Big Telescopes and Little Children

Malcolm G. Smith

We are making rapid progress in realigning our activities with the directions set out in NOAO's Long-Range Plan. Scientific staff in Chile have transferred significant portions of their efforts (3.4 FTE service work so far) onto the new programs, including support of Gemini through the NOAO Gemini Science Center (NGSC). This shift of scientific staff from the CTIO Program to other parts of NOAO South has been combined with more effective sharing of common services with other AURA programs in Chile through AURA's Observatory Support Services (AOSS) Group. When combined with a similar shift of resources in the engineering and technical services area, the net result is that the former CTIO "Program" has been able to withstand a cut in excess of US$1M, and pay for significant staff effort from Tucson in support of SOAR and instrumentation at the Blanco 4-meter without local layoffs.

The SOAR telescope is expecting first light on or about November 1 of this year. The Infrared Side Port Imager (ISPI) has been successfully commissioned on the Blanco 4-meter telescope (see *www.ctio.noao.edu/instruments/ir_instruments/ispi/first_light.html*). In addition, the small telescopes on Cerro Tololo will enjoy a new lease of life and instrumentation under the new SMARTS consortium (see the article, "Small Telescopes Update").

Of course, the drawbacks are that more than 70 percent of the time on the smaller telescopes is no longer available to the general user community, and the 12 scientific staff members, who spend part of their time doing service work, have not been doing enough research. The Telescopes Operations Division on Cerro Tololo will have to run telescopes on two mountains now with little or no increase in staff. Furthermore, we need to develop a strong follow-on to ISPI with an imaginative and competitive plan for instrumenting the Blanco 4-meter telescope. This will have to be done in a world in which the leading instrumentation groups (including the group at NOAO North and South) are busy designing and constructing instruments for 8- to 10-meter class telescopes.

In its final site visit last December, AURA's NOAO Observatory Visiting Committee generally shared these perceptions. So, what are we doing about this?

I have asked the scientific staff to prioritize their service time so that we can compare more accurately the excess time being spent on the lower-priority projects. These projects will be dropped to make more room for research time—unless more resources are provided to NOAO South. This list of threatened projects will be provided to the next CTIO director, who takes over early in November, so that she/he can start to set the new directions for NOAO South in conjunction with the community and the Director and staff of NOAO.

OK, so what about the little children? Public outreach and education in Chile is an essential component of our long-term "Sites" program. Alistair Walker is leading the effort here to locate and characterize sites for future US telescopes. The outreach effort at NOAO South supports the protection of existing and potential sites, mainly from the effects of light pollution but also, in the case of the ALMA site, from radio-frequency interference.

The primary components of AURA's outreach program in Chile are:

(a) **The Mamalluca Municipal Observatory** — See *Sky and Telescope*, February 2002, p91; and *www.angelfire.com/wy/obsermamalluca*. The NSF supplied their first telescope via funding to CTIO six years ago. This public observatory is now famous in the world of amateur astronomers, receiving three times the visitors (who have to pay) than all the international observatories in Chile combined (where visitors do not have to pay). As a result, they have constructed a number of their own telescopes and provide an essential component of the overall public astronomy support system in Chile. They now have the leading national center for astronomical tourism in South America.

(b) **The Office for the Protection of the Skies of Northern Chile** (OPCC) — See *www.opcc.cl*. The OPCC's major achievement has been following up successfully on the implementation of the light-pollution control law DS696/98, which sets clear guidelines for artificial lighting in the astronomically sensitive 2nd (ESO Paranal), 3rd (Las Campanas), and 4th (ESO La Silla and AURA-Pachón-Tololo) Regions. Behind the scenes, work is being done involving the lighting of mines in the neighborhood of Paranal and Las Campanas, well before such artificial light sources become a problem. Potential sites for future large US telescopes will also be areas of priority once the exact locations of such planned telescopes are known. This work is being carried out in close collaboration with AURA, ESO and Las Campanas and with the International Astronomical Union (*www.ctio.noao.edu/light-pollution/iau50*). The director of the OPCC is employed by AURA

continued

Big Telescopes continued

and funded through a consortium of the major observatories and the EPA equivalent (Comision Nacional del Medio Ambiente, CONAMA) of Chile. In the 3rd Region, the city of Copiapó has converted 7,000 of its lights to near full cutoff. Ovalle (to the southwest of the AURA property) has done much the same thing. Following recent visits to see quality lighting in Tucson, the mayor of La Serena indicated that she is studying a project to change all 13,000 municipal "points of light" to comply with DS696/98.

(c) **The RedLaSer schools network** — See *www.ctio.noao.edu/AURA/redlaser.* The La Serena "Red" (network), was started by NOAO staff members Ron Probst and Hugo Ochoa, who worked together with local teachers and the University of La Serena to set up an initial network of seven schools. The network now has grown to 70 schools, mostly in the area near Pachón/Tololo. The presentation of a STARLAB portable planetarium (*www.ctio.noao.edu/AURA/planetario*) by the Gemini Observatory has enabled the RedLaSer to reach out (in a joint program with NOAO) to more than 65,000 Chilean children in four years. The teachers of these children propose how the planetarium can be used within the context of the science programs in their school. RedLaser teachers are participating in NOAO's ASTRO-Chile remote-learning program. Dara Norman, who holds an NSF Postdoctoral Fellowship at CTIO, has led the involvement of NOAO South in this and other Project ASTRO initiatives in the United States.

(d) **StarTeachers** — See *www.gemini.edu/project/announcements/press/2003-1.html*. Three teachers from RedLaSer are funded by Gemini this year to travel to La Serena's sister "city," the island and county of Hawaii. Prior to that trip, three teachers from the Big Island will spend two weeks in La Serena in March.

Plans for 2003 include establishing the RedLaSer network at a national (Chilean) level. The hope is that in 2004, the network can be expanded to an international level. The NSF (via NOAO's ASTRO-Chile initiative) and the Chilean CONICYT (via its EXPLORA program) have both begun to provide specific support for this overall outreach activity.

First ISPI Run with Visiting Astronomers

Nicole van der Bliek, Ron Probst & Dara Norman

After a successful commissioning of the Infrared Side Port Imager (ISPI) at the Blanco 4-meter in September last year (see the December issue of the *Newsletter*), and another set of engineering nights in November, we are right now accommodating the first visiting astronomers. The instrument is stable and allowing the observers to obtain data at a rate of about 10 gigabytes per night.

As the run proceeds, a list of suggestions for improvements, mainly GUI related, is being generated, with some improvements already implemented. We expect that before the next ISPI block, in May, the growing pains will have subsided and that we will be able to offer an even more user-friendly instrument that never crashes.

Results of preliminary throughput measurements are shown in the following table. A set of narrowband filters has been ordered and will hopefully arrive in time to be installed before the May ISPI run. This set includes filters centered at 2.03 microns (continuum), 2.06 microns (He I), 2.08 microns (C IV), 2.12 microns (H_2), 2.14 microns (continuum), 2.16 microns (Br gamma), 2.19 microns (He II) and 2.25 microns (continuum and H_2). Please keep an eye on the ISPI Web pages (*www.ctio.noao.edu/instruments/ir_instruments/ispi*) for further information and updates.

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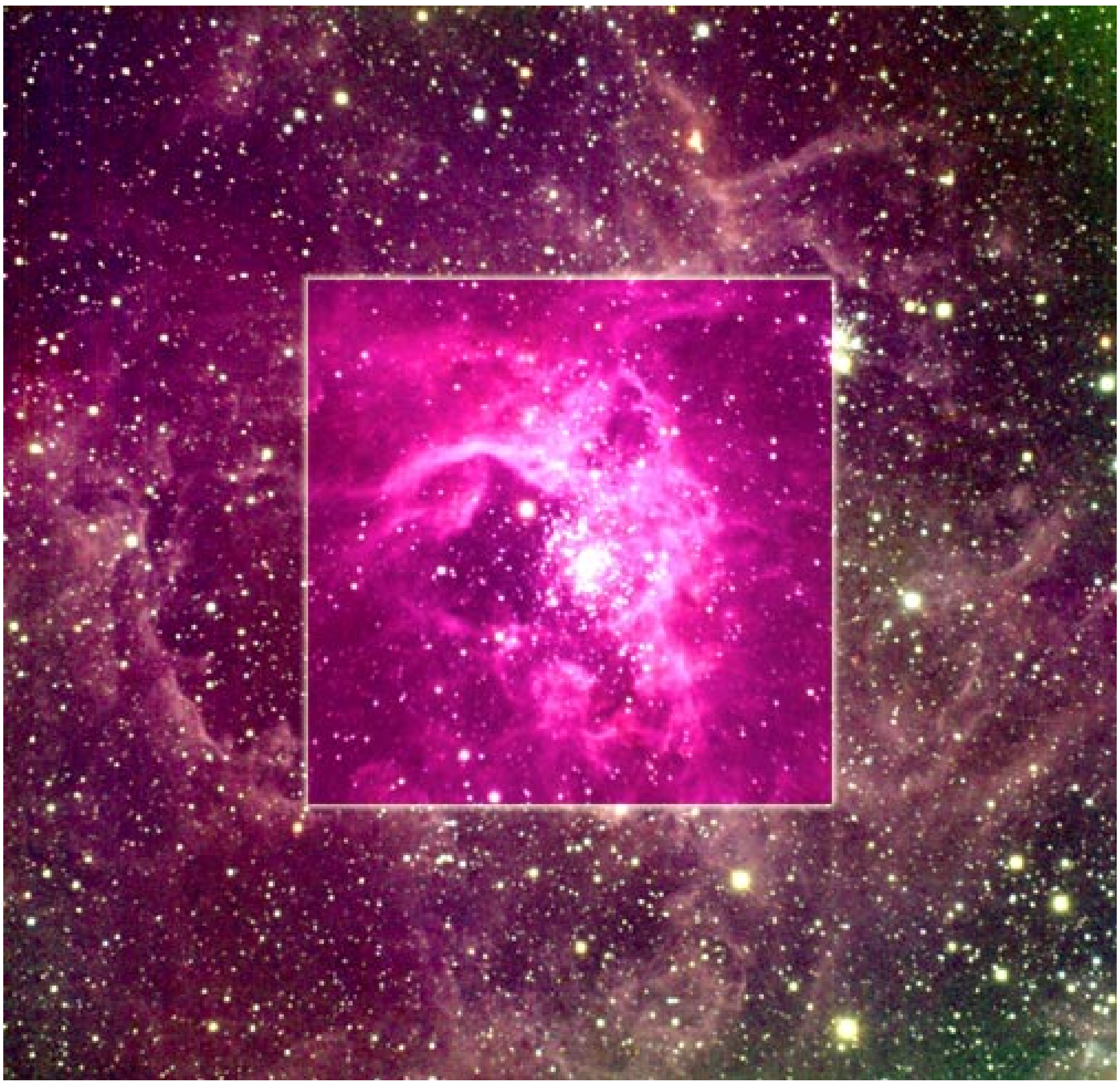
First ISPI Run continued

ISPI Performance on the Blanco 4-Meter

Band	Background flux per pixel (electrons/sec)	Integrated flux from m = 15 star (electrons/sec)	5 sigma source detection limit in 60 sec
J	330	4000	19.6
H	1560	5000	18.9
K’	2160	3300	18.3



This image of 30 Doradus (the Tarantula Nebula) is a combination of three ISPI images taken using J, H, and Ks broadband filters, each with an exposure time of 4.5 minutes. The object’s faint nebulosity is clearly visible, while the stretch of the inset image of the bright core has been modified to demonstrate the instrument’s dynamic range.

33,490 Mosaic II Exposures

Tim Abbott

As a normal part of its operation, the Save The Bits data archiving tool records the primary FITS headers of all images and spectra obtained at the Blanco 4-meter telescope. This disk record provides an invaluable tool for studying the demographics of actual instrument use.

With minor variations, the Mosaic II imager has operated in a stable configuration for some time. It is used in the classical mode and the visiting observer is assisted by a telescope operator (TO). It is possible to script sequences of images of a given field and to slew from field to field semiautomatically with minimal dependence on reaction time of the observer or TO, but guide stars are normally acquired manually.

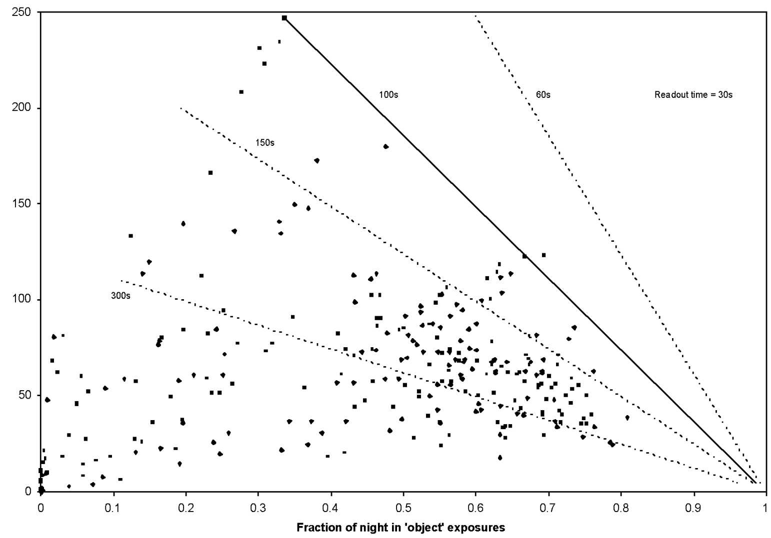


Figure 1. Nightly observing efficiency with the Mosaic II imager on the Blanco 4-meter telescope. Squares indicate nights in 2001, diamonds in 2002.

Figure 1 provides an indication of the typical efficiency of use of the Mosaic II camera in the calendar years 2001 and 2002. The fraction of each night expended as integration time in object exposures is plotted against the number of such exposures collected in that night. The procedure followed by an observer to initiate exposures on program targets is such that we can be reasonably certain that an exposure with FITS keyword OBSTYPE = "object" is indeed of a scientifically interesting target or standard and not, for example, a focus frame, flat field, or other calibration.

This analysis only includes exposures initiated from midway between sunset and evening astronomical twilight through midway between morning astronomical twilight and sunrise. The night length is also defined by this interval, approximately reflecting the useful night for the instrument.

Because the assessment of time lost to bad weather or technical failures tends to be highly subjective, and sometimes not even reported, no attempt has been made to correct for this in figure 1. Thus, partially and completely lost nights will appear as the scattering of points toward and at the origin, respectively.

The maximum possible number of exposures for the stated interexposure dead time, with the fraction of night used to obtain them, are also plotted. The solid line indicates this limit for the actual Mosaic II readout time (~100 seconds) and a few particularly efficient observers manage to approach it (i.e., by following a single field all night). However, more typically, nights tend to cluster between the dashed lines, indicating nightly average interexposure intervals of 150 seconds to 300 seconds. Thus, on a clear, trouble-free night, other overheads normally account for 0.5 to 2 times the readout time (slewing during readout is encouraged when feasible with this instrument). Most nights achieve greater than 40 percent efficiency but never more than about 80 percent, with a median around 65 percent.

Clearly, there is room for improvement. The 100-second readout time is long for modern CCDs, and is limited both by the transfer time of the SITe devices and by the controller itself. The dynamic range of these detectors is less than might be expected, and will therefore discourage long exposure times (in the two years studied, not a single 1,800-second object exposure was acquired). For long-standing but addressable technical reasons, the telescope slews more slowly than it should. Basic observation queuing software is already in place, but the facility can be expanded and rendered more attractive to the visiting observer. For example, guide star acquisition could be automated.

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33,490 Mosaic II Exposures continued

Figure 2 shows the distribution of total object integration time with the filter used. The overlying quantum efficiency (QE) curve indicates the average QE of the mosaic at the central wavelength of each filter. Recent developments in detector manufacture could improve response throughout the optical spectrum, but most dramatically at the red and blue ends. It should be noted that the U and SDSS u filters are significantly affected by a steep cutoff in the transmission of the prime focus corrector at these wavelengths.

These data and their implications are under active consideration at the observatory as we continue to seek ways to improve efficiency and productivity.

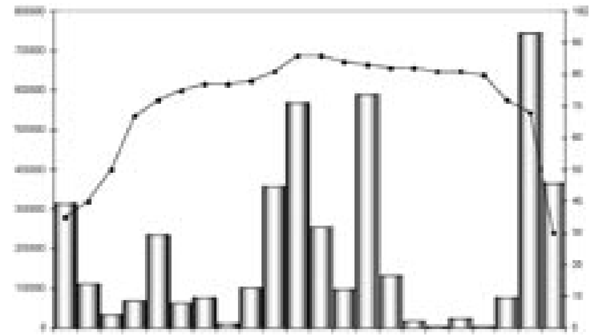

Figure 2. Total Mosaic II object exposure time in the years 2001–2002, as a function of filter used. The filters are ordered from blue to red by central wavelength. The overlying curve shows the QE of the Mosaic CCDs at the central wavelength of each filter used.

Site Testing/Surveying in the Atacama Region of Northern Chile

Robert Blum

Figure 1. Edison Bustos of CTIO downloads meteorological data from the weather station on Cerro Honar (5,400 meters).

NOAO and the AURA New Initiatives Office (NIO) are entering their third year of active site testing/surveying in the Atacama region of northern Chile. This activity forms (in part) the basis from which future telescope sites may be chosen for projects like the Giant Segmented Mirror Telescope (GSMT), the private–public partnership Twenty Meter Telescope (TMT), and the Large Synoptic Survey Telescope (LSST). In addition, NOAO/NIO are engaged with other groups, such as the University of Tokyo, CELT, and ESO, in sharing information and sites analysis data for developing possible future telescope sites in Chile and elsewhere.

Through its group based at CTIO, NOAO has been characterizing mountain tops in the Atacama region of northern Chile. The group has maintained a weather station near the Atacama Large Millimeter Array (ALMA) project site for more than two years and now has agreed to take over the maintenance of another weather station operated by Cornell University as part of the site survey for the Atacama Telescope Project (*astrosun.tn.cornell.edu/atacama*). For more information on the site survey project in general, see *www.ctio.noao.edu/sitetests*. The entire area around the ALMA site (in the 2nd Region of Chile near the border with Bolivia and Argentina) is sometimes referred to as Chajnantor, and a large section of it is officially reserved for science activities by the Chilean government.

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Testing/Surveying in Atacama continued

In January 2003, Edison Bustos and Bob Blum of CTIO met Chuck Henderson and Luke Keller of Cornell University in San Pedro de Atacama to assess the status of Cornell's two weather stations on Cerros Toco (5,500 meters) and Negro (5,025 meters), with the purpose of taking over maintenance and data-download responsibilities for these towers. These are rugged, high peaks, and it is difficult sometimes to keep equipment running. In addition to the activities involving the Cornell towers, a routine visit was made to the NOAO/NIO station at Cerro Honar (5,400 meters). Ascending such high peaks with little time to acclimatize is also difficult. However, other than being tired, the group is happy to have left the Honar and Negro stations busily taking data. The Toco station was removed for repairs.

This on-site activity is producing valuable long-term statistics that will aid in the process of site selection for the large, next-generation ground-based telescopes. In particular, any future telescope whose science drivers point to the need for an excellent "high and dry" site might be well placed in the Chilean Andes on one of these peaks overlooking the new ALMA radio telescope.

On a personal note, the CTIO staff have very much enjoyed the enthusiasm, hard work, and professionalism of the Cornell group. The January trip signaled a break in their visits to Chajnantor, but we hope it will not be a long one. The Cornell group has been a driving force behind the site activities on Chajnantor, and AURA/NIO are indebted to them.

Figure 2. Luke Keller of Cornell University is happy that the weather station on Cerro Negro (5,025 meters) has survived more than one year without human intervention while taking data every few minutes.

Site Activities on Tololo and Pachón

Hugo E. Schwarz

The weather tower on El Peñón, a promising rocky outcrop on Cerro Pachón near Gemini South, has been re-erected after collapsing last winter from ice and snow load. This Chilean summer we will install a weather station there that will send its data to Tololo via a radio modem. This will be a test for more remote weather stations we may put up on mountains in northern Chile. The data will be accessed through the CTIO Web site. We are also planning a road to El Peñón so that we can set up seeing monitors and other instruments without the need for climbing with heavy equipment. The site is also a potential location for the Large Synoptic Survey Telescope (LSST).

A campaign with a DIMM and MASS observing the same star from the ground near the SOAR telescope has been begun. The small instruments have screens to protect against wind buffeting and are operated from the SOAR control room. The DIMM measures the seeing, including ground effect, while the MASS gives the result for the free atmosphere from about 500 meters above the site. The difference in these readings gives us an idea of the ground effect at Pachón.

The Tololo All-Sky Camera (TASCA) is now running in the full four-filter mode. The latest addition to the software is subtraction of the dark-current images from the median filtered light-pollution (Na and Hg) images. This has improved the quality of the images significantly (see *www.ctio.noao.edu/~david/tasca.htm*).

We have taken nighttime photos of the light-pollution sources from Tololo, and the same will be done from Pachón. To be able to monitor the details of polluting sources, we will repeat this approximately every six months. The Tololo images were shown to a group of visitors from EMEC (the electricity utility) and the SEC (the government organization that monitors energy use and installations in Chile), who visited in mid-January to learn about light-pollution issues.

Small Telescopes Update

Alistair Walker & Alan Whiting

At time of writing, the Small and Medium Aperture Research Telescope System (SMARTS) Consortium is two weeks away from starting operations of the CTIO 0.9-meter, 1.3-meter, and 1.5-meter telescopes.

CTIO has built an adaptor for Andicam on the 1.3-meter telescope, and has installed and tested a new CCD TV guide camera. A few weeks ago, similar new cameras were installed at the 1.5-meter and 0.9-meter. Last week, Bruce Atwood (Ohio State University) installed a new Fairchild 2K CCD in Andicam, replacing the dead Loral 2K. In a few days, a team led by Darren DePoy (Ohio State University) arrives to move the instrument from the 1.0-meter to the 1.3-meter. In the meantime, the 1.3-meter queue observers have been gaining familiarity with the telescope, and also have been helping with a few changes needed elsewhere, such as altering arrangements in the 1.5-meter control room to suit single-person operation.

The telescopes have been scheduled by the Yale support team led by SMARTS Principal Scientist Charles Bailyn. For semesters 2003A and 2003B, NOAO users are entitled to one third of the telescope time, the rest goes to Chile (10 percent) and the consortium members: AMNH, STScI, OSU, SUNY-SB, Georgia State, and Yale.

NOAO users applying for time on the small telescopes for 2003B should be aware that the 0.9-meter was heavily oversubscribed in 2003A, so a good proposal is necessary! Again, all 0.9-meter proposals should be for seven nights and, since every second week is Service Observing, please state on your proposal whether having your observations done by a service observer would be acceptable. A decision on which programs will be done by the service observer will be made at scheduling time. Also, although all day-to-day operations of the telescopes will be directed by Charles Bailyn and the Yale operations team, visiting observers will see the familiar faces of Arturo Gomez or Edgardo Cosgrove doing their usual efficient job of making the small telescopes operate smoothly. Alan Whiting (*awhiting@ctio.noao.edu*) is the CTIO astronomer responsible for the interests of NOAO users observing on the small telescopes. Please contact him if the need arises.

Finally, the SMARTS consortium is looking for one or two more partners. If you have a large project that could use observing time on these telescopes, and you can support the project at a level of $50K to $100K per year, please contact Charles Bailyn at *bailyn@astro.yale.edu*.

New Faces in ETS

Brooke Gregory

It's been a long while since we updated our community about changes in staffing in the Engineering and Technical Resources (ETS) group in La Serena. We have always prided ourselves on the stability and depth of experience that the low turnover among our Chilean staff has implied, but we are going to have to change our tune! With the advent of Gemini and SOAR, one began to hear talk of the "loud sucking noise" coming from across the Quebrada San Carlos. But we now prefer another metaphor, that of a refreshing breeze. The winds have settled down a bit now and, though we miss our former colleagues, it is exciting to have so many new ones. It is worth taking this opportunity to note the many additions to our staff—some permanent, some on contract or other temporary postings—who have arrived since January 1999. In the notes accompanying each name, we include a few words describing the background and, where appropriate, the principal project activities of the new staff members.

Mechanical Engineering

Patricio Schurter	Mechanical engineer; U. Técnica Federico Santa María (UTFSM); lead engineer on SOAR Imager
Andrés Olivares	Mechanical engineer; U. de La Serena; SOAR Imager
Juan Gallardo	Mechanical engineer; U. de La Serena; instrument support boxes for SOAR

Instrument Shop (all graduates of La Serena's Colegio Salesiano San Ramón)

Cristian Díaz
Víctor Pinto
Víctor Robledo
Cristian Robledo
Mario Santander

Electronic Engineering

Gustavo Rahmer	Electronics engineer; U. of Chile; prior experience working with detector controllers at ESO; Monsoon hardware development
Michael Warner	Electronics engineer; U. Catolica de Chile, U. of Arizona, 20 years of experience at Hughes (now Raytheon) in Tucson; ISPI, commissioning of SOAR
Rodrigo Alvarez	Electronics technician; INACAP; electronic technician for the La Serena electronics group

Computer Technician

Samuel Flores	Electronics technician; IADE, Stgo.; computer technician for ETS

Software Engineering

Rafael Hiriart	Software engineer; electronic engineering degree from U. de Chile, prior experience at several Chilean firms; data pipeline for Super-Macho and Quintessence projects
Francisco Delgado	Software engineer; electronic engineering degree from the UTFSM, 4 years experience with ESO; software for new detector controllers
David Walker	Software; U. Francisco de Aguirre, La Serena; TASCA

Optical Engineering

Roberto Tighe	Physicist; UTFSM, U. Catolica de Chile, 14 years experience at La Silla; ISPI and SOAR Imager commissioning, SOAR integration
Sandrine Thomas	Optics engineer from the École Supérieure D'Optique, Paris, now a doctoral student in astronomy at the U. de Nice; adaptive optics for SOAR
Joselino Vasquez	Site characterization measurements

continued

New Faces in ETS continued

SOAR Project

Tom Sebring	Optical engineer; Rochester Institute of Technology; project manager for Hobby-Eberly Telescope (former), SOAR (current), Discovery Telescope of the Lowell Observatory in Flagstaff (1 March 2003)
Victor Krabbendam	Mechanical engineer; U. Massachusetts; previously with the Hobby-Eberly Telescope, project engineer for SOAR
Oliver Wiecha	Electronic engineer; Warsaw Technical University, former experience with several Brazilian technical firms; Electrical Engineering Manager for SOAR
Mike Ashe	Scientific programmer; U. Connecticut, Director of Engineering at Imaginatics, Inc.; SOAR telescope control system and ArcView detector controller software
Omar Estay	Software engineer; degree in electronic engineering from the U. Católica de Valparaiso; working on LabView software for SOAR

Other Happenings at CTIO

Cerro Tololo Summer Students Begin Their Research

The 2003 CTIO summer student program began on January 12, bringing five US undergraduates together with two Chilean counterparts for ten weeks of firsthand astronomy. Flying south immediately following the winter AAS meeting (where the 2002 students presented their research), the Research Experiences for Undergraduates (REU) students found themselves in high summer alongside their Prácticas de Investigación en Astronomía (PIA) companions. Together they will attend a series of seminars given by CTIO, Gemini, and SOAR staff astronomers; observe with the CTIO 0.9-meter telescope, gathering data for four different investigations; and each complete a personal research project under the direction of an experienced mentor.

As the students explore Chile, astronomy and the CTIO environment, they will post their results on their Web pages, which together with other information on the program may be found at *www.ctio.noao.edu/REU/ctioreu_2003/REU2003.html*.

Publication of Workshop and Conference Proceedings

The proceedings of the International Astronomical Observatories in Chile (IAOC) workshop on "Galactic Star Formation Across the Stellar Mass Spectrum," held in March 2002 in La Serena, are being published as volume 287 of the ASP Conference Series, edited by James M. De Buizer and Nicole S. van der Bliek.

The proceedings of the "Conferencia Internacional sobre Contaminación Lumínica," a conference initiated by IAU Commission 50's Working Group on Controlling Light Pollution held in March 2002 in La Serena, will be published by Kluwer in their ASSL Series: Light Pollution a Global View, edited by H. E. Schwarz.