its turn at REOSC now, behind the number two and three ESO VLT 8-meter blanks, to be ground and polished. The grinding, polishing and figuring of the Gemini number one mirror blank is scheduled to be complete by July 1997.

On 30 January, Corning announced that the number 2 Gemini mirror blank was successfully fused. The second primary mirror blank will be slumped to the miniscus shape in July and delivered to REOSC in May 1997.

[Photos not included]

Cerro Pachn Telescope Pier Construction, December 1995.

Trucking the Gemini Mirror Blank from Canton, New York to the St. Lawrence River, 29 November, in 10 degree F weather.

Within hours of arriving at the Port of Ogdensburg the 25 ton mirror blank and container were lifted by crane into the 185 meter long Greek freighter.

Several hours were spent lashing and welding the container to the floor of the hold before the ship left for Antwerp, Belgium. From Antwerp the blank traveled by barge down the shore of France to the mouth of the Seine River, through Paris, arriving successfully at REOSC, just south of Paris, on 16 December.

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1996 Software Conference Update (1Mar96)

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1996 Software Conference Update (1Mar96)
(from CCS, NOAO Newsletter No. 45, March 1996)

The Sixth Annual Conference on Astronomical Data Analysis Software and Systems (ADASS) will be held in Charlottesville, Virginia at the Omni Charlottesville Hotel, 22-25 September 1996. The Conference will be hosted by the National Radio Astronomy Observatory. 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 Program Organizing Committee for ADASS `96 has the following members: Rudi Albrecht (ST-ECF/ESO), Roger Brissenden (SAO), Tim Cornwell (NRAO), Dennis Crabtree (DAO/CADC), Bob Hanisch - Chair (STScI), Gareth Hunt (NRAO), George Jacoby (NOAO), Barry Madore (IPAC), Jonathan McDowell (SAO), Jan Noordam (NFRA), Dick Shaw (STScI), Karen Strom (U. Mass.), and Doug Tody (NOAO). The Local Organizing Committee is chaired by Richard Simon (NRAO).

The Conference is in the early planning stages so watch the Conference home page for further details as they become available: http://www.cv.nrao.edu/adass/. Mark your calendar now to attend ADASS `96!

Jeannette Barnes, George Jacoby, Doug Tody

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IRAF Update (1Mar96)

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IRAF Update (1Mar96)
(from CCS, NOAO Newsletter No. 45, March 1996)

The IRAF V2.10.4 distribution for PCs running Linux has been a hot item since its release in September 1995. In the first several months since the release there have been roughly 275 distributions of PC-IRAF, either from the network archive or by purchase of a CD-ROM (there have been about 2500 total copies of IRAF V2.10 downloaded from our server for all platforms in the past couple years). PC-IRAF users should note that newer Linux systems, e.g., Slackware 3.0, use the ELF file format for objects, executables, and other binaries. The September 1995 Linux/IRAF release was built using Slackware 2.3, which was an "a.out" system. The a.out format IRAF executables will run fine on ELF-based systems, but new programs cannot be linked because the IRAF libraries are in a.out format, while newly compiled objects will be in ELF format.

The next Linux/IRAF release will support ELF directly. In the meantime a patch, p-aout.tar.gz, can be installed to work around this problem. This patch was prepared on a Slackware 3.0 system but the ELF support in Slackware is pretty standard, so there is a good chance the patch will also work on other ELF-based versions of Linux. The patch is available by anonymous ftp to iraf.noao.edu in the iraf/v210/LNUX directory. Contact the IRAF hotline if you have further questions.

A second patch to IRAF V2.10.4 is planned and should be available by the time this Newsletter goes out. The new patch is required to support Solaris 2.5 and the SunSoft version 4 compilers, which were released around December 1995. We are waiting for the arrival of all the software and licenses from Sun before we can install the software here and prepare the IRAF patch. This patch will also include a few minor IRAF bug fixes made since the last patch. Hopefully this will be the last V2.10.4 patch before IRAF V2.11 is released.

In the last issue of the NOAO Newsletter we mentioned plans to mirror the IRAF network archive and Web pages at the RAL, courtesy of the Starlink group in the UK. This is still under development, but by the time this Newsletter goes to press we expect to have this initial mirror site set up and in use. Once we have fully tested the RAL mirror site, along with an automatic update procedure, we will look into setting up similar mirrors at other sites around the world. The main holdup in getting the initial mirror functioning has been reworking the IRAF Web pages so that they will work properly when copied to a mirror.

A new version of the X11IRAF package was demonstrated at the AAS in January and is due for release shortly. This release will include a new version of XIMTOOL that adds a print capability and limited file load/save support. The print capability supports output of grayscale and color Postscript to a printer or EPS file. The file load/save capability will initially support only Sun rasterfiles (because they are simple), but will eventually support a variety of PC image formats plus FITS and the IRAF image format. Other minor enhancements are planned. Look for an announcement of this release in the next few weeks.

Lindsey Davis has completed and released a suite of world coordinate driven image registration tasks including SKYCTRAN, a celestial coordinate transformation task, and SREGISTER, a celestial world coordinate system driven image registration task. SKYCTRAN enables users to transform from any one of the supported celestial coordinate systems (equatorial, ecliptic, galactic, and supergalactic) or associated built-in IRAF coordinate systems (logical, tv, physical, world) to any other. SREGISTER permits users to register images with different fundamental equatorial systems (FK4, FK4-no-4, FK5, GAPPT) and/or different equinoxes and epochs. The celestial coordinate transformations are performed using the Starlink positional astronomy library SLALIB which has recently been ported to IRAF. The new tasks and a copy of SLALIB are currently available in the layered package IMMATCH. Lindsey has also modified the IRAF world coordinate interface to support ecliptic, galactic, and supergalactic coordinates. When these changes are implemented in the distributed IRAF system, the SREGISTER task will support these non-equatorial celestial coordinate systems as well. Lindsey has also released a new layered package of median/mode filtering routines called MFILTERS. The major new capabiities of this package include the ability to ring median/modal filter a list of images, and to set minimum and maximum good data value parameters for the median/modal filters.

Frank Valdes has been working recently on tools for the automated identification of arc-line spectra. These are nearly complete and should be available in layered package form by the time this Newsletter goes out. The new auto-identification facilities should greatly simplify the process of spectral dispersion calibration. A new task for doing astronomical calculations (such as precession and airmasses) has been added to the ASTUTIL package on our development system. It will be expanded shortly to provide user access to most of the astronomical procedures in the SLALIB library. This new tool is the engine for a new task that searches a list of images, such as a library of spectra or observations, for those within a specified distance of a point in the sky. Users may easily write similar types of tasks using the astronomical calculator. The tools noted above will be available in an external package and in the next major release.

The IRAF User's Committee met in Tucson on 6 February to review the status of the IRAF project and to advise NOAO in setting priorities for the IRAF project during the coming year. The IRAF User's Committee is appointed by the NOAO Director to provide a communication link between NOAO and the IRAF user community. The current committee members are Jeff Pier (USNO) - Chair, Peter Eisenhardt (JPL), Andrea Prestwich (CfA, Harvard), Bill Romanishin (Oklahoma), Bill Sparks (STScI), and Steve Walton (CalState, Northridge). Feel free to contact the committee members if you have any comments on the IRAF project. The committee's report will appear in a forthcoming issue of this Newsletter.

Doug Tody and Jeannette Barnes attended the AAS meeting in San Antonio in January and provided an IRAF demo and display for interested participants. In particular demos were available for Frank's new automatic spectral line identification task, Lindsey's new IMMATCH package, and the new enhancements to XIMTOOL, described in more detail above. Many handouts were provided including our HotSheet with major IRAF contact information and a PC-IRAF FAQ. We look forward to this once-a-year journey that brings us in closer touch with many of our IRAF users.

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

Doug Tody, Jeannette Barnes

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NOAO FTP Archives (1Mar96)

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NOAO FTP Archives (1Mar96)
(from CCS, NOAO Newsletter No. 45, March 1996)

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

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

ftp ftp.sunspot.noao.edu (146.5.2.1), cd pub Directory containing SP software and data products--coronal maps, active region lists, sunspot numbers, SP Workshop paper templates, information on international meetings, SP observing schedules, NSO observing proposal templates, Radiative Inputs of the Sun to the Earth (RISE) Newsletters, and SP newsletters (The Sunspotter).

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

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

catalogs--Directory of some astronomical catalogues: Jacoby et al. catalog, A Library of Stellar Spectra, the Catalogue of Principal Galaxies, the Hipparcos Input Catalogue and the Northern Proper Motion Catalog.

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

gemini (gemini.tuc.noao.edu)--Information from the International Gemini 8-Meter Telescopes 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 the IRAF distributions, documentation, layered software, and other IRAF related files. It is best to ftp to iraf.noao.edu directly to download large amounts of data, such as an IRAF distribution.

kpno (orion.tuc.noao.edu)--KPNO directory containing filter lists and data, Hydra information, new LaTeX observing form templates, instrument manuals, KPNO observing and monthly support schedules, platelogs for 4-m PF, user questionnaire, reference documents (wavelength atlases), 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--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: currently only some PostScript tools.

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 are the numerical IP addresses 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
ftp.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, and
Steve Grandi or Jeannette Barnes (grandi@noao.edu or jbarnes@noao.edu)
for all others (and they will direct your questions as needed).

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

Jeannette Barnes

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