NOAO Newsletter - December 1998 - Number 56

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NOAO Highlights!

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SCience OPErations

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Kitt Peak National Observatory

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Comments concerning this Newsletter are welcome and will be forwarded to the appropriate editors.
Newsletter Posted: 06 Dec 1998

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Intracluster Stars and the Structure of the Virgo Galaxy Cluster

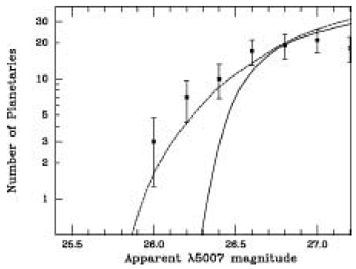
Robin Ciardullo, John Feldmeier (Penn State), and George Jacoby (NOAO) used the KPNO 4-m telescope to find intracluster Planetary Nebula throughout the extent of the Virgo cluster of galaxies. The distribution of planetaries suggests that the cluster is significantly extended along the line of sight, and that galaxies apparently within its projected core cannot be regarded as being at the same distance. Overall, the Virgo cluster is poorly organized, and may still be accreting surrounding galaxies.

Measuring the distance to the nearby Virgo cluster of galaxies has long been considered by many to be a critical step along the path to measuring the Hubble constant. One nasty issue, however, is understanding how well organized and defined the cluster is itself. If Virgo is compact and "relaxed," then most of the galaxies in its core can be assumed to be at the same distance, while if it were highly-structured and poorly organized, it's problematic to relate distance measures to various galaxies within the cluster to each other. Being able to compare and average galaxy distances within the cluster is central to trying to measure the distance to the Virgo cluster overall.

One method that has been used to determine the distance to the Virgo cluster is by observing planetary nebulae (PN). Planetary nebulae are created as stars like our own sun near the end of their lives. As it happens, the various brightnesses that nebulae are seen to have appear to be drawn from a standard distribution, or luminosity function (LF), which Ciardullo and Jacoby have shown to be constant from galaxy to galaxy, in turn allowing them to use the PNLF as a distance indicator.

Ciardullo et al. used the 4-m Prime Focus CCD Camera to identify planetary nebulae (PN) in the outer regions of the giant elliptical galaxy M87 by their ionized oxygen emission. M87 has long been assumed to be at the center of the Virgo cluster; thus, measuring its distance has been particularly important. Ciardullo et al., however, found that the PNLF of M87 is poorly described by the PNLF found in other galaxies (Figure 1). In their new work, they find that this is because M87 is "contaminated" by a foreground population of planetary nebulae. This foreground population does not appear to be associated with any other galaxy, but rather is part of the cluster. In other words Ciardullo et al. have identified a population of stars that has been detached from their parent galaxies and are now adrift within the cluster potential.

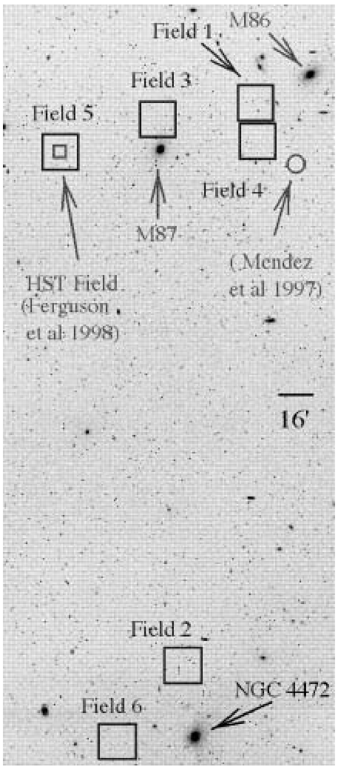
Figure 1: *The [O III] 5007 luminosity function of IPN found in front of M87 compared to two Virgo cluster models. The solid curve gives the PNLF expected from an isothermal cluster with core radius 1.7 (Binggeli, Tammann, Sandage 1987). A better model, displayed by the dotted line, is one in which the intracluster PN are assumed to have a uniform density and extend ~ 4Mpc from M87.*



This hypothesis was confirmed by follow-up observations of six blank 14' 14' fields in the Virgo cluster taken with the 4-m by John Feldmeier (Penn State graduate student), Ciardullo, and Jacoby (see Figure 2). So far, close to two hundred intracluster planetary nebulae (IPN), have been detected, and the survey is still ongoing. From these observations, it appears that the intracluster stars in Virgo are very numerous (over 20% of the total starlight in the cluster), are not centrally condensed, are not dynamically relaxed, and extend up to four megaparsecs in front of M87.

Figure 2: *This is a 2.5 5.7 image of the Virgo cluster, with all the detections of intracluster stars found to date. The six PFCCD fields are indicated by the large squares of side ~ 14'. The number of intracluster planetaries varies significantly from field to field, generally dropping off with distance from the cluster center. The intracluster planetaries in subclump A of Virgo (Fields 1, 3, 4, 5) are a few Mpc less distant from us than those in subclump B (2 & 6).*

Although the presence of intracluster stars complicates the distance determination of the Virgo cluster, the same stars



can serve as a powerful probe of the structure and history of the cluster itself. In the future, two new tools will be used to learn much more about the intracluster stars. The Kitt Peak CCD Mosaic Imager will greatly increase the amount of the Virgo cluster that can be surveyed for intracluster planetaries, and the Medium Resolution multi-fiber Spectrograph on the Hobby-Eberly Telescope will efficiently measure the velocities of large samples of IPN.

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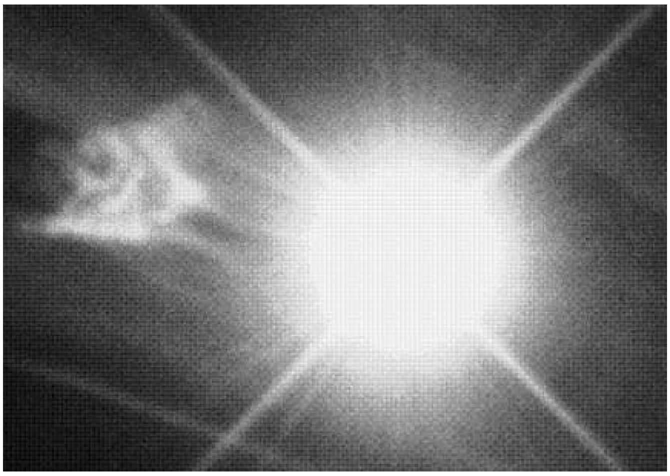
Undergraduate Observers Uncloud a Nebula

John Barentine and Gilbert Esquerdo (University of Arizona undergraduate students), were granted time on the KPNO Coud Feed Telescope to measure the velocity of Barnard's Merope Nebula. Prior observations had suggested that the nebula is virtually at rest relative to Merope, implying that it was formed as part of the cluster. The students' goal was to obtain new velocity measurements to determine if the Merope Nebula is associated with the Pleiades. Their results suggest instead that it may be associated with the passing molecular cloud that is responsible for the Pleiades reflection nebula.

The Pleiades is a spectacular star cluster. The wispy reflection nebula surrounding the cluster is made bright by the light of the luminous, young, cluster B stars well known to naked eye observers. But the nebula, which so enhances the appearance of the Pleiades is just a chance encounter between the stars and a passing molecular cloud, perhaps a fragment of the nearby Taurus-Aurigae nebula lying east and south of the star cluster.

In 1891, E. E. Barnard visually identified a small knot of condensation within the Pleiades nebulosity, just 36" south-southeast of the bright star Merope. The knot is some 15 brighter than the brightest areas of the reflection nebula, and has a diameter of just a few arc seconds, with two arms, about 10'' long, directed away from Merope (see the Figure). The knot is known as "Barnard's Merope Nebula" and was later cataloged as IC 349.



Observation of IC 349 is difficult because of Merope's brightness. The nebula was not even visible on the TV guiding camera. Nevertheless, Barentine and Esquerda obtained 5 one-hour integrations of the nebula, as well as a high signal-to-noise spectrum of Merope itself. A 15" slit was used to allow subtraction of scattered light from the star. They also obtained a second spectrum at a similar distance from Merope, but at a position angle 180 away from the Merope Nebula, to investigate the contribution of instrumentally scattered light. The radial velocity of the nebula was determined by cross-correlation, using the spectrum of Merope as a template.

The new velocity measurement suggests that the Merope Nebula is not associated with the Pleiades cluster. Barentine and Esquerda were also able to calculate the space motion of the Nebula, using proper motions recently measured by B. Jones (Lick Observatory). The Merope Nebula is not only kinematically distinct from the Pleiades cluster, but also from T Tauri stars in the nearby Taurus-Aurigae clouds.

Using L' observations obtained with the Diffraction Limited Infrared Imager on the Mayall 4-m Telescope, the students were also able to set an upper limit to the luminosity of any object embedded in the nucleus of the Merope Nebula. The absence of infrared flux and also of emission lines in the optical spectrum suggests that the Merope Nebula is not hiding a protostar. The nebula may just be a large clump of dust, and its morphology may result from radiation pressure from nearby Merope.

Barnard described the Merope Nebula as "one of the most singular objects in the heavens." It has certainly proved to be fertile ground for two young astronomers at the beginning of their careers. A paper by Barentine and Esquerda will soon appear in the *Astronomical Journal*.

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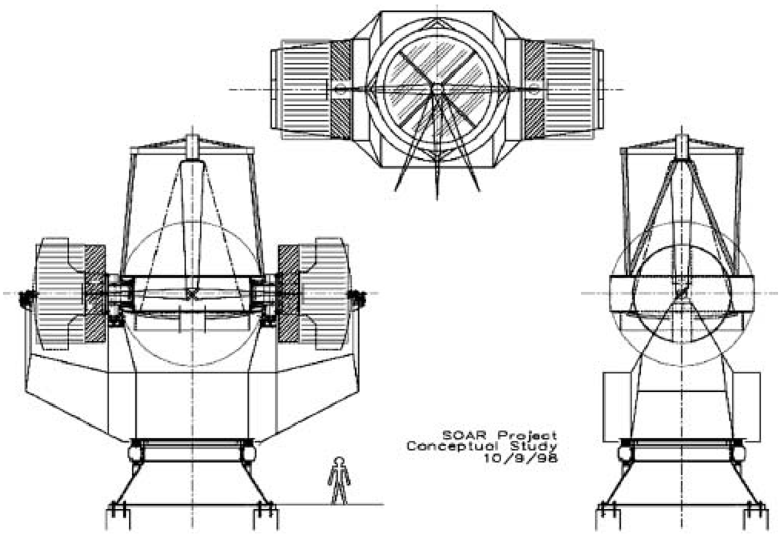
SOAR 4-m Telescope Project Moves Ahead

Work is moving ahead steadily on the SOAR 4.2-m telescope, to be located on Cerro Pachon and operated by CTIO. The SOAR consortium consists of NOAO (30% observing share), Brazil (30%), The University of North Carolina (15%), and Michigan State University (15%). Chile, as the host country, will receive the remaining 10% of the observing time. The basic goals are to build a telescope that produces image quality comparable to that of Gemini and has a package of rapidlyaccessible instruments capable of exploiting that image quality for types of observations optimized to the 4-m aperture.



Caption: *Conceptual Design of the SOAR 4.2-m telescope, showing the general arrangement for carrying many instruments simultaneously.*

A major milestone was passed in June with the Conceptual Design Review, held in Tucson. Project Manager Tom Sebring and Project Scientist Gerald Cecil led the SOAR engineering team and contractor representatives in a presentation of results of several major preliminary design contracts, which compared different approaches to the mount and active optics system designs, as well as showing initial work on the control software, enclosure, dome, and instrumentation package designs. The outside Review Committee, chaired by Jim Oschmann (Gemini Project Manager) had many helpful comments, but felt that the project generally was in good shape and ready to move into a final design and construction phase.

The general approach is to have only a small inhouse engineering team, with most of the work subcontracted in very major chunks. The project team are currently writing proposal requests for, or negotiating, major subcontracts for the mount (with drives), mirror substrates, Active Optics system (including figuring of M1, M2, M3 and providing their active support systems with all controls), design of the enclosure building and dome, plus a few smaller contracts for the Telescope Control System software, etc.

The telescope building design and preliminary dome design is being carried out by M3, who have done similar work for Gemini and several other major projects. The building construction will be managed by CTIO, who will then subcontract the actual construction work to appropriate companies operating in Chile. As described in a previous Newsletter article (Number 54), the site on Cerro Pachon has been leveled, inaugurated, tested, etc. and is ready to go.

The primary mirror will be a 4.3-m diameter by 10 cm thick meniscus, and will be made of Corning ULE. The goal is to have 4.-2m usable aperture. The primary and secondary mirrors will be supported and controlled with an active optics system such has become standard on all new telescopes. In addition, all foci will be tip-tilt stabilized; the telescope will have only Nasmyth and bentCassegrain foci, all fed by a single tertiary mirror, which will be the element under tip-tilt control. The telescope will be f/16, offering compatibility with Gemini and with NOAO telescopes. As noted above, the primary technical goals of the project are to achieve and exploit very high image quality over the isokinetic patch.

One result of the Conceptual Design Review is that two rather different mount designs would each be capable of meeting the project's specifications. One such design is sketched in Figure 1, which also illustrates the way in which a large number (up to 8-9) instruments can simultaneously be mounted on the telescope. Each of the two Nasmyth ports is shown with "only" a single large Geminisized instrument mounted, but these can instead be occupied by adapter cubes, which offer a selection of three smaller instruments each, with access controlled by an additional folding flat (M4). In addition, there will be 2-3 folded Cassegrain ports, also fed by rotating the tertiary mirror. The time for switching between instruments is specified to be less than 5 min, so that the telescope will be well suited for synoptic and queue observing programs.

The instruments will be produced by the various partners in the project. Proposals have been received for an IR imager, optical imager, optical highresolution IFU spectrograph, and optical highthroughput spectrograph. It is hoped that all of these instruments, plus an infrared spectrograph, can come online within the first year or so of operations, and can be mounted on the telescope simultaneously.

We are aiming to start assembling the telescope in Chile in early 2001 and have it go into service in 2002.

J. Baldwin (jbaldwin@noao.edu)

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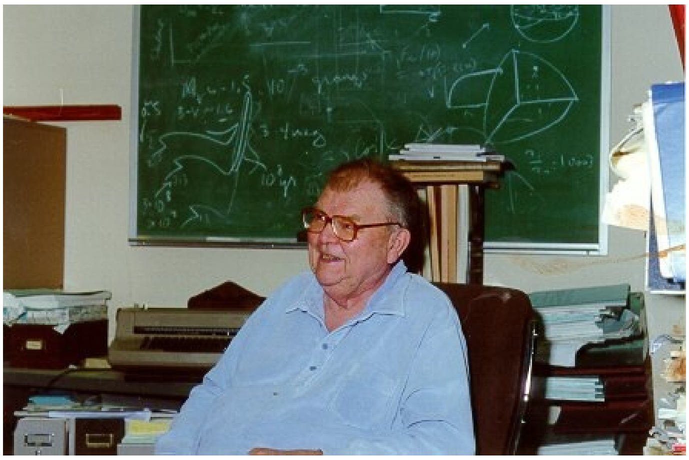
A Remembrance of Olin Eggen - 1919-1998

With the passing of Olin Eggen on 2 October, we lost an energetic and trailblazing researcher, a vigorous advocate for CTIO, and a warm friend of many of us around the world. Nick Suntzeff made the following remarks at a memorial service held here, shortly after Olin's death in Australia.



It is difficult to express one's feelings at the time of the death of a dear friend. Many of us take comfort in the wise teachings of Western Religion. If there be an afterlife, Science cannot tell us. However, the memories and affection we have for Olin live on in us, and in that allegorical sense, a life is not lost but lives on in all the people that knew Olin. People around the world--Pasadena, Tucson, Mt. Hamilton, Champaign-Urbana, Washington DC, Cambridge, Cape Town, La Serena, Canberra, Fremont CA--remember Olin in their own ways. But I imagine we all bonded by the similar ways in which he affected our lives. I think that Malcolm Smith put it well when he said "Olin is someone whom we remember more with a chuckle than a tear. While we all know his stature as a scientist is truly world-class, we will also remember the twinkle in his eye and his wonderful sense of humor. Astronomy has lost a truly great colleague and a wonderful human being."

Olin was one of those special people that grew out of the Depression years in the US. He was born Olin Jeuck Eggen to Olin Eggen and Bertha Clare Jeuck of Orfordville, Wisconsin on 9 July 1919. He was the first born child to a very young couple of 21 years old. Olin was very private about his early life, but one can imagine it was very difficult living on a rural farm in the 1920's and 1930's. He graduated from Orfordville Public High School in 1937 in a class of 14 students. Their class motto was "Perseverance overcomes everything," a philosophy, no doubt, based on the difficult life where most students did not complete high school. Evidently his parents encouraged his studies. Elaine Mac-Auliffe was told by Olin that when he was young he would sometimes wake up terrified at night that there was so much to know and not enough time to learn it all!

He entered the University of Wisconsin and graduated in three years, in 1940. One forgets how revolutionary this was: a farm boy from a poor rural family of the United States being allowed and encouraged to go to college. The Second World War interrupted his life, and he joined in the war effort. Olin never told me the full story of his war years. He was assigned as a Scientific Liaison to the Office of Strategic Services (OSS) and spent time behind the lines in the Balkans and Austria as well as the Pacific. I was told he posed as a ball bearing salesman or specialist as his cover. He rose to the rank of Captain.

After the war, he went back to the University of Wisconsin where he received his PhD in astrophysics in 1948. For the next 50 years he spent, as he called it, a "Life in the Dark" as one of the most influential observational astronomers of the last half-century. Over that time he was an Assistant Astronomer at Lick Observatory (1949-1956), Chief Assistant to the Royal Astronomer at the Royal Greenwich Observatory (1956-1961), Professor of Astronomy at Caltech and Staff Astronomer at the Hale Observatories (1961-66), Director of the Mt. Stromlo and Siding Spring Observatory and Head of the Department of Astronomy at ANU (1966-77), and finally Astronomer at Cerro Tololo Inter-American Observatory (1977-1998). As he would joke, the only bad thing about his job at CTIO was that he had never lived so far from the office before.

It is easy to forget how profoundly our concept of the Universe has changed in the last 50 years, and Olin was one of the astronomers who was at the head of this advancement. At the time of Olin's PhD, careful measurements of the brightness of objects were just beginning. The estimated size of the Universe was 10X larger than we know it is today, and people argued if the Universe really was expanding or if it was an optical illusion. The whole field of stellar evolution was obscure. Where are stars born? How do stars die? Why do some stars become giants? At that time all stars were thought to be made of the same gaseous material. The instrument that drastically transformed our knowledge of the Universe was the photomultipiler tube, which was invented during the war and applied to astronomy first by Professor Whitford and his young associates at the Washburn Observatoryincluding Olin Eggen. This instrument allowed astronomers to measure the brightness of objects to an accuracy of 1%, which was 10 better than in the past. That was Olin's observational specialty that he took with him around the world. As an aside, you can imagine how scared I was when I first came to CTIO in 1980 to do photoelectric photometry on the 60", and learned that Eggen would be instructing me! Olin told me that he actually hated observing--staying up all night in a dark dome. He had to do it, because no one else took data that were good enough!

Olin used photometry to study the structure of stars and their orbits in the Galaxy. He is most remembered for his paper which all astronomers know as ELS "Eggen, Lynden-Bell, Sandage 1962. "Evidence from the Motions of Old Stars that the Galaxy Collapsed." This paper has been named as one of the 100 seminal papers on astronomy this century and will be republished as part of the American Astronomical Society Centennial. Imagine how controversial this idea was! The Galaxy was not an immutable swirl of stars that had always been, but it collapsed from a giant gas cloud. Galaxies live (and by implication) die as do stars and people. Olin's careful studies showed that the Galaxy is made up of distinct associations of stars--a punctuated growth and evolution rather than a continuous process. Many of his ideas about the "moving groups" of stars and thick disks of galaxies took years to be accepted. In fact, the idea that stars can maintain a kinematic signature over long periods of time is a concept very much in vogue right now, yet 10 years ago it was a pretty wild idea championed almost alone by Olin.

This is the scientific legacy of Olin Eggen, the astronomer. As Olin the very human man we all associated with, we will remember him for his sense of humor, his very deep humility in front of Nature, and his very human concern for those around him. In remembrance of Olin, I would like to insert a short piece written by him, the last paragraph from his autobiographical article for Annual Reviews, "Notes from a Life in the Dark."

"Walter Baade was once asked, if starting over would he still be involved in astronomy? After a little thought he replied "yes, but only if the ratio of total to selective absorption is the same everywhere." That was the public Baade's response--the personal one would almost certainly have been an unqualified yes. Most astronomers are involved in our discipline by compulsion and are overjoyed at being paid to do what we would at least be trying to do, in any case. The answer to another question--what do you personally receive from research?--would be more varied. The short answer, of course, is that it is fun. My opinion is that it has nothing (or very little) to do with a craving for recognition, present or posthumous, but is essentially self-centered with an aim of self-satisfaction. Flamsteed, whom Newton called "an insolent puppy" is little remembered although Newton would have had difficulties without his observations. Sir Richard Woolley used to become very upset upon finding current astronomy students unaware of the name of Eddington. I really doubt Eddington would have mindedalthough he had made valuable contributions but he also had his personal satisfaction. Science may benefit very much (or only very little) from what we do but since we do it for ourselves, for the satisfaction of our own curiosity, we should be thankful for the circumstances that permit a life in the dark."

Nicholas Suntzeff (nsuntzeff@noao.edu)
6 October 1998, La Serena, Chile

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Gemini Near Infrared Spectrograph

In October 1995 NOAO was selected by an independent NSF peer review panel to design, fabricate, test, and deliver the Gemini Near-Infrared Spectrograph for the Gemini North telescope sometime in the year 2000. In September of this year we determined that the instrument cost will substantially exceed the original estimate and that delivery will be delayed by at least a year.

The Observatories Council and AURA decided that a thorough evaluation of the reasons for the cost and schedule problems was required. The information developed through this review will be used to advise NOAO on a recovery plan. The review team met in mid-October, and a report should be delivered by early December. NOAO and the Observatories Council will assess the implementation of the recommendations, and NOAO will negotiate with Gemini regarding the revised timescale for delivery and possible use of the PHOENIX spectrograph at Gemini North until GNIRS is delivered. NOAO and the Council will also assess and try to minimize the effects of these efforts on the instrumentation availability and other instrumentation efforts at NOAO. Updates on the recovery plan will be provided at the NOAO web site.

NOAO and the Council are committed to ensuring that such problems will not recur, regardless of the size of future instrumentation efforts for NOAO or on behalf of Gemini. It is also our joint goal that the scientific capabilities of the US national community are maximized, through continued access to the telescopes at NOAO and Gemini, and equipped with state-of-the-art instrumentation.

Sidney Wolff, Director, NOAO
Bruce W. Carney (Chair), Observatories Council

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NOAO Educational Outreach

NOAO, through its Teacher Enhancement Program, "The Use of Astronomy in Research Based Science Education," hosted sixteen teachers from around the country this past summer. This professional development program, described in earlier newsletters, provides a research experience to middle and high school teachers and then supports their efforts to transfer the experience to the classroom during the academic year. One aspect of this support is the selection of a local mentor, a professional astronomer living in the same area as the RBSE teacher. We would like to acknowledge the following astronomers who stepped forward and the RBSE '98 teachers they'll be working with:

RBSE '98

TEACHERS	ASTRONOMERS
Stephen Burke, Woonsocket High School, Woonsocket, Rhode Island	Timothy Barker, Wheaton College
Rick Donahue, Eastchester Middle School, Eastchester, New York	Charles Liu, Columbia University
Warren R. Fish, Paul Revere Middle School, Los Angeles, CA	Matt Penn, CalState Northridge
Tom Gehringer, Harry A. Burke High School, Omaha, NE	Edward Schmidt, Univ. of Nebraska, Lincoln
Susan M. Hayden, El Camino Real High School, Placentia, CA	Stephen Walton, CalState Northridge
John E. Persichilli, North Canyon High School, Phoenix, AZ	Donald McCarthy, University of Arizona
Elizabeth S. Sanghavi, Chenery Middle School, Belmont, MA	Eliza Garfield, Harvard Graduate School of Education Steve Saar, Harvard-Smithsonian CfA
Linda Syferd, New Franklin Middle School, New Franklin, MO	Charles Peterson, Univ. of Missouri, Columbia
Stacey Jones-Willy, Tucson High Magnet School, Tucson, AZ	Charles Lindsey, Solar Physics Research Corp.
Lynn H. Williams, Pittman Middle School, Hueytown, AL	Kurt Bachmann, Birmingham Southern College William Keel, University of Alabama
Brenda Ann Wolpa, Canyon Del Oro High School, Tucson, AZ	Travis Rector, NOAO
Douglas Showell, Lewis & Clark Middle School, Omaha, NE	Daniel Wilkins, Univ. of Nebraska, Omaha
David L. Vondra, King Science Center, Omaha, NE	David Kriegler, Univ. of Nebraska, Omaha
Frank J. Sinclair, Ida Middle School, Ida, MI Ardis Maciolek, Grosse Pointe North High School, Grosse Point, MI Linda K. Witzburg, New Morning School, Plymouth, MI	Mario Mateo, Univ. of Michigan, Ann Arbor Donald Bord, Univ. of Michigan, Dearborn

Recruitment for RBSE '99 is in progress. Please see our web page at http://www.noao.edu/outreach/rbse/ for more information.

In September, Project ASTRO-Tucson welcomed another 38 participants to the program, bringing the total number of trained astronomers and teachers in the Tucson area to approximately 135. 1998 marks the third year of Project ASTRO's expansion to Tucson, with NOAO as the lead institution. David Levy gave an inspiring presentation, "More Things in Heaven and Earth," at the Flandrau Science Center to open the workshop; many of the two-day activities took place at the UA Steward Observatory conference room. Each year, the workshop gets better as we draw on past-year participants to share experiences and advice.

Caption: *Maria Andrade (Girl Scout leader from Nogales, Arizona) observes overhead lights with a spectroscope she made during the September 1998, Project ASTRO-Tucson workshop.*

Highlights of this year's workshop included a demonstration of video taping *The Universe at Your Fingertips* activity E-1 "Experimenting with Craters" for stop-action analysis, and a panel discussion of topics ranging from classroom management techniques, the importance of turning off automatic sprinklers during star parties, and dealing with creationism in the classroom.

We are especially pleased to have a multi-age-classroom teacher from the Tohono O'odham Nation Santa Rosa Ranch School in Project ASTRO this year, as it was forty years ago that the agreement leading to the establishment of Kitt Peak as the first US national observatory was signed on the school grounds.

Suzanne Jacoby,
NOAO Education Officer

NOAO Preprint Series

The following preprints were submitted during the period 1 September to 30 November 1998. Please direct all requests for copies of preprints to the NOAO author marked.

814 *Massey, P., "Massive Stars in the MCs: What They Tell Us About the IMF, Stellar Evolution, and Upper Mass `Cutoffs'"

815 *Geisler, D., Sarajedini, A., "Standard Giant Branches in the Washington Photometric System"

816 *Lin, H., Rimmele, T., "The Granular Magnetic Fields of the Quiet Sun"

817 Auchre, F., Boulade, S. Koutchmy, S., *Smartt, R.N., Delaboudinire, J.P., Georgakilas, A., Gurman, J.B., Artzner, G.E., "The Prolate Solar Chromosphere"

818 *Pilachowski, C.A., "Abundance Anomalies in Stars: A 30-Minute Tour of the HR Diagram"

819 *Barentine, J.C., Esquerdo, G.A., "Bernard's Merope Nebula (IC 349): An Interstellar Interloper"

820 *Armandroff, T.E., Davies, J.E., Jacoby, G.H., "A Survey for Low Surface Brightness Dwarf Galaxies Around M31"

821 *Massey, P., "What the Galaxies of the Local Group Tell Us About Massive Star Evolution"

Other NOAO Papers

Preprints that were not included in the NOAO preprint series but are available from staff members are listed below.

Alves, J., Lada, C.J., Lada, E.A., "Correlation Between Gas and Dust in Molecular Clouds: L977"

Alves, J., Lada, C.J., Lada, E.A., Kenyon, S.J., Phelps, R., "Dust Extinction and Molecular Cloud Structure: L977"

Gilliland, R.L., Bono, G., Edmonds, P.D., Caputo, F., Cassisi, S., Petro, L.D., *Saha, A., Sara, M.M., "Oscillating Blue Stragglers in the Core of 47 Tucanae"

Hartigan, P., Morse, J., Tumlinson, J., Raymond, J., & Heathcote, S. "Hubble Space Telescope FOS Optical and Ultraviolet Spectroscopy of the Bow Shock HH 47A"

Im, M, Griffiths, R.E., Naim, A., Ratnatunga, K.U., Roche, N., *Green, R.F., Sarajedini, V.L., "The Morphologically Divided Redshift Distribution of Faint Galaxies"

Kovacs, G., Walker, A.R. "A Detailed Analysis of Double Mode RR Lyrae Stars: Further Support for a Brighter Luminosity Scale."

Korista, K.T., Baldwin, J.A., & Ferland, G.J. "Quasars as Cosmological Probes: The Ionizing Continuum, Gas Metallicity and the Equivalent WidthL Relation"

Lada, C.J., Alves, J., Lada, E.A., "Infrared Extinction and the Structure of the IC 5146 Dark Cloud"

Olsen, K.A.G., Hodge, P.W., Mateo, M., Olszewski, E.W., Schommer, R.A., Suntzeff, N.B., and Walker, A.R. "Results from HST Observations of Six LMC Globular Cluster Fields"

Olsen, K.A.G., Hodge, P.W., Mateo, M., Olszewski, E.W., Schommer, R.A., Suntzeff, N.B., and Walker, A.R. "HST Colour-Magnitude Diagrams of Six Old Globular Clusters in the LMC"

Sahu, K.C., *Sahu, M.S., "Spectroscopy of Macho 97-SMC-l: Self-Lensing Within the SMC"

Silva, D.R., Bothun, G.D., "The Ages of Disturbed Field Elliptical Galaxies: II. Nuclear Properties"

Schmidt, G.D., Hines, D.C., "The Polarization of BALQSOs"

Suntzeff, N.B., Walker, A.R., Smith, v.V., Kraft, R.P., Klemola, A., Stetson, P.B. "Properties of a Proper-Motion Selected Sample of Giants in the Small Magellanic Cloud Near NGC 121"

Treu, T.L., Stiavelli, M., Walker, A.R. & others "An Extremely Red r1/4 Galaxy in the Hubble Deep Field South Test Image" astro-ph/9808282

Walker, A.R., Hodge, P., Mateo, M., Olszewski, E., Schommer, R., Suntzeff, N. "A Photometric Survey of the LMC Field Near NGC 2257"

Walker, A.R. "The Distances of the Magellanic Clouds" astro-ph/9808336

Wang, J., Heckman, T.M., Lehnert, M.D., "Towards a Unified Model for the `Diffuse Ionized Medium' in Normal and Starburst Galaxies"

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

New Opportunity on NOAO Telescopes - Survey Programs

Over the past few years we have seen forefront science driven more and more by survey programs. Such programs allow the identification of complete, well defined samples of objects that can both yield conclusions based on statistical analysis of the survey data itself and also provide important subsets for more detailed observations with larger telescopes. For example, the recent discovery (Kirkpatrick et al., 1998) of a new spectral class of stars, L dwarfs, is a result of follow-up studies of objects found in the 2MASS and DENIS surveys. Although the most obvious examples are very large efforts such as 2MASS and SDSS, there are many smaller surveys as well, covering areas of a few or a few tens of square degrees. A workshop held in Tucson in 1997 identified such surveys as a critical enabling tool for effective use of very large telescopes (http://www.noao.edu/scope/supcap_workshop/).

Survey programs that require more than a few nights of telescope time do not fit well into the existing structures for time allocation. TACs always tend to cut everything back a little to let a few more proposers have access to some telescope time, and a survey program that displaces several smaller programs rarely gets support. While the downside of this balance, the decrease in the number of people who are getting data, is easily seen, the upside often is not. The upside is that the survey has scientific returns in addition to those that are advertised in a standard proposal. The survey data may be made available to scientists outside the proposing team who are searching for other kinds of objects. The survey may produce catalogs of objects that will support follow up observations by many more people.

NOAO is initiating a program that will permit survey proposals to be considered in a partially separate process. Both the concept of this program and an implementation plan have been reviewed by the NOAO nighttime users' committee. A substantial amount of telescope time is potentially available, but successful proposers will have to justify their survey both in terms of overall scientific return and in terms of how they will conduct the project to make that return available to the community. The details of how this program will be carried out can be found at the survey program Web address (http://www.noao.edu/noaoprop). The following is a summary of the ground rules for this new program:

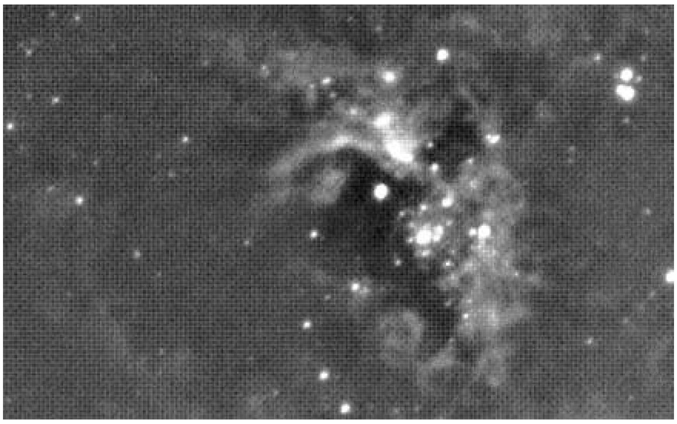
- A letter of intent to propose a survey must be received at NOAO by 29 January 1999. Letters will give the names of PI and Co-Is and will include a brief overview of the survey to be proposed to confirm that it fits within the guidelines of the program. Letters will also be used to assist in the selection of appropriate TAC members. See the web page listed above for details on writing the letter.
- Survey proposals will be due 15 March 1999 (two weeks ahead of the regular deadline)

  The proposals will be submitted on an expanded version of the standard NOAO proposal form with slightly different instructions. In particular, survey proposals will include a discussion of the management of the survey in the section on experimental design.
- The survey proposals will be reviewed and ranked by a Survey Panel and will then be considered by a joint TAC that will meet following the meetings of all the other panels. The Survey Panel will judge survey proposals by additional criteria such as the credibility of the management plan and the commitment to quickly making the results public as well as the usual ones.
- Surveys may be proposed for multiple telescopes and/or instruments at more than one site. Proposals that require observations in both hemispheres are particularly encouraged.
- Up to 20% of the time on all telescopes will be available (with possibly a larger percentage on the HET and MMT when time on these becomes available to the community). Since it is expected that surveys may take several years to be completed, allocation to new surveys in any given year will be limited to a fraction of this total.
- Following selection of a survey project for telescope time, participation will be required in several different activities aimed at sharing information about the technical and scientific progress of all surveys. These will include an annual workshop for all currently operating or approved projects and an annual public forum.
- The solicitation of new survey proposals and the process described above will be repeated annually. Note that this means that surveys in which the observations are limited to the "A" semester will be proposed six months ahead of the usual deadline for that semester.

Todd Boroson, Richard Green,
Malcolm Smith, Sidney Wolff

Observing Opportunity at the South Pole

In late October the Center for Astrophysical Research in Antarctica (CARA) and the National Optical Astronomy Observatories (NOAO) announced the availability of telescope time on the SPIREX/Abu facility at the South Pole. SPIREX/Abu is a 60-cm aperture telescope with a 1024 1024 InSb detector array. Approximately 30% of the time during the next austral winter (March-October 1999) will be made available to the astronomical community through a peer-review process.



Caption: *555 minute composite of 30 Doradus taken with the L filter using the SPIREX/Abu facility. The data were provided courtesy of the Abu team with special thanks to Mike Merrill (NOAO) for the image processing.*

The Abu IR instrument/detector combination provides a spectral range of 2.4-4.8 m, with a pixel scale of 0.6" per pixel and a field-of-view of 10.2' on a side. All observing will be done in queue mode. Ian Gatley (Rochester Institute of Technology) and his team at will lead all aspects of the observing program and distribution of data. See more about this capability and sample data on the NOAO SPIREX/Abu Web page at http://www.noao.edu/scope/south_pole/.

The deadline for proposals for this observing opportunity is Tuesday, 1 December 1998, at Midnight MST. We were unable to provide more advanced notice of this opportunity through the NOAO Newsletter, since it was decided to go forward with this plan after the September issue was printed and distributed. Fortunately, we were able to distribute information about this observing opportunity through the AAS Newsletter, the AAS Electronic Announcements, and our own e-mail exploder. Proposals are being accepted through the NOAO Web-based proposal form (with slight modifications to accommodate this facility)-see the URL http://www.noao.edu/noaoprop/.

Questions about the instrument and its capabilities may be directed to Nigel Sharp (nsharp@noao.edu) or Mike Merrill (mmerrill@noao.edu). Questions about the proposal process may be directed to noaoprop-help@noao.edu.

Todd Boroson

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NOAO Workshop on Telescope Proposals of the Future

As new and more complex telescopes come on-line, telescope time applications are becoming more complex, too, with requirements for machine-readable target lists, guide star selections, detailed exposure estimates, and specifications on sky conditions. Learning to use new tools for each observatory just to submit proposals may well become a daunting and time-consuming task for all of us.

To try to prevent this situation from arising, representatives of several observatories, including NOAO, Gemini, STScI, McDonald Observatory and the HET, the MMT Observatory, the CFHT, the National Research Council of Canada, the AAO, and JACH, met at a Proposal Process Workshop, hosted by NOAO in August. The goals of the workshop were:

- To develop a shared understanding among observatories, including the National Gemini Offices and the Gemini Project, of the requirements and procedures for telescope proposals.
- To encourage cooperation among the national observatories of the partner countries, STScI, and other institutions faced with similar issues and concerns related to the telescope proposal process.

Through discussions at the Workshop, a broad consensus emerged. First, the proposal process should include an option for web-based proposal preparation and submission that does not require the distribution of software. For now this was the best option for the US community, but we will need to continually re-evaluate the situation as new tools and methods become available.

Second, the proposal process should be as simple as possible for users, with required information kept to a minimum, while allowing investigators to present their case in a suitable manner. Wherever possible, observatories should share common and familiar tools for developing proposals.

Finally, the process should minimize the effort required at each observatory to support TAC evaluation and observing. The process should allow integration of proposals for the variety of telescope time available through each observatory.

Actions resulting from the Workshop include:

- Distribution of the NOAO Web proposal system to several observatories.
- Formation of two working sub-groups to develop a set of LaTeX/XML tags to be shared among observatories and to develop guidelines for layout and organization of Web-based tools for proposal submission that will allow the sharing of tools among observatories.

Caty Pilachowski, Jeannette Barnes

Visit the NOAO Display at the AAS Meeting

If you are attending the AAS meeting in Austin, Texas be sure to drop by the NOAO display to find out the latest about observing opportunities through NOAO, which include not only CTIO and KPNO but also the South Pole, the HET, the MMT, and Gemini. NOAO will be accepting proposals for community access time on the HET (27 nights per year) and the MMT (27 nights per year) for the February-July 2000 observing period (proposal deadline 30 September 1999); this access will continue for six years. NOAO is currently accepting proposals for time on the SPIREX/Abu facility at the South Pole (see accompanying article in this section of the Newsletter). Proposals for Gemini North could be accepted as early as September 1999. All time will be awarded through a peer-review process (see article in March 1998 issue of this Newsletter about changes to the proposal and TAC processes to accommodate these facilities).

We will have flyers outlining the capabilities of these new facilities as well as information on current telescopes and instrumentation at Cerro Tololo and Kitt Peak. There will also be information about the new NOAO Survey Program being initiated for NOAO facilities next year (see accompanying article in this section of the Newsletter). NOAO staff members will be at the display to answer questions you may have about NOAO and its facilities in general.

Hope to see you at the AAS meeting!

Todd Boroson

1999A Proposals Received and Processed!

For NOAO users, September 30 is the day for completing and submitting proposals. For SCOPE staff, October 1 is the day for processing the proposals that arrived the night before. This year we were especially busy processing not only KPNO proposals but CTIO proposals as well. By the midnight deadline we had received 409 proposals: 179 for CTIO and 230 for KPNO--75% arrived on the last day! As in the previous semester, all proposals arrived in electronic form. Seventy-one percent of proposals included figures; we processed over 500 figure files. We received 77 graduate thesis proposals. With diligent effort, all proposals were processed by Friday, 2 October.

Once the proposals were received, they were printed, checked, and entered into our proposal database. Most proposals flew through the system without intervention, and we are grateful to our users taking care to submit accurate information in their proposals. Some 30% of proposals, however, required manual intervention of some form:

- About 9% of proposals required some correction of the information on the front page: an investigator status was missing or wrong, more than one investigator was included on a line, the lunar age was missing, the acceptable or optimal date ranges were entered incorrectly (or not at all), or long-term status information was given in the table of observing runs rather than on the long-term status line.

- About 5% of proposals had figure problems, usually because the subject line was typed incorrectly when a figure was submitted.

- The remaining problems included lines added before a proposal submitted by e-mail ("Hi - Here's my proposal..."), mailers that wrap long comment lines, and incorrectly edited target tables. Occasionally, someone forgot a "Ã¯n front of a % sign.

Our users seemed to appreciate the new "Proposal Queue Status Page" on the Web to confirm receipt of proposals and figures and to follow the status of their proposal. By 15 October, this page had received 1859 hits, and several investigators alerted us to possible figure problems by checking the web page.

The NOAO Proposal Team

Journals Available

The following items are available for **free** from the NOAO Library (shipping charges to be paid by recipient). Please contact me at library@noao.edu if you are interested in obtaining any of them.

- Bound set of *The Astrophysical Journal*, volumes 157 to 473.

- Unbound set of *The Astrophysical Journal*, volumes 163 to 226.

- *The Astrophysical Journal* on microfiche, volumes 227 to 401.

- A long list of duplicate journals, mostly *Nature*, *Science*, and *Physics Today*.

Mary Guerreri

CTIO 1999A Observing Request Statistics February 1999 - July 1999

Summary:

	4-m	1.5-m	YALO	0.9-m	SCHM
No. of requests	127	60	10	22	5
No. of nights	384.00	273.00	37.75	135.00	27.00
No. of nights	146	159	15	138	90

Oversubscription	2.63	1.72	2.52	0.98	0.30
Average request	3.02	4.55	3.77	6.14	5.40

*The number of nights available is approximate until engineering time assignments have been allocated.

Requests by Telescope:

4-m Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
BTC	22	2	69.00	8.00	77.00	20.1%
CFIM	5	0	16.00	0.00	16.00	4.2%
CIRIM	0	14	0.00	33.50	33.50	8.7%
COB	0	1	0.00	4.00	4.00	1.0%
ECH	1	12	3.00	39.00	42.00	10.9%
HYDRA	10	2	30.00	7.00	37.00	9.6%
IRS	1	12	4.00	38.00	42.00	10.9%
OSCIR	0	13	0.00	45.00	45.00	11.7%
PFIM	2	0	2.00	0.00	2.00	0.5%
RCSP	22	6	62.00	16.50	78.50	20.4%
RFP	1	0	4.00	0.00	4.00	1.0%
VIS	1	0	3.00	0.00	3.00	0.8%
	-	--	-----	------	------	----
	65	62	193.0	191.00	384.00	100.0%

1.5-m Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
ASCAP	1	3	6.00	21.00	27.00	9.9%
BME	1	3	5.00	14.00	19.00	7.0%
CFIM14	6	0	28.00	0.00	28.00	10.3%
CFIM8	8	4	41.00	18.00	59.00	21.6%
CIRIM	1	17	3.00	71.00	74.00	27.1%
CSPEC	4	9	13.00	35.00	48.00	17.6%
RFP14	1	0	4.00	0.00	4.00	1.5%
RFP8	0	1	0.00	4.00	4.00	1.5%
VIS	1	0	10.00	0.00	10.00	3.7%
	-	-	-----	----	-----	----
	23	37	110.0	163.00	273.00	100.0%

YALO Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
ANDICAM	3	7	11.25	26.50	37.75	100.0%
	-	-	-----	-----	-----	------
	3	7	11.25	26.50	37.75	100.0%

0.9-m Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
CFIM	17	5	109.0	26.00	135.00	100.0%
	--	-	-----	-----	------	------
	17	5	109.0	26.00	135.00	100.0%

SCHM Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
NFDIR	2	3	10.00	17.00	27.00	100.0%
NFPRM	0	0	0.00	0.00	0.00	0.0%
	-	-	----	----	----	----
	2	3	10.00	17.00	27.00	100.0%

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KPNO 1999A Observing Request Statistics February 1999 - July 1999

Summary:

	4-m	WIYN	W2HR	2.1-m	CF	0.9-m
No. of requests	108	41	15	54	19	42
No. of nights	326.00	108.50	3.15	243.00	162.00	196.00
No. of nights	162	58	2	138	152	168
Oversubscription	2.01	1.87	1.58	1.76	1.07	1.17
Average request	3.02	2.65	0.21	4.50	8.53	4.67

*The number of nights available is approximate until engineering time assignments have been allocated.

Requests by Telescope:

4-m Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
CRSP	0	4	0.00	13.00	13.00	4.0%
CRYO	8	1	24.00	3.00	27.00	8.3%
ECH	3	11	7.00	33.00	40.00	12.3%
IRIM	0	4	0.00	11.00	11.00	3.4%
MOSA	26	7	83.00	22.00	105.00	32.2%
ONIS	0	6	0.00	15.00	15.00	4.6%
PFIM	14	0	45.00	0.00	45.00	13.8%
RCSP	18	6	58.00	12.00	70.00	21.5%
VIS	0	0	0.00	0.00	0.00	0.0%
	-	-	----	----	----	----
	69	39	217.0	109.00	326.00	100.0%

WIYN Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
DSPK	0	1	0.00	3.00	3.00	2.8%
HYDR	16	7	43.05	19.00	62.05	57.2%
NFIM	14	3	36.45	7.00	43.45	40.0%
	--	-	-----	----	-----	-----
	30	11	79.50	29.00	108.50	100.0%

W2HR Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
DSPK	0	3	0.00	0.45	0.45	14.3%
HYDR	4	4	1.00	1.00	2.00	63.5%
NFIM	4	0	0.70	0.00	0.70	22.2%
	-	-	----	----	----	-----
	8	7	1.70	1.45	3.15	100.0%

2.1-m Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
CFIM	10	2	39.00	10.00	49.00	20.2%
CRSP	0	4	0.00	15.00	15.00	6.2%
GCAM	12	8	56.00	45.00	101.00	41.6%
IRIM	0	5	0.00	21.00	21.00	8.6%
ONIS	0	13	0.00	57.00	57.00	23.5%
VIS	0	0	0.00	0.00	0.00	0.0%
	-	-	----	----	----	----
	22	32	95.00	148.00	243.00	100.0%

CF Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
CAM5	0	15	0.00	138.00	138.00	85.2%
CAM6	0	4	0.00	24.00	24.00	14.8%
	-	-	----	-----	-----	-----
	0	19	0.00	162.00	162.00	100.0%

0.9-m Telescope

	Requests		Nights Requested		Total Nights	
Instrument	**Dark**	**Bright**	**Dark**	**Bright**	**Requested**	**Percentage**
CCDP	0	2	0.00	8.00	8.00	4.1%
CFIM	6	8	27.00	36.00	63.00	32.1%
MOSA	19	7	94.00	31.00	125.00	63.8%
	--	-	-----	-----	------	-----
	25	17	121.0	75.00	196.00	100.0%

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Computer Changes at CTIO

The CTIO computer system is continually undergoing change, as we try to keep up with our users' needs, as well as advances in computer and detector technology, such as Mosaic-II. Here are some highlights of recent changes which are likely to be of most interest to visitors using our computers.

New Hardware

We are substantially increasing the computer power available in each dome by installing new data reduction computers in place of the ancient and ailing VME bus computers, which have served this role for many years. The Blanco 4-m has been equipped with a dual processor Sun Ultra 2200 for almost a year. However, in preparation for the arrival of Mosaic-II, this will shortly be replaced by a new Ultra 60 workstation, providing a modest improvement in data reduction muscle. This machine will also be loaded with 45 Gb of disks for bulk data storage, and a DLT-7000 and twin Exabyte drives for data transfer. The three other domes will see a much more dramatic improvement in computing power, with the arrival of Ultra 10s for data reduction at each of the 1.5-m, 0.9-m, and Schmidt telescopes. At the same time the data acquisition machines will be receiving a boost from HyperSparc CPU upgrades. The disk space available in each dome will also be increased to around 20-30Gb.

Observers who arrive early on the mountain, or stay for a few days between runs will also now find a small number of public machines available in the round office building library and in the "old coffee area" at the 4-m. For the most part these are "cast off" but still serviceable machines adequate for reading e-mail, web browsing, and maybe making a start on that world-shattering paper based on the data you just took. However, there will also be access to an Ultra 10 or comparable machine for those who need to finish off their data reduction or tape writing.

The public computing hardware in La Serena is also changing for the better. The new centerpiece will be the Sun Ultra2 dualprocessor workstation (demoted from the Blanco 4-m), which will be available for large reduction tasks such as handling data from BTC and Mosaic-II. This machine will correspondingly be equipped with a large amount of disk storage, and a DLT-7000 and Exabyte and DAT drives for media conversion. The two other public "server" machines will also be replaced with Ultra10s, and a new Linux PC workstation (400Mhz DualPentium II) will be added. This latter machine is our Linux IDL server (see IDL section below), but will also be available for limited use by visiting astronomers.

The working environment in La Serena will also be improved as we remodel the La Serena computer room with the addition of computing cubicles. These will be used by our summer REU students from January through March, but are otherwise available for visiting astronomers who plan on using the La Serena computing facilities for more than a day or so.

Finally, the La Serena network has been upgraded to a 10/100mbps switched ethernet system and the Tololo ethernet will follow suit within the next few months. In addition to faster and more reliable intermachine communication this provides improved lightning protection on the mountain and increases network security (see next section).

Computer Security

For a long time CTIO has been sheltered from unwanted visitors by its remote physical and network location. However, we have suffered two separate, but probably related, hacker breakins during the course of the past year. No serious damage was done on either occasion, but considerable inconvenience was caused to both ourselves and to a number of observers here at the time. In particular, the hacker installed a packet sniffer allowing him to capture user names and passwords for a number of users when they logged on to their home machines from CTIO using *telnet* or *rlogin*. Our unwelcome guest then used the information obtained to break into several of these machines spreading the infection to a number of other institutions.

As a result, we are taking a number of steps to improve the security of our network. The majority of these will be largely transparent to users, or even improve service. For instance, the upgrade of the downtown and mountain networks to a modern switched ethernet system has the desirable side effect of severely limiting how much information a hacker can capture by planting a sniffer. However, we are also forced to take a number of measures and adopt policies (see http://www.ctio.noao.edu/sys/security.html), which may somewhat inconvenience legitimate users of our system.

Firstly, we have installed the SSH2 (Secure SHell) software package on all our machines. This provides for secure remote logins in a way similar to *telnet, rlogin*, or *rsh* and for secure file transfers in a way analogous to *rcp*. This software package is available for most operating systems, and is free of charge to educational and noncommercial users, while an enhanced version is available commercially (follow the links on the CTIO security page for further information on SSH). Hence forward we will not accept logins from machines outside the *ctio.edu* domain except via *ssh*. This means that users who wish to log into our machines from outside must first install *ssh* on their home machines. You will still be able to log onto your home machine from CTIO without using *ssh*. However, we strongly recommend its use, in this case in order to protect your home system. Special arrangements can be made in exceptional cases where it is very difficult or impossible to use *ssh*.

FTP service is another security risk which we have severely limited. Regular anonymous FTP service for getting information from our systems (e.g., downloading instrument manuals, etc.) is only available through our central server, *www.ctio.noao.edu*. Depositing files into the CTIO anonymous ftp area is not allowed. If you need to transfer files down here while you're observing, you can pull them in by FTPing from our machines to your home machine. Alternatively, we encourage you to use *scp*, the secure remote copy component of *ssh*, as an alternative to FTP to bring your files over.

Bringing Your Own Computer to CTIO

Despite the above mentioned improvements in the computing power at CTIO, the availability of powerful portable computers means that many visitors ask if they can bring their own computers with them and connect them to our network. You are welcome to do so, and we maintain a number of "spare" IP numbers to facilitate this. However, we ask that you please read and follow CTIO's guidelines for visiting computers (http://www.ctio.noao.edu/sys/usys.html). We also note that while laptops are now as much a part of the world travelers' equipment as a phrase book, exportation from the US and importation into Chile of larger computers (e.g. desk tops) is controlled by the respective governments (see http://www.ctio.noao.edu/diroff/obser_trav.htm for advice and importation procedures)

Tape Drives

CTIO's policy regarding magnetic media follows that of KPNO very closely (see NOAO Newsletter No. 53, March 1998). The following kinds of tape drives and media are currently supported at CTIO:

Exabyte: Currently drives capable of writing both 8500 ("high density") and 8200 ("low density") format are available in each dome and in the La Serena computer center. In noncompressed mode a 112-m tape holds 2Gb in 8200 format and 5Gb in 8500 format. It is now impossible to buy new drives capable of writing the 8200 format. Thus when the existing drives fail they will be replaced with drives that can only write 8500 format tapes. Thus we can make no commitment about how much longer low density format will be available. We will support writing such tapes in a central location on Cerro Tololo, and in the La Serena computer room for as long as our existing drives can be affordably maintained, and reading them for as long as compatible drives are available. Like KPNO, CTIO is committed to supporting 8500 format at each telescope until at least 2001.

DAT: Drives capable of reading and writing DDS3 format (12Gb non-compressed on 125-m tape) are available in each dome and in the La Serena computer center. These units will also read and write the shorter DDS1 (2Gb on 90-m tapes) and DDS2 (4Gb on 120-m tapes) formats. Again CTIO is committed to support this format until at least 2001.

DLT: This is our medium of choice for storing data from the large format imagers BTC and Mosaic-II. In preparation for the arrival of Mosaic-II, DLT-7000 drives have been installed at the 4-m telescope and in La Serena. These drives can read and write DLTtapeIV tapes, which hold 35Gb of data in non compressed mode. They can also read and write DLTtapeIIIxt (15Gb) and DLTtapeIII (10Gb) media. An older DLT2000xt drive capable of reading and writing DLTtape-III and DLTtape-IIIxt, but not DLTtape-IV, is currently available at the 4-m, but this will depart along with the BTC at the end of first semester 1999.

NineTrack Magnetic Tapes: Yes, we still have some 6250/1600 BPI tape drives in La Serena should anyone have a fit of nostalgia, or a very old data tape.

We maintain a stock of 112-m Exabyte and 90-m DAT tapes, which may be purchased by users. However, our prices are relatively high, $17/tape because we must cover the costs of shipping and handling (we do have great deals on used ninetrack tapes, though!). Observers are therefore encouraged to supply their own data grade media. You may choose to bring 160m Exabyte, or 60-m or 120-m tapes, but should be aware that the longer tapes will not work with all drives and that the IRAF "tapemon" program is not configured to report the correct length of the tape, or the correct number of megabytes remaining for these alternate media. We currently maintain a small stock of DLTtape-IIIxt and DLTtape-IV media, which visitors may borrow while they transfer data to other media but these tapes are not available for purchase.

IDL at CTIO

The arrival of our three new postdocs has resulted in an irresistible surge of inhouse demand for IDL at CTIO. As a consequence we are able to offer our visitors limited access to IDL. We have one general use Sun "floating" license which can be used on any CTIO Sun workstation, either in La Serena or on the mountain. This only permits one user at a time, so please log out of IDL when not using it. We have also installed four Linux licenses, primarily to support staff use on the new IDL/Linux workstation in La Serena. Note that support for IDL will be exclusively limited to providing sitespecific details (such as how to start it up on our systems). Thus you should only plan to use IDL at CTIO if you are already an experienced and self sufficient user. We also have no plans to develop any public data reduction software for CTIO instruments using IDL.

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Increase in Lodging Rate on Tololo

We regret to inform CTIO users that we are compelled to raise the room rate per night on the mountain starting February 1999.

The only changes are:

	Current Charges	February 1999
1 Full day (Lodging and Meals)	50	60
Double Occupancy	47	57
Lodging	25	35

Elaine Mac-Auliffe (emacauliffe@noao.edu)

NOAO Newsletter - Cerro Tololo Inter-American Observatory - December 1998 - Number 56

Summary and Status of CTIO Instrumentation Projects

A number of major instrumentation projects are nearing completion. As reported elsewhere in this Newsletter, the Hydra multiple fiber spectrograph is presently being commissioned at the RC focus of the Blanco 4-m Telescope. Many components of the system, including the corrector-ADC, the bench spectrograph, comparison lamps, and much software, were supplied by CTIO. Initially our Loral 3K CCD and blue Air Schmidt camera will be used, to be replaced during 1999 with a 2K 4K format CCD and a Folded Schmidt camera.

Also at this time final tests and installation of a new servo system for the 4-m drives is taking place. The new system, the same as that chosen by Gemini, will provide much needed reliability and ease of tuning. Other telescoperelated projects include an upgrade for the F/14 tip-tilt system. Although in regular use, enhancements to both hardware and software, and installation of a higher-QE CCD, are expected to provide improved image quality and a fainter limiting magnitude.

Another major new instrument, the Mosaic II imager, is scheduled to be commissioned in mid-1999. Prior to this time, modifications will be made to the Blanco prime focus cage and pedestal. Construction of the ARCON controller for the Mosaic is near completion, and the instrument itself, built by NOAO-Tucson, has been delivered. The eight SITe 2K 4K CCDs are scheduled to be installed in the dewar next April, followed by system testing involving both CTIO and NOAO-Tucson personnel.

The third new 4-m instrument is OSIRIS, the Ohio State University Imaging Spectrometer, expected to be re-commissioned early in 1999. CTIO is providing a 1K HgCdTe "Hawaii" array, and is supporting building of a new focal plane assembly and telescope interface.

Significant manpower is being provided to the SOAR project, mainly in the software area. A proposal has been submitted to build a high resolution CCD imager for SOAR. This project is expected to consume significant ETS resources over the next couple of years, in common with a project to build a wide-field IR imager for the Blanco f/8 sideport.

Finally, visitors should notice a considerable improvement in computer power, both at the telescopes and in La Serena, over the next few months as computers are upgraded. In addition, the Tololo ethernet is being improved.

Alistair Walker, chairACTR (awalker@noao.edu)

NOAO Newsletter - Cerro Tololo Inter-American Observatory - December 1998 - Number 56

Developments at the Curtis Schmidt

The Curtis Schmidt continues to fill a unique niche at CTIO, offering an extremely wide fieldofview with good sensitivity. Changes in the CCD plans for the Hydra spectrograph (see Hydra article) mean that the SITe 2K #5 CCD will remain on the Schmidt for the foreseeable future, providing excellent image quality over a 1.3 1.3 degree field, albeit with the 2.3" pixels producing very under sampled images (typical FWHMs of 1.1 to 1.2 pixels). The SITe 2K #5 is a thinned, backside illuminated CCD, providing a quantum efficiency curve similar to the other SITe (or Tek) CCDs at CTIO. It only has two good amplifiers, but recent modifications in the Arcon control software have sped up the readout to about 38 seconds at the default gain (there are 4 gain settings available, from 2.7 e/ADU down to 0.6 e/ADU). The users' manual (available at http://www.ctio.noao.edu/cs/c-s.html) has been updated to reflect these changes, as well as changes to the IRAF/Arcon acquisition software.

For studies of extended or low surface brightness objects, the combination of the Curtis Schmidt with the SITe 2K CCD is competitive with telescopes such as the KPNO 0.9m+Mosaic in the north. Its wide field, deep imaging capability and low subscription rate make it an ideal instrument for surveys or larger projects for which it might be difficult to obtain enough time on the larger telescopes.

Chris Smith csmith@noao.edu

NOAO Newsletter - Kitt Peak National Observatory - December 1998 - Number 56

CCD Mosaic Imager Status Report

We installed thinned SITe science-grade CCDs in the CCD Mosaic Imager in June 1998. Preliminary results from an engineering run in July were already reported in the September 1998 NOAO Newsletter, but many changes have taken place since then.

First, the terrible news: one of the CCDs self-destructed. For unknown reasons, CCD #4 developed a large region of saturated pixels. A replacement CCD was installed and the defective chip was sent to SITe for a post-mortem.

Now, the good news:

1) The replacement CCD was installed in August with no problems and has been working perfectly (thanks to Rich Reed and Tom Wolfe).

2) We reduced the readout time from 4 minutes to 2.5 minutes with some minor hardware modifications and by adjusting the clocks (thanks to Roger Smith at CTIO).

3) In the last Newsletter, we indicated that an "on-the-fly" processing feature would be added to the display program. This functionality is required because some of the CCDs exhibit strong (10-15%) spatial sensitivity variations that make it impossible to display faint objects at high contrast. We have added this optional processing step (overscan and flat-fielding) to the display task (raw data is not touched) so that observers can evaluate their data immediately and effectively. That feature is now fully operational and works great (thanks to Frank Valdes, Mike Fitzpatrick, and Doug Tody of the IRAF group). In the process, Frank found and fixed a significant bug in the display task that was slowing down the display of incoming data.

4) Astrometric solutions are now installed for both the 0.9-m and 4-m setups for a variety of bandpasses (thanks to Lindsey Davis of the IRAF group).

5) Sensitivity from U through (SDSS) z' has been verified to be at the expected level. Count rates in electrons per second for a 20th mag star for the 4-m (0.9-m) at UBVRI are: 40 (2), 330 (14), 340 (14), 410 (16), 225 (9). The sharp-eyed reader will see that the ratio between the 4-m and 0.9-m is ~ 25 rather than ~ 17 as expected from the ratio of the clear apertures of the telescopes. (The U-band ratio of 20 is another story-see below.) We are looking into the possibility that the 0.9-m is suffering from some unexpected loss (or the data were taken on a far inferior night than we thought), or that the 4-m has grown since we last measured it.

6) A new coating was applied to the last element of the 4-m corrector to replace a degraded Solgel coating that was exacerbating the presence of the "ghost pupil" (thanks to David Vaughnn for leading the Solgel research effort). With the new coating, the ghost severity has been reduced to a nearly imperceptible level (0.5-1%) in BVRI, and rises to ~ 1.5% at U. Narrow-band imaging, where the problem is most evident, is also much improved. Before the re-coating, images taken through a 50 (FWHM) [OIII] filter exhibited a ghost level exceeding 15%; it is now under 4%, and this is the worst case filter.

7) After 37 nights at the 0.9-m and 4-m telescopes with the new, thinned, science-grade CCDs, the upgraded Mosaic system has performed at an extremely high level of reliability. It appears that nearly all significant problems have been resolved. This is a non-trivial point because requests for Mosaic next semester total 230 nights!

8) The manual and all web pages have been updated to reflect the new CCDs and software (see the Mosaic web page: http://www.noao.edu/kpno/mosaic).

Filters

We are still in the throes of developing the ultimate U-band filter. Several attempts have demonstrated that we can achieve superb efficiency with a peak transmission of ~ 84% with no red leaks (thanks to Jim De Veny, Gary Poczulp, and David Vaughnn). This filter, though, uses liquid copper sulfate that can attack the Schott glass that contains it, leading to a loss of throughput and image quality. (The low 4-m count rate noted in item 5 is a consequence of this effect.) Further, any liquid poses a hazard to the instrument should a leak develop. We are continuing along several paths to obtain that elusive filter.

Mosaic-II

Hardware for the second copy of the Mosaic system was shipped to CTIO, received, and tested. Receipt, testing, and integration of the second complement of SITe science-grade CCDs, and modifications to the Blanco 4-m prime focus are the two most important outstanding tasks. Mosaic-II is expected to be on-line for testing and commissioning at the Blanco 4-m telescope by the third quarter of 1999.

Concerns

There are two issues that may affect observing strategies:

1) Cross-talk ("echos"). Two CCDs are run from each of four controllers in the NOAO Mosaic. We have found that saturated stars in one of the CCDs produce "echo" images in the other CCD of the pair. In some cases, not-quite saturated stars leave faint echoes, too. The direction of the echo is one-way: from CCDs 2, 4, 5, 7 to CCDs 1, 3, 6, 8, respectively. We are investigating ways to reduce the amplitude of the echo (currently at < 0.1%), or providing software to flag affected pixels.

2) Binning: Data obtained with the current set of CCDs, if binned, is mysteriously destroyed. With the readout time reduced to 2.5 minutes, and the option to block average the data after the fact, most programs should not be affected very seriously. Note that the 0.9-m and 4-m pixel scales (0.42" and 0.26", respectively) are barely adequate to sample the seeing profile, and so, binning will usually degrade the spatial resolution of the images. Consequently, we recommend against the use of binning.

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

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News from the WIYN Board

The WIYN Consortium recently made major commitments toward realizing a new strategic plan for the WIYN Observatory. The Board held its semi-annual meeting on 19 September at Yale, following a WIYN instrumentation forum and a meeting of the WIYN Scientific Advisory Committee. All three meetings wrestled with the issue of the level of continuing investment required to keep a state-of-the-art facility at competitive performance level.

At the heart of the issue is the very lean operations model specified in the WIYN agreement. That model calls for 6.5 FTE (full-time equivalent) staff and a modest amount of non-payroll funding. Shortly after operational handover, the WIYN Site Manager David Sawyer led the consortium to realize that such a level of support was just adequate to maintain the facility at its current capability. No upgrades, improvements, or major repairs would be possible within that envelope. At that time, the Consortium agreed to a one-time increment of support for two years. The purpose was to bring the facility closer to its design performance goals, and to address a number of issues with potential impact on safety and reliability that had been identified.

The backdrop to September's decisions was that the two-year bulge in funding was about to expire. We recognized that once again we would not be able to support development of new capabilities like the WIYN tip/tilt module, address ongoing performance issues like telescope top-end stability, and still keep up with basic infrastructure needs like improvement of the mirror handling facilities. After extensive deliberations of both the SAC and the Board, the Board agreed on an initial plan that leads to a long-term commitment of increased technical support for WIYN. The plan calls for an additional FTE per year from the KPNO technical pool and an increase in non-payroll funding for purchased equipment and contracted labor. The new support represents almost a 25% increase over the previous operations base. Dave Sawyer and Tony Abraham, Kitt Peak's lead engineer, are currently defining the program of improvements to be carried out in the coming fiscal year, based on this new level of support.

At the same time, the scientific members of the WIYN Consortium made genuine progress toward defining a joint approach to instrumentation development. Taft Armandroff (NOAO), Eric Wilcots (Wisconsin), and Steve Zepf (Yale) organized a very effective instrumentation forum, to which participants brought their ideas for the next generation of WIYN instruments. Those present agreed that the concepts for exploiting the wide field and good image quality were scientifically exciting. The excitement from a management perspective was that the university partners and NOAO expressed a new sense of joint commitment, based on a process and a plan for going forward.

The strategic plan calls for exploiting the unique qualities and features of the WIYN Observatory as they apply to leading-edge astronomical research. These administrative and fiscal steps mark a critical step on the path to reaching that goal.

Richard Green

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1998 KPNO REU Students Had a Busy Summer

Every summer for more than a decade we have been fortunate at Kitt Peak to have a few talented undergraduates from around the country come and work with members of the scientific staff. The program has evolved over the years and is currently run as a site program of the NSF funded Research Experiences for Undergraduates program. Participants in the 1998 program were the following:

Caption: *The summer of 1998 saw nine undergraduates come to Tucson as participants in either the NSO-Tucson or KPNO REU programs. Shown are (left to right), Lynn Carter (KPNO REU and the University of Illinois), Michelle Stark (KPNO REU and Michigan State University), Jacob Taylor (NSO REU and Harvard University), Alicia Soderberg (KPNO*

REU and Bates College), Avi Mandell (KPNO REU and Vassar College), Amy Smith (NSO REU and Davidson College), Christopher Burke (KPNO REU and Yale University), and Patricia Van Lew (NSO REU and University of Wyoming). Not pictured, Jenna Burroughs (KPNO REU and Baker University). The research activities of the NSO REU students were described in the September Newsletter. In the article below we report on the work of the KPNO REU students.

Christopher Burke (Yale) worked with Ken Mighell on the reduction and analysis of Hubble Space Telescope WFPC2 images of the Ursa Minor dwarf spheroidal galaxy. Christopher constructed a color magnitude diagram from photometry of the stars in the images that reaches two magnitudes below the main sequence turnoff. Additional analysis has demonstrated that the Ursa Minor dwarf is similar in age to the Galactic globular cluster M92; i.e., as old as the Milky Way.

Jenna Burroughs (Baker) worked with Doug Geisler on a project that also involved reducing and analyzing HST WFPC2 data. Jenna studied globular cluster systems in two distant giant elliptical galaxies, NGC 1129 and UGC 9799. Analysis is continuing on these data with the goal of comparing the results to various theories of globular cluster and elliptical galaxy formation scenarios.

Lynn Carter (Illinois) worked with Mike Belton and Nalin Samarasinha on an investigation of the nature of active regions on the nucleus of Comet Halley. Using photometry from various space missions and ground-based observatories, Lynn created a model of the changing rate of water production observed from five active regions of the nucleus. Properties derived from this study include the physical sizes and variations in chemical composition of the five regions. Her results have already been presented at the DPS meeting this past October.

Avi Mandell (Vassar) worked with Nigel Sharp processing multi-band images of Messier objects as part of a large project to generate a complete set of "true-color" images of this entire catalogue. The resulting images will be useful not only for educational purposes (they will eventually be available through NOAO), but also for various scientific projects as well.

Alicia Soderberg (Bates) worked with Caty Pilachowski on a search for binaries in the Globular Clusters M3, M13, M15, and M92. The properties of binary systems found in these clusters will be used to improve our understanding of the frequency of occurrence, radial distribution, and ultimately the formation mechanisms of globular clusters. Alicia reduced multi-object spectra of giant stars in the clusters (several epochs were obtained) and then searched for candidate binaries by identifying stars with significant changes in their relative velocities between observations. The spectra were obtained with the Hydra spectrograph on the WIYN telescope.

Michelle Stark (Michigan State) worked on two projects. The first, with Buell Jannuzi, focused on mapping the redshift distribution of galaxies (using spectra obtained with the Hydra spectrograph on WIYN) in the fields of quasars that have been observed spectroscopically with HST. This is part of a larger program to compare the distribution of absorption line systems with other structures, including large-scale structures traced by normal galaxies. Michelle also developed an independent project to study several variable stars during the summer students' observing time on the 2.1-m, 0.9-m, and Coud Feed telescopes. Working with several of the other students, Michelle carried out monitoring observations, and then completed the data reductions and construction of light curves for the stars. Her continuing analysis has allowed her to determine the periods of several previously unmeasured variables, correct the classification of one variable, and find a new one. Further analysis of the variable star work is in progress.

In addition to their research projects, the students also participated in several observing runs at the KPNO 2.1-m, 0.9-m, and Coud Feed telescopes making imaging and spectroscopic observations. The observing runs were coordinated by Nigel Sharp, but the observational plans were generated by the students and included a wide range of projects and experiments. Other official activities included a trip to SAC Peak and the VLA; a lecture series; and tours of instrumentation facilities at NOAO and the University of Arizona Mirror Lab. Unofficial activities included road trips to the Grand Canyon and Mexico.

If you would like to meet our now former research assistants, most will be presenting results (from their REU work or senior research projects) at the AAS meeting in Austin, Texas, January 1999 and I encourage you to stop by their posters for a chat.

Buell Jannuzi

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The 1999 Kitt Peak National Observatory REU Program

We are pleased to announce that during the summer of 1999 Kitt Peak National Observatory will again have six positions available in the NSF funded Research Experiences for Undergraduates program. A goal of the program is to give students considering a career in science or science education the chance to engage in substantive research activities with scientists working in the forefront of contemporary astrophysics. Participants are hired as full-time research assistants to work on specific aspects of on-going research projects at NOAO (e.g., the origin, nature, and evolution of stars, galaxies, and stellar systems; observational cosmology; analysis of Galileo spacecraft images). As part of their research activities, REU students are also given opportunities to observe at Kitt Peak (often having developed the observing plans themselves) and gain first-hand experience with modern telescopes and instrumentation. Additional activities include visits to SAC Peak and the VLA, a lecture series, and an end of summer "student symposium" at which the students present brief talks describing their work during the summer.

Participants must be citizens or permanent residents of the United States. The positions are full-time for 10 to 12 weeks between May and September, with a preferred starting date in early June. A salary of $345 per week and funds to cover travel to and from Tucson are provided. Application materials and instructions can be obtained from http://www.noao.edu/kpno/reu/. The deadline for completed applications is 15 January 1999. Questions about our program can be sent to kpnoreu@noao.edu.

Buell Jannuzi

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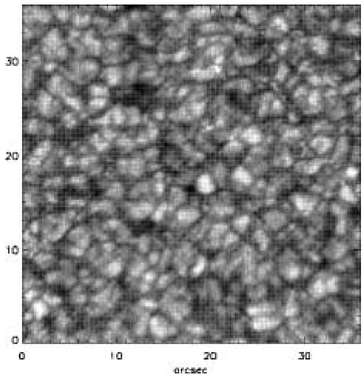
Servo-Loop Closed with Solar Adaptive Optics System at the R.B. Dunn Solar Telescope

During the past 60 days, the solar adaptive optics program at NSO/Sac Peak has achieved two major milestones: in mid-September, the control loop was closed for the first time on the bench, and the loop was again closed with solar granulation and small pores as the wavefront sensing target during the system's first tests at the Dunn Solar Telescope (DST) in early November.

The solar adaptive optics program, a joint effort involving both the NSO and the Air Force detachment at Sac Peak, is currently concentrating on converting the low-bandwidth active optics system developed previously into a higher bandwidth, low-order adaptive optics system capable of compensating about 20 spatial (Zernike) modes through atmospheric turbulence. A correlating Shack-Hartmann wavefront sensor with 24 subapertures, capable of using solar granulation or other time varying, low contrast, spatially extended targets, is used to measure the wavefront aberrations. The hardware design features parallel processing using off-the-shelf DSP components. This approach will allow the system to be expanded to more spatial modes later. A modal wavefront reconstruction algorithm is used to derive drive signals for the 97 actuators of the XINETICS deformable mirror from the wavefront sensor data. Currently, the development effort is concentrating on creating a functional system that will demonstrate the concepts and validate the approach; a user system will be implemented at a later stage.

For both the bench and the telescope tests, the servo loop was closed at an update rate of 800 Hz and a lag of more than 2.0 milliseconds, resulting in a system bandwidth of about 25 Hz. This is inadequate to fully compensate the atmosphere except under the best seeing conditions. The loop bandwidth is currently limited by both the frame rate and read-out speed of the wavefront sensor camera and to a lesser extent by the processing hardware.



These bottlenecks will be alleviated in the near future through the purchase of a faster camera and vendor improvements to the hardware. The small number of subapertures presents another performance limitation that will be more costly to deal with, and the current reconstruction and control algorithms, which remain imperfectly understood, are certainly not optimal. In particular, controlling the outer edge of the adaptive mirror has proven difficult. In the face of these and other difficulties (e.g., vibrations in the preliminary optical setup), the partial atmospheric compensation that the system achieved under good, but not exceptional, seeing conditions at the DST was genuinely exciting: improved and more stable resolution and a reduction of residual jitter were both clearly evident in the corrected image. Now that the critical milestone of closing the atmospheric loop has been achieved, attention can be turned to improving the performance of the current system and planning the next steps for the overall program.

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

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Sunspot Dynamics and Network Bright Points

K.R. Sivaraman and S.S. Gupta (Indian Institute of Astrophysics, Bangalore) spent about four months at NSO, beginning in mid-June 1998, working with Bob Howard on completing the analysis of the merged data set of the Sunspot position and area measures from the Kodaikanal and Mt. Wilson data sets for the years 1917-1985, and deriving the differential rotations for sunspot groups and individual spots. This combined data set forms the most accurate and complete set currently available for sunspot groups and certainly for individual spots. The analysis of the entire Kodaikanal sunspot measurements for 82 years (1906-1987) for differential rotation and its variation with sunspot cycle are in progress.

During this period, Sivaraman and Gupta also worked with Bill Livingston on looking for spatial correspondence of the chromospheric K-line inner network bright points and the arcsec inner network magnetic elements at the photospheric level with fresh data. These data consist of near temporally simultaneous spectroheliograms in the K 2v emission peak with a pass band of 40 m obtained at the McMath-Pierce Telescope and magnetic scans at the spectro-magnetograph of the Vacuum Telescope on quiet regions at the center of the solar disk. The spectroheliograph setup was fabricated by Keith Pierce for this program. They find that 70% of these bright points correspond spatially to the inner network magnetic elements while the remaining 30% do not. This confirms the earlier findings of Sivaraman and Livingston (Sol. Phys., 1982, 80, p. 227).

K.R. Sivaraman, S.S. Gupta

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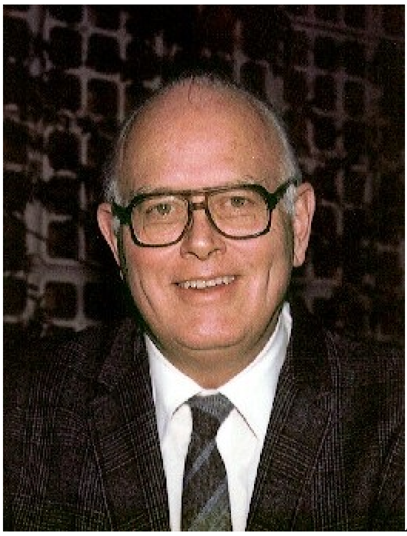
Sac Peak Vacuum Tower Telescope Renamed the Richard B. Dunn Solar Telescope

The 19th annual Sacramento Peak workshop on High Resolution Solar Physics this year was dedicated to Richard B. Dunn on the occasion of his retirement. The highlight of the workshop was the rededication of the Vacuum Tower Telescope to Dick on 30 September 1998. The ceremony accompanying the renaming of the telescope *The Richard B. Dunn Solar Telescope* was attended by the many scientists from all over the world who participated in the workshop, as well as numerous others who had come to celebrate this momentous occasion.

Dick Dunn was the inventor of vacuum solar telescopes and the creator of what will probably from now on routinely be called the Dunn Telescope. This telescope, though originally dedicated 29 years ago, still represents the state-of-the-art in solar telescopes. It remains one of the world's premier telescopes in its sophistication among day or nighttime telescopes. In naming the telescope after Dick, the solar astronomy community expresses not only its admiration for his ingenuity but also its appreciation of his generous support in the creation of solar observing facilities worldwide.

Â Â Â Â Â Â Â Â Â 

The renaming ceremony was attended by most of the National Solar Observatory's past directors (Jack Evans, Dick Dunn himself, Jack Zirker, and John Leibacher), as well as directors from many other solar observatories worldwide, including: Oskar von der Lhe (German Kiepenheuer Institute), Michael Knoelker (High Altitude Observatory), Gran Scharmer (Swedish Observatory), Alan Title (Stanford-Lockheed Institute for Scientific Research), Rob Rutten (Dutch Open Telescope), Arnold Hanslmeier (Graz/Kanzelhhe Observatory), Phil Goode (Big Bear Solar Observatory), and Ye Binxun representing Ai Guoxiang (Beijing Astronomical Observatory). A letter by US Senator Jeff Bingeman (D-NM) with "An Appreciation of Richard B. Dunn" was read before the official unveiling of the commemorative plaque by Ben Snavely (NSF) and Goetz Oertel (AURA).

Jacques Beckers

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19th NSO/Sac Peak International Workshop on High Resolution Solar Physics: Theory, Observations, and Techniques

The 19th NSO/SP summer workshop was held in Sunspot, NM from 28 September to 2 October 1998. The topic was High Resolution Solar Physics: Theory, Observations, and Techniques. High-resolution angular, spectral, and temporal observations of the Sun are required in order to answer many important questions in solar and stellar physics. Furthermore, the Sun is the only star that can be spatially resolved well enough to allow detailed study of fundamental astrophysical processes such as magneto-convection.

Previous NSO/SP summer workshops on high-resolution solar observations were held in 1980, 1988. and 1992. It was evident during this year's workshop that substantial progress continues to be made in the solar astronomer's quest for observations of ever higher angular resolution, but much remains to be accomplished. The proceedings of the 1998 workshop will review the current state of high-resolution solar physics from the theoretical, observational, and modeling perspectives, and the state-of-the-art of instrumentation used to achieve high-resolution solar observations.

About 75 scientists from around the world participated in this workshop, with nearly half from countries outside the US, including Austria, China, Germany, India, Ireland, Italy, Japan, The Netherlands, Norway, Russia, Spain, and Sweden.

The workshop was dedicated to Richard B. Dunn, who recently retired from the NSO. Dunn's pioneering contributions in engineering, design, and observation have done much to lay the foundations of present-day high-resolution solar physics. A highlight of the workshop was the ceremony during which the Vacuum Tower Telescope at Sacramento Peak, one of the finest high-resolution solar telescopes in the world, was renamed the Richard. B. Dunn Solar Telescope, after its creator.

The workshop's keynote address was presented by J. Thomas (University of Rochester) who reviewed the scientific case for high-resolution solar physics, giving examples of important solar phenomena occurring at length scales at or below the current limit of angular resolution of about 0.2". His conclusion was that both theoretical considerations and recent observational successes bolster the case for further effort and investment in high-resolution solar telescopes and instrumentation.

The scientific case for a new, large-aperture solar telescope was further developed and restated in several workshop contributions (e.g., C. Keller, NSO/Tucson). A large aperture is required not only for improved angular resolution, but also just to collect enough photons. The high spectral and temporal resolution and polarimetric accuracy needed to study small-scale solar phenomena are the main drivers for apertures of 2-4 m for new generation solar telescopes. This theme also featured in the final summary talk by A. Title (Lockheed-Martin Solar and Astrophysics Lab), who argued that the fundamental astrophysical processes observed on the Sun at small scales are of importance to non-solar astronomers and plasma physicists, a fact that the solar community needs to convey more effectively to the broad astronomical community.

O. Steiner (Kiepenheuer Institut fr Sonnenphysik, Germany), and M. Rast (High Altitude Observatory) described advances in numerical modeling techniques that are now driving the field to achieve observations of extremely high resolution. Steiner described the rather few key high-resolution experiments that have dramatically changed our understanding of the nature, formation, and evolution of flux tubes, and how the lack of high-resolution observations has prevented us from exploring this new frontier. Rast described simulations that explain granular convection as a phenomenon driven by radiative cooling effects at the very surface of the Sun. In these simulations, solar oscillations are excited by acoustic noise generated in down-drafting plumes just beneath the solar surface. P. Goode (New Jersey Institute of Technology/Big Bear Solar Observatory) presented observations which show that acoustic noise is indeed generated in the intergranular lanes where the strongest downdrafts occur.

An interesting but controversial idea, which would completely alter our current picture of sunspot penumbrae, was presented by J. Sanchez-Almeida (Instituto de Astrofisica de Canarias, Spain), who proposed that the actual size of penumbral filaments is as small as 1-10 km.

A new small-scale, weak-field component covering a large fraction of the solar surface was revealed by high-resolution polarimetric observations in the near infrared (Lin, NSO/Sac Peak). The inferred field strengths are of order 500 G or smaller; such field strengths can only be measured accurately using infrared lines at the spatial resolution currently available. The developing field of far infrared solar physics was featured in presentations by T. Ayres (University of Colorado) and D. Gezari (NASA/GSFC).

A major highlight of the meeting was the presentation of new results from NASA's Transition Region and Coronal Explorer (TRACE) satellite by A. Title and T. Berger (Lockheed-Martin Solar and Astrophysics Lab). TRACE was launched on 2 April 1998 and has since produced over 700,000 images of superb quality. The TRACE observations indicate an enormous amount of fine structure with actual spatial scales that are most likely below the 750-km resolution of TRACE in the transition region and corona. Movies produced from TRACE observations show the dynamic nature of the solar corona with its emergent and interacting loops, including a spectacular example of an oscillating post-flare loop system.

A powerful tool to study the highly dynamic upper solar atmosphere is provided by combining observations from different instruments such as TRACE, SoHO and ground-based observatories. Examples of such observations were presented by P. Brekke (Institute of Theoretical Astrophysics, Norway), who showed movies of jets and eruptions observed in the transition region. Progress in the field of flare physics and prediction of solar flares was reviewed by S. Keil (Air Force Research Laboratory) who demonstrated that dynamical motions measured in the chromosphere using Ha images may constitute precursors to flare activity and may aid in the attempt to predict flares.

An entire day of the workshop was dedicated to discussions of new instrumentation, tools and techniques. The current status of the Dutch Open-Air Telescope (DOT) on La Palma was summarized by R. Rutten (Sterrekundig Instituut, The Netherlands). The DOT saw first light about one year ago and has already produced some exciting high-resolution imagery. The experience with the DOT's open-air telescope design is particularly relevant for future solar telescopes which will have apertures of 2-4 m. For such large telescopes, the entrance windows used in existing telescopes may no longer be feasible.

Technical aspects of a ground-based Advanced Solar Telescope of about 3-m aperture were discussed by J. Beckers (NSO/Sac Peak). Although high-resolution observations are best performed from space, the cost of a 3-4 m space solar telescope makes it unlikely that such a telescope will be launched in the near future. A crucial technology for high-resolution solar observations from the ground with large aperture telescopes is adaptive optics. Substantial recent progress in the design and development of solar adaptive optics was described during the workshop by T. Rimmele (NSO/Sac Peak) and M. Shand (Compaq-Digital, France). Results of the first successful bench tests with a solar adaptive optics system based on a correlating Shack-Hartmann wavefront sensor were presented by Rimmele.

Major progress has been made recently with image reconstructive techniques such as phase diversity, described by J. Sheldon (ERIM), A. Tritschler (Kiepenheuer Institut fr Sonnenphysik, Germany), M. Lfdal (Royal Swedish Academy of Sciences), and M. Koschinsky (Universitts Sternwarte Gttingen, Germany), and speckle reconstructive techniques, presented by C. Keller (NSO/Tucson) and C. Denker (Big Bear Solar Observatory).

G. Scharmer (Royal Swedish Academy of Sciences) presented plans to upgrade the 50-cm Swedish Solar Vacuum Telescope on La Palma to approximately one-meter aperture. Efforts to modernize existing telescopes or to build new facilities and instruments to achieve high-resolution observations were described by workshop participants from Russia (A. Boulatov, Institute of Solar-Terrestrial Physics), China (B. Ye, Beijing Astronomical Observatory), India (V. Verma, Uttar Pradesh State Observatory), Germany (O. v.d. Lhe, Kiepenheuer Institut fr Sonnenphysik), and Spain (V. Martinez-Pillet, Instituto de Astrofisica de Canarias). P. Bernasconi (John Hopkins University/APL) summarized the Flare Genesis experiment, which will attempt high-resolution polarimetry from an 80 cm balloon-borne telescope circling Antarctica at stratospheric altitudes, thus avoiding the adverse effects of atmospheric seeing.

A major effort of the international solar physics community for the next decade will be the Solar-B space mission. After its launch, approximately in the year 2004, the 50 cm optical telescope on board Solar-B will provide continuous imaging data and polarimetric observations of the Sun with a diffraction limited resolution of 0.2". Y. Suematsu (National Astronomical Observatory, Japan) described the scientific goals of the mission, post-focus instrumentation plans, and the status of the project.

The Workshop was sponsored by the National Solar Observatory, the National Optical Astronomy Observatories, U.S. Air Force Office of Scientific Research through its European and Asian Offices, the National Science Foundation, and the National Aeronautics and Space Administration. The proceedings will be edited by T. Rimmele, K. S. Balasubramaniam, and R. Radick and published in the ASP Conference Series.

Thomas Rimmele

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1999 NSO Summer Student Programs

Applications are invited from undergraduates for the NSF-sponsored Research Experience for Undergraduates (REU) program and from graduate students for the NSO Summer Research Assistant (SRA) program. Selected students will be given the opportunity to work closely with one of the observatory scientific staff members on a specific research project of mutual interest, either at Tucson or at Sunspot. Research programs will emphasize data reduction and analysis, computer programming, instrumentation, or theoretical modeling. Current solar astrophysics research interests range from understanding and modeling solar activity processes, helioseismology and the interior, high resolution spectroscopy and imaging, polarimetry, physics of coronal heating and solar wind acceleration, to instrumentation techniques.

The positions are normally full-time for 10 to 12 weeks between May and September. The deadline for applications to participate in the NSO 1999 Summer Research Experiences for Undergraduates Program is 15 January 1999. Interested individuals can obtain information and application packets by visiting our web site at: http://www.sunspot.noao.edu/INFO/MISC/SS_PROGRAM/index.html or by calling or sending email to Brenda Ramos (505-434-7003; bramos@sunspot.noao.edu) or Priscilla Piano (520-318-8294; ppiano@noao.edu).

K.S. Balasubramaniam

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NOAO Newsletter - National Solar Observatory - December 1998 - Number 56

NSO Observing Proposals

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

Dick Altrock

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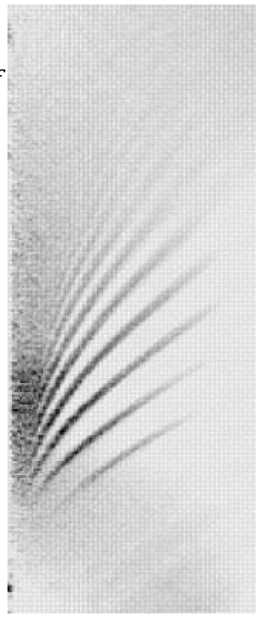
Global Oscillation Network Group

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

We are happy to report that after three years of network operations, the processed data duty cycle is holding steady at about 87%, the daily sidelobes are virtually invisible, and the overall technical performance and reliability of the network continues to be excellent. We are well on our way to the replacement of the initial 256^2 pixel detectors with 1024^2 detectors (a.k.a. GONG+). The effort should pick-up steam when the production cameras from Silicon Mountain Designs and the high-speed electronics from DNA Enterprises arrive later this fall. The development of the GONG+ Data System has also begun and will proceed in parallel with the production of the upgraded systems. In order to exploit the full scientific potential of the GONG+ data, the Project has begun preparing for an additional phase, GONG++, a high-performance computing capability, to exploit this scientific potential of the high resolution data as we approach maximum solar activity.



Caption: *An m-averaged, l-v spectrum, l = 0 to 1000 and the v range is 0 to 8 1/3 mHz, from 8.5 hours of data taken centered on the solar disk center. The data were obtained by interfacing the new camera to the existing GONG data collection system. This arrangement allowed observation of only about 1/16 of the area of a GONG+ image. The diagram shows no spatial aliasing and a high signal-to-noise, with p-mode ridges beginning to merge into the background at an l-value of about 1000. A few faint temporal aliases are attributable to the temporary nature of the data collection system.*

Operations

The GONG network continued to run well for the third quarter of 1998. Much of the network down-time was attributable to the scheduled preventive maintenance visits which took place at El Teide (24 June-4 July) and at CTIO (4-14 September). An incident of note, which resulted in nearly seven hours of downtime, occurred at CTIO when one of the electronic cards in the data acquisition system failed. The on-site staff discovered the problem, and with help from Tucson, were able to isolate the problem card.

A mix of circumstances at Udaipur caused the telescope to be shut down with unfortunate regularity. During the monsoon season, when little data could be acquired anyway, Udaipur Solar Observatory was suffering prolonged power outages. Although there is a backup generator which will power the GONG telescope, it was felt that it would be best not to run the generator during prolonged periods of power outage, which resulted in the site staff bringing up the instrument each morning and shutting it down each evening. A problem also occurred with the half-waveplate rotator. It appeared that it was not getting power and we suspected a blown fuse. When the on-site staff was able to investigate, they found a good fuse, but a fuse holder that was not making a good connection. That was soon remedied, but about a day of down-time accumulated. The lens slide mechanism, which operates during the daily calibration sequence, is beginning to show signs of age. There have been occasions when it has not moved the calibration lens into its final position by the time image integration has begun. This situation has arisen most visibly at Big Bear, but has not been bad enough even there to cause total loss or corruption of the calibration images. The situation will be addressed more thoroughly during a November PM visit to Big Bear, and at all the other sites as PM trips occur in the future.

Data Management and Analysis

During the past quarter, month-long (36-day) velocity, time series and power spectra were produced for GONG months 29 and 30 (ending 980420) with respective fill factors of 0.92 and 0.79. The p-mode reprocessing campaign (data that have been reprocessed or initially processed with the improved p-mode pipeline) added GONG months 4, 5, 6 and 7, boosting the available data set to months 4-30 (950823-980420). The project is also producing time series and power spectra from the intensity images. These products were generated for GONG months 21, 22, and 23.

Ed Anderson, who had been part of the GONG Project since its inception and who was integral to the development of the DMAC's reduction pipeline, left the Project and NOAO in July. Ed has headed north to Flagstaff, the Northern

Arizona University campus, and the observatories of the Arizona northland. The Project has also said good-bye to Enrique Chavez, who had joined the Project in January 1996. Enrique leaves us to join Lucent in Denver. We will miss them both and are grateful for their many contributions.

Data Algorithm Developments

We have completed a revised first-guess table for the peakfinding process, thanks to the efforts of Ed Anderson and Rachel Howe. In the end, the original set of central frequencies proved to be adequate, but the splittings and widths have been revised using values derived from an average of six three-month time series. A final test, which consisted of finding peaks in a three-month series twice using both the original and revised tables, showed no significant differences in the derived frequencies. With the new guess table complete, and with the removal of the temporal deconvolution step (discussed below), regular production of GONG frequencies has resumed. With the rapidly rising solar activity level, the (thankfully brief) hiatus in SoHO observations, and the completion of three years of GONG data, the resumption of regular GONG frequency production will contribute to the advancement of helioseismology and solar physics.

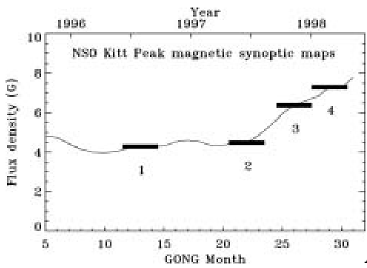
The temporal deconvolution step has been dropped. We had been performing a "brute-force" deconvolution of the first 30 mHz segment of the temporal window power spectrum using code provided by H. Antia. While this was effective and relatively fast for a 36-day spectrum, it was too slow to use for the current 108-day spectra. R. Komm has taken the lead in developing an alternate strategy. First, he tested an FFT-based method, but found that while it was fast enough, it resulted in nearly 25% of the points in the deconvolved spectrum becoming negative. This is much higher than results from Antia's method, and it clearly adversely affects the number of good fits from peakfind to an unacceptably low level. The same conclusion was reached when deconvolving the entire frequency range of the temporal window rather than the first 30 mHz. There was also an attempt to incorporate the temporal window into the model used by the peakfind routine, but this too is unacceptably slow.

In light of these tests, and since deconvolution primarily affects the estimated widths and amplitudes and not the frequencies, we have decided to eliminate temporal deconvolution of the spectrum prior to peakfinding, but instead, determine a correction factor for both the widths and amplitudes. This development has begun and has resulted in two important bits of information. We again verified that the frequencies are unchanged, and we found that the widths are increased (and the amplitudes decreased) by a nearly constant factor approximately equal to the duty cycle of the window. We are further testing the second conclusion by performing an analytical investigation, and by comparing the time series with different fill factors. We will refine the width and amplitude correction while the mode parameters are being produced.

In anticipation of GONG+, C. Toner has developed a method of merging images obtained simultaneously at widely separated sites. Currently, we merge spherical harmonic coefficients which would preclude the usage of GONG+ data for local helioseismology, which is one of the main scientific objectives of the GONG+ upgrade. The new approach will register images for each site-day into heliographic coordinates, and detrend them with a two-point backwards difference filter. Simultaneous images will then be averaged together with equal weights. For traditional helioseismology, the merged images are then decomposed into a time series of spherical harmonic coefficients which are corrected for the average image degradation by division by the merged network modulation transfer function (MTF). Tests with current GONG data produce a power spectrum that is virtually identical with the power spectrum produced by the current merging algorithm, and the process is computationally efficient, eliminating the need for "real" (expensive) image restoration. We're not out of the woods however, the GONG+ images will provide a new challenge since the higher spatial resolution will require high accuracy and precision angular registration between the sites.

Data Analysis

As we begin to track solar cycle variations in anticipation of solar maximum, we have looked at the frequencies for four three-month GONG time intervals and have found that they display an interesting variation in a_2 and a_4.



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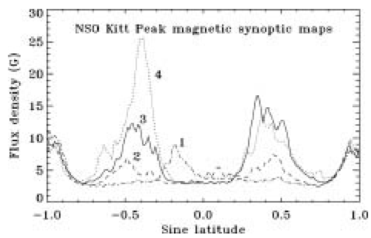


Figure 2 shows the variation of the magnetic flux density, while Figure 3 illustrates the average latitudinal distribution of the flux for the four time periods. Notice that for interval 1, at the end of the previous cycle, the flux is concentrated close to (and a little south of) the equator and is distributed asymmetrically, while for intervals 2 to 4, at the beginning of the new cycle, the flux is distributed at higher latitudes. The activity of intervals 1 and 2 is comparable. The magnetic flux is much stronger at interval 3 and increases further at interval 4.

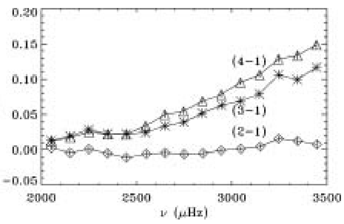
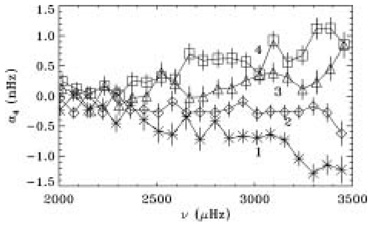


Figure 4 shows the frequency differences (i.e., changes in a_0) between Intervals 1 and 2 (diamonds), Intervals 1 and 3 (stars), and Intervals 1 and 4 (triangles), averaged over *l*, from 1-150, and in frequency bins of about 70 microHz, clearly demonstrating the well-known correlation between changes in the frequencies and changes in solar cycle activity.

The degeneracy between modes of the same *l* and *n*, but different *m* (azimuthal order), is lifted by effects that break the

Sun's spherical symmetry, the most important of which is rotation. The coefficients of the Legendre polynomial series are commonly used to parameterize the frequencies, where the odd-order coefficients, a_1, a_3, ..., are used in rotation inversions and reflect the advective, latitudinally symmetric part of the perturbations caused by rotation. The even-order coefficients, a_2, a_4, ... , which are much smaller than the odd-order coefficients, are sensitive to latitude-dependent properties. a_1 and a_3 showed no discernible changes, but the a_4 coefficients, which are plotted in Figure 5 for the four time intervals, illustrate an interesting variation. The curves suggest a relationship to the latitudinal distribution of the magnetic flux as well as the total magnetic flux, but we will need more data to confirm this comparison. We also see changes in the a_2 coefficients, which for the periods we have examined, have values about half the size of the a_4 coefficients and of opposite sign. This behavior is different from what was observed during the previous solar minimum.



For the intervals 1 and 2, the independent SOI and GONG measures of a_2 and a_4 are nearly coincident, which gives us confidence. The changes in a_0, a_2, and a_4 are already highly significant, and as solar activity picks up, we look forward to following these variations.

New Camera Development

The camera development team has been operating one of the Silicon Mountain Designs 1M60_20 test cameras at the Tucson GONG facility. The temporary image sub-sampling interface, which provides a 242 line by 256 pixel portion of the camera's output to the existing data acquisition electronics, has provided a means of evaluating not only the camera's performance but also alternative observing methods and optical components.

DNA Enterprises of Richardson, TX, has been selected as the vendor to provide the video data acquisition system for the instrument upgrade, and will deliver a system incorporating two Texas Instruments TMS320C80 digital signal processors on a single VME board. The computational capability of this product is an astonishing 480 megabytes per second and should easily handle the camera's output data rate of 120 megabytes per second. We are eagerly awaiting the first prototype system for testing, which is expected to arrive sometime before the end of the year.

Modifications to the existing instrument synchronization system necessary for the installation of the new camera have been implemented and tested. The existing Cohu video cameras currently convert the video synchronization signals generated by the GONG electronics into pulses used by the waveplate speed control system. Because the new camera is not equipped to handle this conversion, a prototype circuit board has been built to emulate this function and the results are quite satisfactory.

The volume of raw data collected each week at each site is expected to be about 70 Gigabytes. Our plan is to use a pair of 18 gigabit hard disk drives to temporarily store accumulated data during the day and then transfer those files to the DLT tape drives (each with a capacity of 35 Gigabytes) at night. The purpose of the pairing scheme is to permit redundancy of data storage and to provide additional data capacity in the event of equipment failure.

We expect to have procured all of the equipment for the GONG camera upgrade by next summer and we will be deep into the system verification effort. Recent tests indicate that an *l* value of ~ 1000 can be reached with the new GONG+ instrument in average seeing conditions. Full disk images will be available as soon as the data acquisition system electronics arrive later this fall.

John Leibacher

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First Light Coming!

The next several months will be exciting times at Gemini-North on Mauna Kea. First Light is expected in late December or January. As there are many systems that have to work together effectively to make this happen, there will be many milestones along the way. In the middle of October, the Gemini-North primary mirror was accepted. It is now being stored in the coating chamber in the base of the enclosure while work on the mechanical structure of the telescope proceeds. During 19-23 October, the telescope structure was tilted to the horizon. The process went well and the drives are being aligned for the first time. Related to this was the first test of the mirror support system (with the dummy mirror) in orientations other than zenith-pointing. These tests also went well. Watch for more frequent announcements on the Gemini Web site: http://www.gemini.edu.

Todd Boroson

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US Gemini Instrumentation

Near Infrared Imager (NIRI)

Fabrication of NIRI is nearly complete. Nearly all optical elements are complete, the vacuum vessel passed its vacuum test, and most mechanisms have been machined and assembled. The instrument completed a cold test, achieving its design working temperature of about 70K with some mechanisms installed. Klaus Hodapp (instrument PI, Institute for Astronomy, University of Hawaii), plans to continue installing mechanisms into the dewar, with a goal of performing final alignment in early 1999. NIRI will be the commissioning instrument for Gemini North.

Thermal Region Camera System (T-ReCS)

Charles Telesco (PI) and his team held the Preliminary Design Review in mid-September and passed this critical milestone. The Gemini Science Committee endorsed the team's request to investigate adding a limited spectroscopic capability to the baseline 8-26 m imager, which has a single plate scale of 0.09"/ mm. The contract with the University of Florida calls for delivery to Cerro Pachon in early 2001.

Near Infrared Arrays and Controllers

After ten hybridization attempts by Boeing SBRC , the result is two good science grade arrays. The program was placed on hold temporarily to increase the odds of obtaining better devices. NOAO shipped the NIRI IR controller in August, and the controller for the Gemini Hilo Base Facility in September. The GNIRS controller will be delivered later this year.

GMOS/HROS Science CCDs and Controllers

EEV in the UK delivered two engineering grade arrays to be used for initial testing of the SDSU-2 controller and integration of the Dewar of the Gemini Multi-Object Spectrograph (GMOS). NOAO has produced an image from this combination, and is proceeding with final software integration.

Todd Boroson, Mark Trueblood

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IRAF Users Committee Report

The IRAF Users Committee (IUC) held its annual review in Tucson in May 1998. Their report is attached below. I thank the committee members for their perceptive recommendations, and hope to meet the challenges set forth in their report during the coming year. As always, if you have any questions, comments, or concerns about the IRAF project, please send mail to iraf@noao.edu, contact me (jacoby@noao.edu), or one of the IUC members:

Andrea Prestwich (Chair) (prestwich@cfa.harvard.edu)
Mike Bolte (bolte@ucolick.org)
Peter Eisenhardt (prme@kromos.jpl.nasa.gov)

Steve Heathcote (sheathcote@noao.edu)
Jon Morse (morsey@casa.colorado.edu)
Gary Schmidt (schmidt@as.arizona.edu)

George Jacoby, IRAF Project Scientist

Introduction

Once again, we would like to thank the IRAF group for their interesting and informative presentations. Special thanks to George Jacoby for hosting and organizing the meeting.

The past year has been a highly productive one for the IRAF group. Highlights include the release of V2.11, upgrades to Ximtool, new astrometry and CCD Mosaic packages, and progress on Open IRAF (e.g. the message bus.) The addition of Nelson Zarate and very recently Matt Cheselka to the IRAF group has helped in bringing certain long-overdue projects to completion. We congratulate the IRAF group on their successful proposals for NASA funding, which made the addition of new staff possible. While the total staff is now at the strength recommended by previous IUCs, we caution NOAO management that the obligations and recommendations discussed below may once again overburden the group, and additional personnel may be required.

Recommendations

Management Plan

We once again call for the development of a management plan and the presentation of this to the committee next year. It is extremely difficult for the IUC to offer practical advice on priorities, or to justify additional staff, without an idea of the workload and anticipated schedule of each project. We ask that the NOAO scientific staff member assigned to the IRAF group make this a personal priority for the coming year.

Gemini

We are especially concerned about the impact of the Gemini project on the continued development and maintenance of IRAF. It is clear that a portion of the Gemini USA obligation will be borne by the IRAF group in the form of instrument (and telescope?) software development. Our concern stems from the lack of a clear definition of the nature of this project, in both scope and longevity. As far as we have been able to ascertain, no estimate exists of the manpower required to fulfill this obligation. We strongly suggest that an NOAO scientist be immediately identified who can define the software requirements for the Gemini instruments. Since the Gemini telescopes are to be IR optimized, a lead scientist with an IR background would be a real plus. Such experience would also be valuable to the IRAF group in developing IR data reduction software recommended below. An outside consultant should be hired if it is not possible to find someone within NOAO with the appropriate background. Additional programmers should be hired to carry out these tasks, such that the impact on the remainder of the IRAF project, esp. Open IRAF, is minimized.

Software Priorities

We have divided our software priorities into short (3-6 months), medium (1-2 years), and long-term (> 5 years) goals.

Short Term: Our highest priority is the completion of the IRAF GUI science tasks. Prototypes were demonstrated at AAS meetings several years ago, and we were very impressed with the products we saw at the meeting in May. However, the various tasks used different philosophies of operation and presented different appearances to the user. It is time to choose a common interface and release these useful tasks to the community, preferably by the end of 1998.

Medium Term: We recommend the development of a comprehensive set of science tasks for the reduction of IR data. This has been a wish-list for several years, and is even more crucial with the advent of Gemini.

Long Term: Our highest priority for the long term is Open IRAF. IRAF is now 15 years old, and needs to be modernized to take advantage of modern programming technology. Open IRAF architecture is essential to ensure the continued use of IRAF into the next century.

Documentation

IRAF documentation needs improving. There are help files for each task, but there is a need for more global documentation. This should include not only NOAO packages, but tasks contributed by other institutions (e.g. STSDAS and PROS). An example of the frustration caused by inadequate documentation was given to us by a newcomer to IRAF who spent several hours fiddling with contour and imtool, only to learn later that *xray.tvimcontour* did just what he wanted! Reference manuals should be cross-referenced (hyperlinked online) to helpfiles and more cookbooks be collected. Many such primers have been written by users of IRAF; these should be solicited, collected, evaluated, and the best examples linked or made generally available. More detailed documentation for IRAF programmers would also be useful. We note that IRAF WWW "search" page () is very useful and should be more widely advertised.

Cooperation with STScI Developers

The requirements of Space Telescope (and AXAF) instruments continues to have a major effect on IRAF priorities, and in the past has occasionally led to the postponement of other work (such as GUI tasks). We strongly advocate close cooperation to ensure that STScI/STSDAS and AXAF deadlines do not derail other important tasks. To further cooperation, we suggest that a representative of the STScI team be invited to attend future IUC meetings. User input to these activities is extremely important, and many of our suggestions are relevant to their efforts.

IRAF Update

The IRAF V2.11 upgrade for OpenVMS running on the VAX and the DEC Alpha is now in the final stages of testing. We expect to have the system available for distribution before the end of the year. Initial testing was done with help from Space Telescope Science Institute and we would like to thank them for their assistance. With this release IRAF V2.11 platform support will be available for all the supported IRAF systems including SunOS and Solaris, Dec Alpha systems running Digital Unix V4.0, Hewlett-Packard systems running HP-UX 10.20, SGI IRIX, IBM AIX, and PC-IRAF for Slackware Linux V3.3, Red Hat Linux V5.0, and FreeBSD V2.2.5.

For our patient Mac users, we are happy to report that Apple finally released MkLinux DR3 in August and we now have this installed and configured on our development machine. The IRAF port will go forward as time permits, and will be included as part of the next release of PC-IRAF, which will provide an upgrade for all PC-IRAF platforms (e.g. RedHat Linux 5.1). In the meantime the X11IRAF tools have already been ported and are available for download from our */iraf/x11iraf* archive as *x11iraf-v1.1-mklinux-bin.tar.gz*. Having these tools running locally will be an improvement if you rlogin to another supported IRAF platform.

With the year 2000 (Y2K) only a little more than a year away, we have been asked by many of our users if we expect any Y2K-related problems with IRAF. Initial tests with IRAF running on a time-shifted workstation proved that (as expected) IRAF would run for the most part, but we did find several Y2K-related IRAF system-level bugs which are present in the current IRAF V2.11.1 release. The bug (caused deep within the system by a date conversion routine) would prevent listing of image headers due to a buffer overflow. This bug has been fixed locally in IRAF V2.11.2 and the fix will be exported in the next public IRAF patch.

The great majority of IRAF tasks will be unaffected by the Y2K problem. Those tasks that rely on the FITS DATE-OBS keyword will need to be modified however to support the new Y2K-compliant FITS date convention. We are in the process now of planning these modifications and further Y2K testing of IRAF. A fully Y2K compliant release of IRAF is planned for early 1999. More details about IRAF and the Y2K problem are available on the web page http://iraf.noao.edu/projects/y2k, which will be updated as the Y2K project progresses.

The IRAF Web pages on http://iraf.noao.edu now have a full text Web-tree search capability. Simply type in a word or phrase and select your location (US, UK, ESO, Japan), hit <Return>, and a list of Web links to IRAF Web pages or documents containing that word or phrase will appear. This is in addition to the existing on-line search facilities () available for searching help pages, mailing list discussions and so on.

The NOAO CCD Mosaic was upgraded this summer to use the new science grade SiTe CCDs. Many enhancements were made to the system, with the IRAF group providing software support for data acquisition and data handling. This included modifications to the multiextension FITS data format, the addition of on-the-fly calibration for real time image display, a new version of the Mosaic reduction package MSCRED, astrometric solutions for new SiTe chips, and DCA GUI enhancements. The data format changes consisted of keyword updates such as new astrometry coefficients. The display enhancements included quick bias and flat field calibrations while loading the display server. The new version of MSCRED is available during observing and for home installation.

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

Doug Tody, Jeannette Barnes

NOAO Newsletter - Central Computer Services - December 1998 - Number 56

NOAO FTP Archives

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

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

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

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

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

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

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

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

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

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

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

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

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

   noaoprop---NOAO nighttime observing proposal LaTeX forms.

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

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

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

   utils---PostScript tools.

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

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

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

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

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

Jeannette Barnes

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