NOAO NEWSLETTER

Issue 104, September 2011

NOAO Newsletter

NATIONAL OPTICAL ASTRONOMY OBSERVATORY

ISSUE 104 — SEPTEMBER 2011

Science Highlights

Finding Hidden Supermassive Black Holes in Distant Galaxies........ 2
Star Formation Rises with Time in UV-Bright Galaxies over the First Two Billion Years.. 4
Gemini/GMOS—Spectroscopy of a Large Sample of Strong Lensing Selected Galaxy Clusters 5
Late-Time Light Curves of Type II Supernovae: Physical Properties of SNe and Their Environment...................... 7

System Science Capabilities

NOAO at the Science Frontiers of the 2010 Decadal Survey 10
Dr. Timothy Beers to Become Associate Director for KPNO 11
Phoenix Returning to Kitt Peak.. 12
KOSMOS and COSMOS Updates 12
The WIYN One Degree Imager—an Update................................. 14
Launching a Laser & Acquiring a Laser Guide Star: A SAM LGS Mode Update... 15
A New Infrared Spectrograph for NOAO South 16
Dark Energy Camera Update 17
LSST Science Collaborations at Work... 18

System Observing: Telescopes & Instruments

2012A NOAO Call for Proposals Due 30 September 2011 19
Update on DECam Installation & Blanco 4-m Availability: Blanco Shutdown in 2012A... 20
Delayed Call for New NOAO Survey Programs.............................. 20
Availability of the CTIO 1.0- and 0.9-m Telescopes in 2012A 21
Mayall 4-m Telescope News 21
WIYN 0.9-m Telescope News 21
Community Access Time Available in 2012 with CHARA 22
System-Wide Observing Opportunities for Semester 2012A: Gemini, MMT, and Hale 22
CTIO Instruments Available for 2012A 24
Gemini Instruments Available for 2012A* 25
KPNO Instruments Available for 2012A....................................... 26
MMT Instruments Available for 2012A.. 27
Hale Instruments Available for 2012A 27
CHARA Instruments Available for 2012.. 27
Changes Made to the ORP.. 27
Participating in the SMARTS Consortium 28
After Twelve Years of Mosaic II. 28

NOAO Operations & Staff

Students Needed for the 2012 REU Program at Kitt Peak 30
Students Wanted for 2012 CTIO REU Program.............................. 30
Mayall Standing Strong after Winter Ice Damage 31
American Recovery and Reinvestment Act, an NOAO Update........ 32
Astronomy Night on the National Mall.. 36
NEWFIRM's Stay in the South 37
Astronomy Camps XXIV... 38
The 2011 Tohono O'odham Horse Camp 40
45 Years of Observing at Kitt Peak... 40
Three Decades of Coudé Feed Observing..................................... 41
Photos from an International Contest that Help You Touch the Sky... 42
The National User Facility Organization...................................... 44
CTIO Welcomes New Scientific Staff Members............................. 44
Key Staff Retiring at CTIO: Fond Farewells 45
Bici-Tololo Bike Race.. 46
Staff Changes at NOAO North and South (1 February–15 August) 47

On the Cover

The installation of DECam on the Blanco 4-m telescope has begun. The cover image illustrates the dome floor of the Blanco 4-m telescope with components of the *f*/8 handling system in the early stages of its installation for use with DECam. Other completed work includes the DECam focal-plan, which now has all 74 science-grade CCDs installed (see "Dark Energy Camera Update" inside for more details). (Image credit: Tim Abbott, NOAO/AURA/NSF.)

Beginnings and Endings…Many of us have been observing for so many years that we forget our first experience at a telescope. Nicole Snook, a science teacher at Tucson's Toltecalli High School wrote this after her first night observing at Kitt Peak. Toltecalli High School is a low income urban school, but thanks to Nicole, these students can hear first-hand about astronomy. While all things have a beginning, so too do all things have an end. In that vein, we also share a poem by Andrea Kunder, celebrating all the work that the Blanco's Mosaic II has done for astronomers over the years!

Silence
broken only by a bird's song…a cricket's chirp
darkness is coming.
Asleep in the light, domes closed to the stars
await.
A hum.
Cool air brushes my skin as I look down upon the desert baking below me.
A buzz. A lone bug zips by my ear.
Hawks soar on the warm thermal drafts above
searching…floating…circling….
A breeze tickles the leaves around…they sway back to where it all started.
The mountain is closed until sunrise.
I face north.
The sun is to my left, SOLAR to my right awaits its setting.
It is another season up here.
I hear airbrakes in the distance.
It is time to position the domes for the night
a hum of metal working its way around.
The Darkness has come to awaken the mountain to see the universe.

Nicole Snook, Toltecalli High School

Mosaic-II: An Ode

M*ore than just a CCD,*
O*ur Mosaic-II was eight.*
S*ince '99 she sat at the prime*
A*t the Blanco she pulled her weight.*

I*nspiring surveys she could see*
C*ataclysmic supernova at high z.*
I*n this state we probed the expansion rate,*
I*t's true that dark energy does dominate!*

I*nto time and space her half-degree frolicked.*
M*osaic-II what wonderful photons you collected!*
A*ll your 30 filters gave us spectacular shows,*
G*lamorizing nebulae and light echoes.*

E*veryone, ever where, I propose to you:*
R*aise a glass, give a cheer, for our Mosaic-II.*

Andrea Kunder, CTIO

The *NOAO Newsletter*
is published semi-annually by the
National Optical Astronomy Observatory
P.O. Box 26732, Tucson, AZ 85726
editor@noao.edu

Publication Notes

This *Newsletter* is presented with active links online at

www.noao.edu/noao/noaonews/html

Katy Garmany, Editor

Tod Lauer	Science Highlights
David Silva	NOAO Director's Office
Jane Price, Ken Hinkle	NOAO System Science Center
Betty Stobie	Science Data Management
Nicole S. van der Bliek	CTIO
Abi Saha, Elizabeth Alvarez	KPNO
Katy Garmany	Education & Public Outreach
Dave Bell, Mia Hartman	System Observing
David Sprayberry	NOAO System Technology Center
Victor Krabbendam	LSST Project

Production Staff

Barbara Fraps	Managing Editor
Peter Marenfeld	Design & Layout
Kathie Coil	Production Support

If you are receiving a paper copy but would prefer not to, please let us know at *editor@noao.edu*.

Finding Hidden Supermassive Black Holes in Distant Galaxies

Stéphanie Juneau (University of Arizona)

Stéphanie Juneau and collaborators Mark Dickinson (NOAO), David M. Alexander (Durham University), and Samir Salim (Indiana University) have developed a new method to identify a population of active galactic nuclei (AGN) that had been missed in earlier surveys of distant galaxies. Their observations find AGN that have X-ray emission too faint to be securely identified in even the most sensitive X-ray surveys to date. Of particular interest, their approach has identified a sample of "Compton-thick" AGN candidates at the extreme end of X-ray obscuration. A key part of their program is based on observations obtained at the KPNO Mayall 4-m telescope with Mosaic and the Florida Multi-Object Imaging Near-Infrared Grism Observational Spectrometer (FLAMINGOS).

The heart of the program undertaken by Juneau and collaborators was the development of a Mass-Excitation (MEx) diagnostic diagram, which is a modification of a well-understood diagnostic that used emission lines to determine the excitation conditions of ionized atomic gas in galactic nuclei. Key observations included photometry over a broad range of wavelengths and optical spectra to measure the [O III]λ5007 and Hβ emission lines. U, J, and K_s band photometry obtained with Mosaic and FLAMINGOS played a crucial role in determining the stellar masses of the distant galaxies hosting the AGN. The galaxy sample was provided by the Great Observatories Origins Deep Survey North (GOODS-N) program, and spectra were obtained with the Keck Deep Imaging Multi-Object Spectrograph (DEIMOS) instrument.

It is known that most if not all galaxies harbor a supermassive black hole in their center. Whether the observed correlations between black-hole mass and host galaxy properties (such as stellar velocity dispersion) result from a true causal relationship remains a topic of debate. If so, then black holes regulate galaxy growth or vice versa. The answer is unclear because we lack a complete census of black holes that are actively growing by accreting gas in the nucleus of their host galaxies. There is clear evidence for a missing population of such active black holes, a large number of which are suspected to lie at redshifts $0.5 < z < 1$ when the Universe was half to two-thirds of its current age. Identifying these hidden AGN is important to complete the galaxy evolution picture.

The original "Baldwin, Phillips & Terlevich" (BPT) diagram (Baldwin et al. 1981), which was used to calibrate the MEx diagram, probes gas metallicity and ionization parameters, distinguishing gas that is excited by newly formed stars from that excited by the more energetic photons produced around the accretion disks surrounding the supermassive black hole in an AGN. The [N II]λ6584 and Hα emission lines used in the BPT diagram are redshifted beyond the optical band at $z > 0.4$. These lines were replaced with stellar mass, allowing the new diagnostic to be applied out to $z \sim 1$, thus reaching much more distant galaxies (Figure 1).

The MEx diagnostic diagram includes a novel approach to galaxy classification based on the probability that a given [O III]λ5007/Hβ ratio and stellar mass is associated with a galaxy hosting an AGN. Setting the threshold of P(AGN) > 30% was necessary to identify the majority of the X-ray faint black holes, suggesting that some of the galaxies containing obscured AGN have both star formation and a hidden black hole. (The combination of the two processes results in a more ambiguous AGN signal because of dilution with star-formation, thus a lower AGN probability. A probabilistic approach is more useful than a "clear-cut" method to identify such composite galaxies.)

X-ray obscuration was inferred by comparing the observed X-ray signal (luminosity at energies 2–10 keV) to the total signal from gas ionized

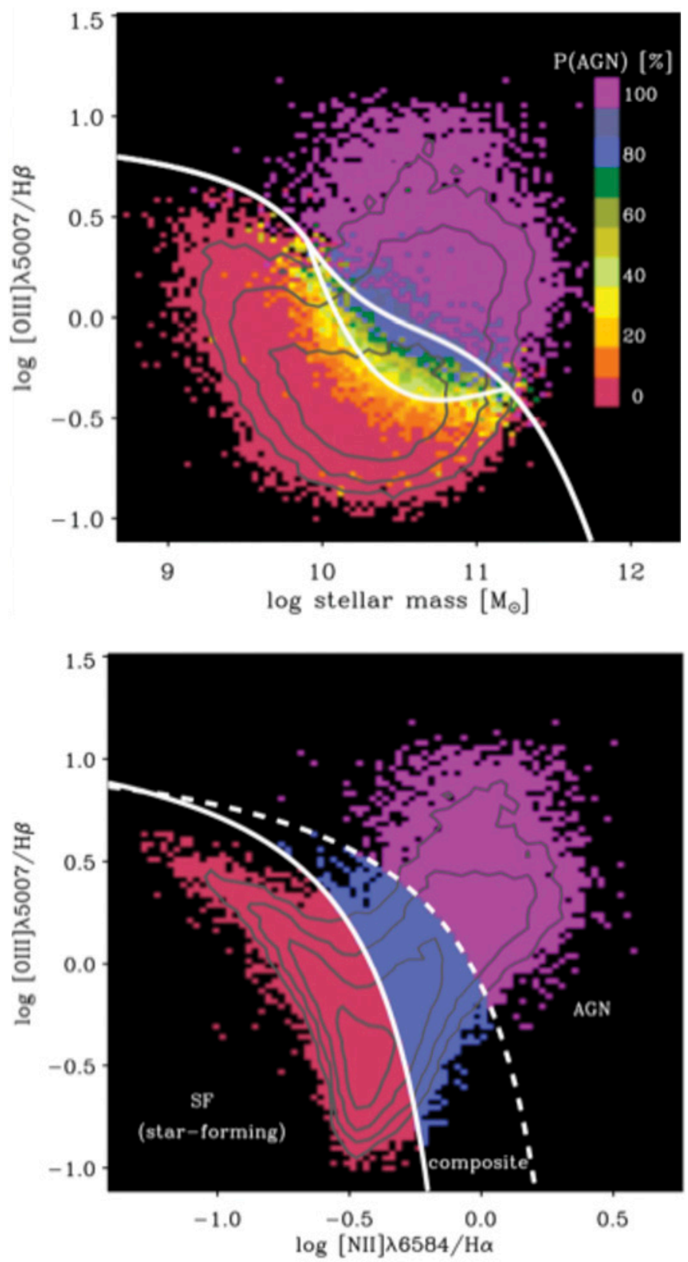


Figure 1: (top) Mass-Excitation (MEx) diagram to identify the presence of AGN in galaxies out to $z \sim 1$. The probability that an AGN is present, P(AGN), is indicated with the color bar and increases toward higher values of [O III]λ5007/Hβ and stellar mass. (bottom) The BPT diagnostic is traditionally used to identify the presence of AGN. It was generated to calibrate the MEx diagram using >100,000 galaxies from the Sloan Digital Sky Survey (density contours shown here).

continued

Finding Hidden Supermassive Black Holes continued

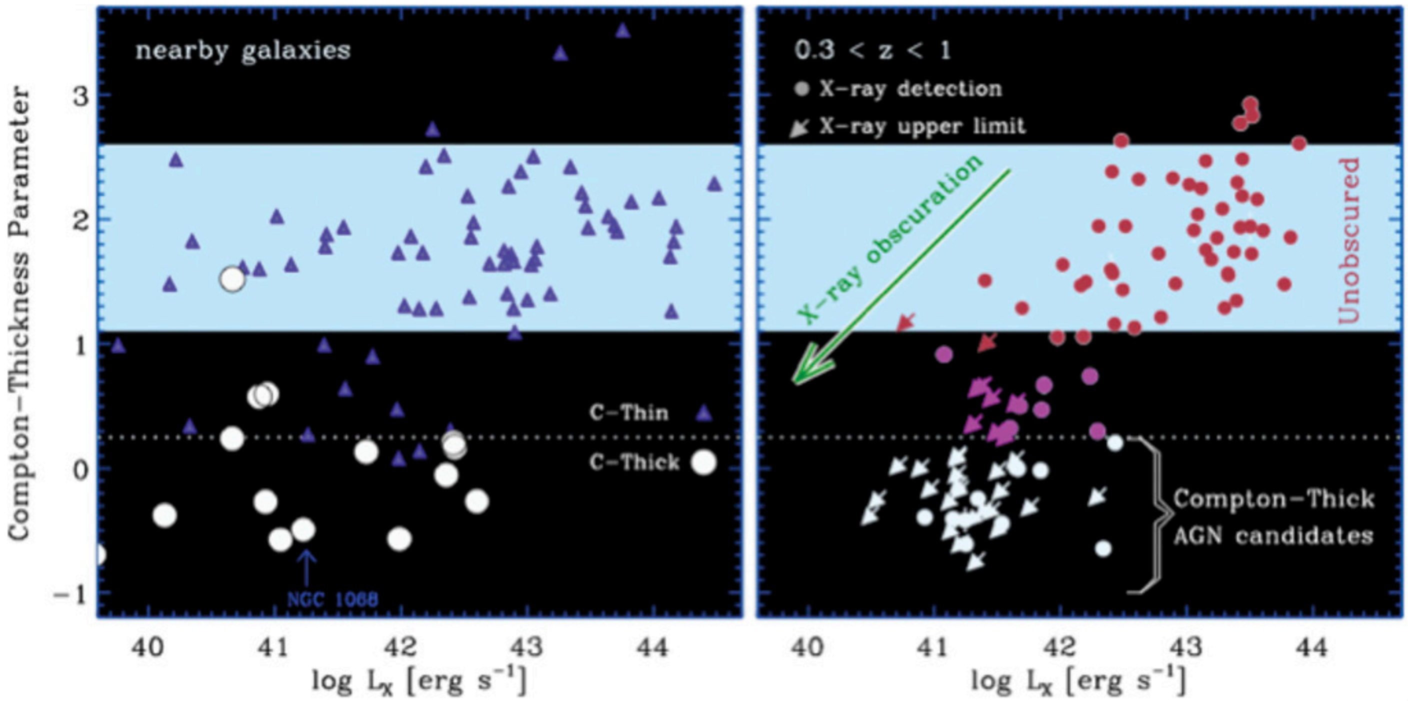


Figure 2: Compton-thickness parameter (= $\log(L_X/L_{[O\,III]})$) shown as a function of the observed X-ray luminosity (uncorrected for obscuration). AGN that are obscured in the X-rays have a suppressed value of the X/[O III] ratio as well as a lower X-ray luminosity. (left) There are well-studied Compton-thick systems in the nearby Universe, where they are easier to observe in more detail. (right) A significant population of Compton-thick AGN candidates are found in the more distant Universe thanks to the novel AGN classification approach and to very sensitive X-ray observations allowing derivation of faint X-ray luminosities and upper limits. Galaxies with P(AGN) < 30% were removed to avoid potential star-forming contaminants.

by the AGN in the surrounding narrow-line regions. While the X-rays are emitted from a small region in the vicinity of the accretion disk (sub-parsec scale), the ionized gas of the so-called narrow-line regions is spread over much larger scales (reaching >100 parsec), making it less likely for the latter to be obscured along a given line of sight. X-ray-obscured AGN have a lower ratio of X-ray luminosity relative to highly ionized gas luminosity from the narrow-line regions, probed by the [O III]λ5007 transition (Figure 2).

The suspicion of X-ray obscuration was confirmed by stacking the sources that were not detected individually in the ultra-sensitive 2-Ms Chandra observations (Alexander et al. 2003). The combination of the signal during the stacking further increased the sensitivity and showed clear evidence for a flattened (obscured) X-ray spectrum.

Beyond finding X-ray obscured AGN, the applications of the MEx diagnostic diagram are numerous. Most galaxy evolutionary studies are concerned with correctly assessing the presence of an AGN because its signal can be confounded with that from newborn stars. It is often crucial to differentiate between these two different physical processes, and the AGN probability scheme introduced in Juneau et al. 2011 provides us with such a tool.

Publicly available code to calculate the probabilities of AGN excitation is distributed along with a summary of common AGN diagnostics: *https://sites.google.com/site/agndiagnostics/*.

References

Alexander, D.M., et al. 2003, AJ, 126, 539
Baldwin, J.A., Phillips, M.M., & Terlevich, R. 1981, PASP, 93, 5
Juneau, S., Dickinson, M., Alexander, D.M., & Salim, S. 2011, ApJ, 736, 104

Star Formation Rises with Time in UV-Bright Galaxies over the First Two Billion Years

Kyoung-Soo Lee (Yale University)

Kyoung-Soo Lee and a team of collaborators that includes Arjun Dey (NOAO), Buell Jannuzi (NOAO), Naveen Reddy (NOAO), and Anthony Gonzalez (University of Florida) used broadband imagery obtained by the NOAO Deep Wide-Field Survey (NDWFS) and the Infrared Boötes Imaging Survey (IBIS) to measure the rate of star formation in a sample of young galaxies in the early Universe. Using the strength of ultraviolet (UV) emission of the galaxies as a proxy for intensity of star formation, they conclude that the star formation rate in the galaxies is actually rising smoothly with time as the Universe ages. This result is important for understanding the mass growth and evolution of galaxies at early times.

The average star formation history (SFH) constrains how galaxies assembled their mass over cosmic time, and thus is of fundamental importance to the theory of galaxy formation. While significant progress has been made in characterizing some of the general physical properties of the high-redshift galaxy population, major questions remain about the details of how these galaxies form their stars. We do not know yet whether their SFH is dominated by a series of short but intense bursts, perhaps driven by major mergers, or a long continuous accretion of gas converted into stars. Putting constraints on the SFH of galaxies also demonstrates how much fuel is available for star formation, and hence their gas accretion history (Papovich et al. 2011). Such uncertainties pose challenges in our understanding of the evolutionary sequence of galaxies observed at different cosmic epochs and can lead to large systematic bias in stellar population parameters (e.g., ages and stellar mass, Maraston et al. 2010).

To improve our understanding of the SFH of young galaxies, Lee and collaborators studied the average physical properties of the most UV-luminous galaxies at z ~ 4. Their hypothesis was that if star formation is a smooth function of time, the observed star formation rates (SFRs) should correlate strongly with the existing stellar mass in these galaxies. Conversely, if galaxies grow mainly via intense starbursts, the same correlation would be much weaker or non-existent. Naturally, the most UV-luminous (and thus most actively star-forming) galaxies provide the best candidates to test these scenarios as intense starbursts imply high star formation rates. The sample was selected in the optical (B_W, R, I) data of the NDWFS (Jannuzi & Dey 1999), sampling the rest-frame far-ultraviolet portion of the galaxy spectra. The galaxy sample, containing 1,906 galaxies in total, is then sorted according to their UV luminosity (I-band magnitude as proxy, which samples the rest-frame ~1700 Å), and the average spectral energy distribution is measured by combining the multi-wavelength data in the Boötes field. These include the IBIS data (J, H, and K_S) taken with the NEWFIRM wide-field infrared imager on the Kitt Peak National Observatory, Spitzer Deep Wide-Field Survey data (3.6 µm, 4.5 µm, 5.8 µm, and 8 µm), and the Large Binocular Telescope U-band data. The combination of these data sets provides a wide wavelength baseline (out to the rest-frame 2 µm) to robustly determine the stellar population properties such as age, stellar mass, star formation rates (SFRs), and the amount of internal dust.

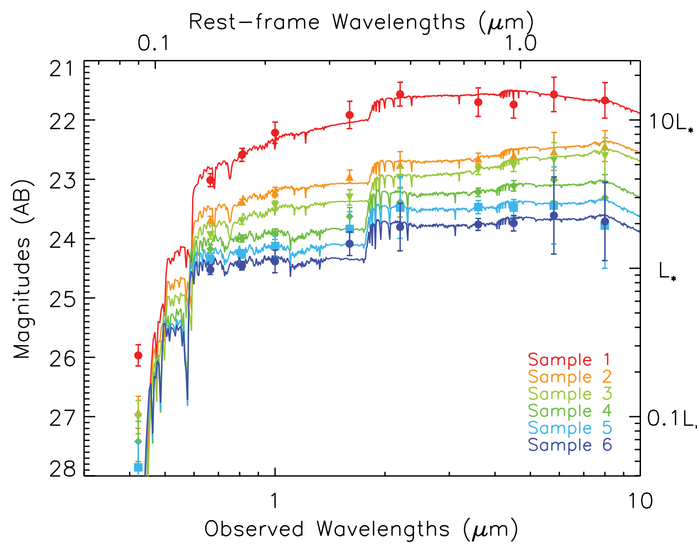


Figure 1: The image illustrates the average spectral energy distributions of star-forming galaxies at z ~ 3.7 at different UV luminosities. More UV-luminous galaxies are on average also more luminous at longer wavelengths. (Lee et al. 2011, reproduced by permission of AAS.)

Figure 1 summarizes the main results. The average spectra of galaxies in six UV luminosity bins appear remarkably similar to one another except the overall normalization. In other words, more UV-luminous galaxies are, on average, also more luminous at longer wavelengths. Furthermore, galaxies in all UV bins have a relatively weak Balmer break (at ~4000 Å), which is an age indicator. When stellar population models are used to derive the average physical properties based on these stacked spectra, the physical implications are: (1) star formation rates (SFRs) scale closely with stellar mass and that more UV-luminous galaxies are also more massive, and (2) the median ages of the stellar populations are relatively young (<0.4 billion years) and show little correlation with UV luminosity (Figure 2). Intriguingly, the two main implications are at odds with each other as the former (the tight correlation between SFR and stellar mass) suggests that these galaxies have been assembling their mass smoothly over a long time while the latter implies that these galaxies started to form at the tail end of the time window of their sample (z_{form} = 4.2–4.5). Furthermore, Lee et al. (2011) argued that the only way to explain both phenomena using conventional SFHs, in which SFR either declines exponentially with time or remains constant, is by assuming a synchronized formation epoch for all the observed galaxies at z = 4.2–4.5. Such a scenario is unphysical not only because z = 4.2 is an arbitrary number of no particular significance, but also because it contradicts itself by further requiring that star formation in all galaxies at higher redshift (z > 4.5) must be turned off before the new epoch of synchronized formation begins (hence, star formation is not so continuous after all!). Lee and collaborators proposed that the average SFH of these galaxies rises with cosmic time on the contrary to the conventional assumptions.

continued

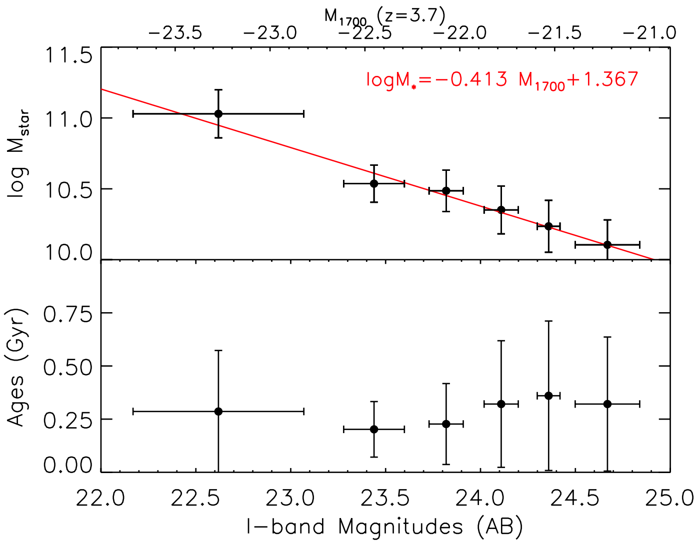


Figure 2: The population synthesis modeling indicates that star formation rates scale closely with stellar mass, and the median ages of the stellar populations are relatively young (< 400 million years) at all luminosities. The combination of this observation with that illustrated by Figure 1 can be explained naturally only by a rising star formation history. (Lee et al. 2011, reproduced by permission of AAS.)

They argued that a smoothly rising SFH provides a more natural solution to explain the two main observations. The tight SFR-$M_\odot$ correlation is preserved because all galaxies form smoothly over time, while the population ages appear young at all epochs because galaxies are always dominated by recently formed stars (Lee et al. 2011).

A rising SFH has interesting implications for the fate of these UV-luminous galaxies (also see Renzini 2009, Papovich et al. 2011). If the SFRs of these galaxies rise at the current rates, these galaxies will double their mass every 300 million years. This means that galaxies with stellar mass 10^{10} $M_\odot$ will grow into 2.5×10^{11} $M_\odot$ by z = 2 (1.5 billion years later). It is not clear if such growth in the SFR is sustainable either by the fuel supply within a galaxy or by the physical mechanisms of star formation. More detailed studies of individual galaxies can shed light on the gas content and fueling of star formation and the feedback processes (due to activity from accretion into a nuclear black hole), which may play an important role in shutting down the star formation.

References

Jannuzi, B.T. & Dey, A. 1999, Astronomical Society of the Pacific Conference Series, 111
Lee, K.S., et al. 2011, ApJ, 733, 99
Maraston, C., et al. 2010, MNRAS, 407, 830 (arXiv:1004.4546)
Papovich, C., Finkelstein, S.L., Ferguson, H.C., Lotz, J.M., & Giavalisco, M. 2011, MNRAS, 412, 1123
Renzini, A. 2009, MNRAS, 398, L58

Gemini/GMOS—Spectroscopy of a Large Sample of Strong Lensing Selected Galaxy Clusters

Matthew Bayliss (University of Chicago)

Matthew Bayliss and collaborators Michael Gladders (University of Chicago), Joseph Hennawi (Max-Planck Institute for Astronomy), and Masamune Oguri (IMPU/University of Tokyo) used the Gemini Multi Object Spectrograph (GMOS) at Gemini North to study 26 strong-lensing galaxy clusters. The clusters are the largest virialized structures in the Universe and serve as natural telescopes for zooming in on the distant Universe to depths that are inaccessible to field surveys. The masses of the clusters measured from the spectroscopy are in agreement with simulations that predict the properties of strong-lensing clusters, while the redshift distribution of the background galaxies that are "lensed" into arcs appears to resolve a conflict between observations and theory on the expected prevalence of the arcs.

Strong gravitational lensing in the cores of galaxy clusters is sensitive to the dark matter structure of galaxy clusters and encodes information about the mass of the cluster lenses (e.g., Broadhurst et al. 2000, Sand et al. 2002), while the statistics of background galaxies that are strongly lensed into bright giant arcs can provide an independent test of cosmological structure models (e. g., Bartelmann et al. 1998, Oguri et al. 2003). Additionally, the strongly lensed galaxies themselves are excellent laboratories for studying galaxy structure and evolution at z > 1, with a signal-to-noise ratio that is dramatically boosted by the lens magnification (e.g., Pettini et al. 2000, Siana et al. 2009).

However, galaxy clusters exhibiting strong lensing are extremely rare, and the small number of known systems has limited their practical value. Bayliss and collaborators have worked with other groups in the US and abroad to address the persistent lack of a large, well-selected sample of galaxy cluster strong lenses. Together they have defined a sample of several hundred cluster lenses by systematically searching two large imaging surveys, the Sloan Digital Sky Survey (SDSS) (Hennawi et al. 2008, Bayliss et al. 2011) and Red Sequence Cluster Survey 2 (RCS2) (Wuyts et al. 2010). These two samples will ultimately provide a catalog of giant arcs that will nail down the absolute abundance of giant arcs on the observational side (examples of giant arcs identified in three clusters are shown in Figure 1). A catalog of hundreds of arcs will also be useful for testing higher-order giant arc statistics, such as the distribution of azimuthal angular separations between giant arcs on the sky and the major

continued

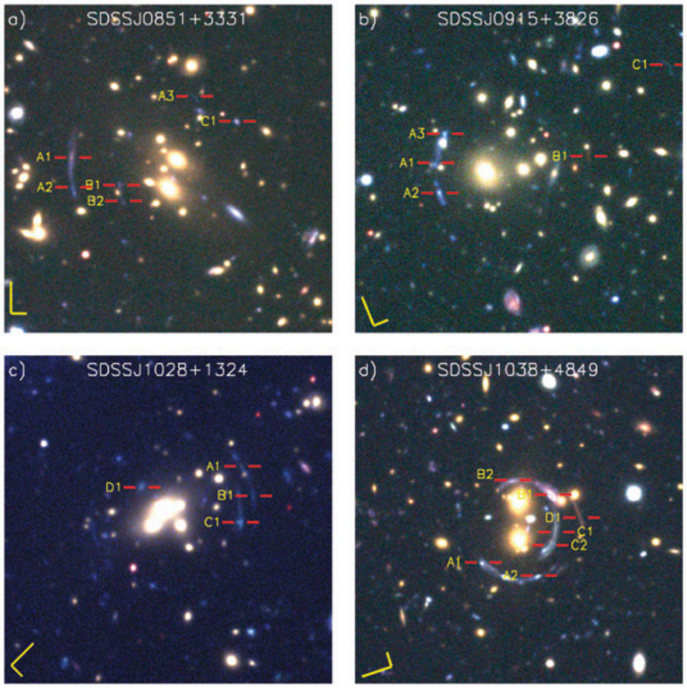


Figure 1: GMOS-North *g, r, i* images of four example strong-lensing cluster-cores are shown. Lensed background sources are identified with horizontal red lines and text tags in yellow. (Bayliss et al. 2011, reproduced by permission of AAS.)

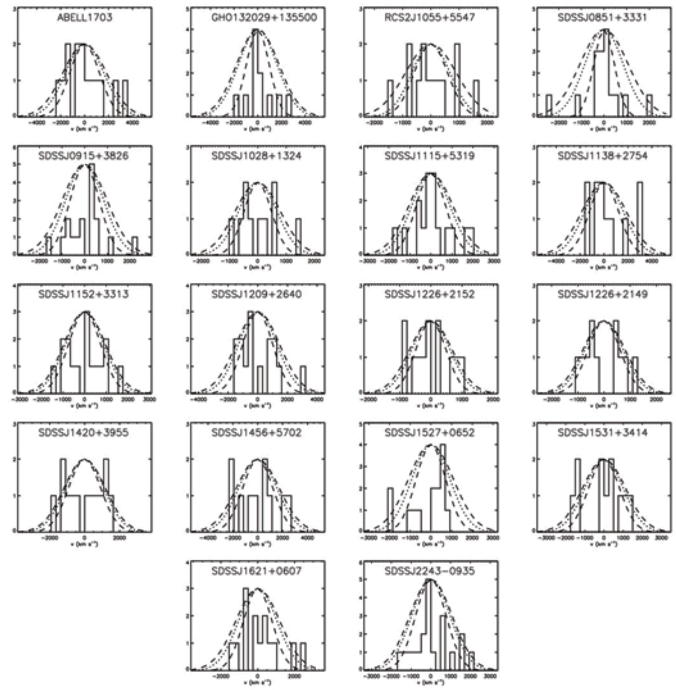


Figure 2: Velocity histograms for the 18 clusters with at least 10 cluster member redshifts, plotted as histograms. Best-fit Gaussians with the mean and variance values from the bi-weight estimator for each cluster are over-plotted (dotted lines), along with the 1s errors on the velocity dispersion (dashed lines). The typical mass of the strong-lensing selected cluster sample: $M_{VIR} = 7.8 \times 10^{14} M_{\odot} h^{-1}$. (Bayliss et al. 2011, reproduced by permission of AAS.)

axes of the foreground lenses, which is a clean, direct probe of the average shape of the projected two-dimensional density profile in the cores of lensing clusters (Dalal et al. 2004, Rozo et al. 2008).

In the mean time, Bayliss and collaborators are collecting extensive follow-up imaging and spectroscopy of the cluster lenses with Gemini North. Velocity histograms for 18 clusters are presented in Figure 2. These new data probe the ensemble properties of both the foreground cluster lenses as well as the lensed background sources, which are essential for understanding the subpopulation of galaxy clusters that are efficient strong lenses as well as for testing the prevailing model for structure formation in cosmology. Using simulations, theorists can identify clusters with large cross sections for strong lensing and compare this subset to the total cluster population. For the first time, they are able to measure the properties of a large sample of real clusters that were selected by virtue of their strong lensing features (Bayliss et al. 2011). Encouragingly, the typical masses of these "strong lensing selected" clusters are in agreement with simulations and confirm that the strong lensing selection tends to pick out the most extremely massive galaxy clusters. Future work will focus on establishing an empirical constraint on the structural and orientation biases that apply to strong lensing selected clusters. These biases have been quantified in cosmological N-body simulations, but have yet to be observed.

Bayliss and collaborators also are using Gemini data to address the issue of giant arc statistics by providing a direct measurement of the redshift distribution for a spectroscopically complete sample of giant arcs. The giant arc statistics problem was posed by Bartelmann et al. (1998) when the authors produced a simulated sample of giant arcs in numerical simulations and compared the giant arc abundance on the sky against small (N = 7) samples of giant arcs that were observed around galaxy clusters in the Einstein Medium Sensitivity Survey (EMSS). Bartelmann et al. (1998) concluded that the number of arcs observed on the sky differed by an order of magnitude when compared against the number produced by simulations in a Lambda-CDM cosmology. The general belief is that there are physical effects that are unaccounted for in the numerical simulations, which result in a predicted giant arc count that is much lower than it should be. However, most of these effects, when quantified in state-of-the-art simulations, do not come close to accounting for an order of magnitude discrepancy between theory and observations. The most promising hypothesis in the literature comes from Wambsganss et al. (2004), who estimate that the detailed properties of the background sources that are lensed into giant arcs can have a dramatic effect on the giant arc statistics produced in simulations. Specifically, Wambsganss et al. (2004) conclude that if most giant arcs are formed by galaxies at much higher redshift than initially thought (e.g., $z = 1.5$–2), then this single factor can produce an increase in the number of simulated giant arcs of a factor of 10. Gemini spectroscopy provides the redshift of a sample of 28 giant arcs that were identified from uniform imaging data from the SDSS. The resulting redshift distribution (Figure 3) has a median of $z = 1.82$ with approximately two-thirds of giant arcs residing at $z > 1.4$. This result represents a large step forward in resolving the tension between observed vs. predicted giant arc abundances, and in doing so points the way toward a resolution for an outstanding question in observational cosmology.

Looking to the future, the published Gemini data (Bayliss et al. 2011) will be combined with forthcoming observations and used to inform more

continued

Gemini/GMOS continued

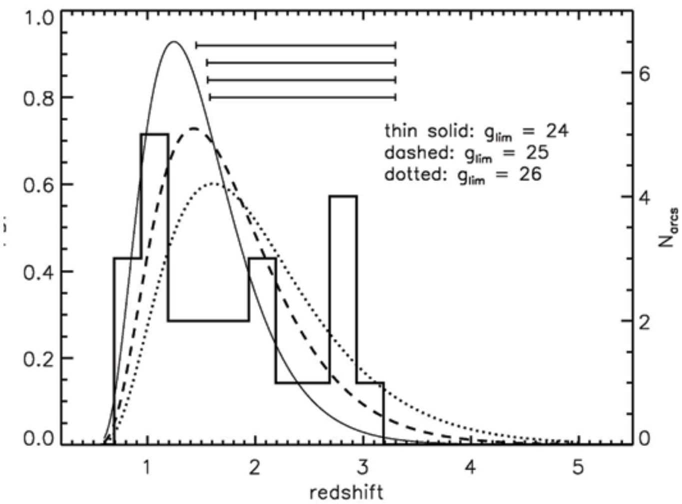


Figure 3: The distribution of redshifts for the primary giant arc sample. Arcs with redshift desert constraints are plotted as horizontal error bars indicating the upper and lower redshift limits for each. This primary giant arc sample constitutes the first spectroscopically complete giant arc sample ever measured. Kolmogorov-Smirnov tests confirm that the distribution can be described by physically motivated models (e.g., the dashed curve). (Bayliss, M. B. et al. 2011b, reproduced by permission of AAS.)

complex analyses, such as strong lens mass reconstruction. The Gemini-observed sample of strong lenses have data either planned or in-hand that will enable dynamical, Sunyaev-Zel'dovich (SZ), and weak lensing measurements of the cluster lenses, and these data will be used to test detailed predictions for cluster profile structure with a sample size of 30+. Strong lensing provides precise constraints on the mass in the cores of clusters, which, when combined with other virial-scale mass measurements, can be used to populate the mass-concentration relation for clusters. First results from these analyses have been published (e.g., Oguri et al. 2009, Gralla et al. 2011), and tests using larger samples are in progress (Oguri et al. 2011 in preparation).

References

Bartelmann, M., et al. 1998, A&A, 330, 1
Bayliss, M.B., et al. 2011, ApJS, 193, 8
Bayliss, M.B., et al. 2011b, ApJL, 727, L26
Broadhurst, T., Huang, X., Frye, B., & Ellis, R. 2000, ApJL, 534, 15
Dalal, N., Holder, G., & Hennawi, J.F. 2004, ApJ, 609, 50
Gralla, M.B., et al. 2011, *ArXiv: astro-ph/1011.6341*
Hennawi, J.F., et al. 2008, AJ, 135, 664
Oguri, M., Lee., J., & Suto, Y. 2003, ApJ, 599, 7
Oguri, M., et al. 2009, ApJ, 699, 1038
Pettini, M., Steidel, C.C., Adelberger, K.L., Dickinson, M., & Giavalisco, M. 2000, ApJ, 528, 96
Rozo, E., Nagai, D., Keeton, C., & Kravtsov, A. 2008, ApJ, 687, 22
Sand, D.J., Treu, T., & Ellis, R.S., 2002, ApJL, 574, 129
Siana, B., et al. 2009, ApJ, 698, 1273
Wambsganss, J., Bode, P., & Ostriker, J. 2004, ApJL, 606, 93
Wuyts, E., et al. 2010, ApJ, 724, 1182

Late-Time Light Curves of Type II Supernovae: Physical Properties of SNe and Their Environment

Masaaki Otsuka (Space Telescope Science Institute)

Masaaki Otsuka and a team of collaborators that includes, Margaret Meixner and Nino Panagia (STScI), Joanna Fabbri and Michael J. Barlow (University College London), Geoffrey C. Clayton (Louisiana State University), Joseph S. Gallagher (Raymond Walters College), Ben E. K. Sugerman (Goucher College), Roger Wesson (UCL), Jennifer E. Andrews (LSU), Barbara Ercolano (Universitäts-Sternwarte München), and Douglas Welch (McMaster University) used the WIYN High-Resolution Infrared Camera (WHIRC) at WIYN and the Near-Infrared Imager (NIRI) and Gemini Multi Object Spectrograph (GMOS) at Gemini to observe the formation of dust in Type II Supernovae (SNe). The goal is to understand the role of SNe in generating dust in galaxies, particularly at high redshift where other dust formation mechanisms may be ineffective.

The origin of dust in high-redshift galaxies has been hotly debated since Bertoldi et al. (2003) discovered large amounts of dust (~4×10^8 $M_\odot$) in the quasi-stellar object (QSO) J1148+5251 (z = 6.4). Core-collapse SNe such as Type II SNe and asymptotic giant branch (AGB) stars are the main dust producers (Gehrz et al. 1989) at the present epoch in our Galaxy. AGB stars are not likely to contribute significantly to dust production in young galaxies, however. Such low-mass stars evolve too slowly toward the AGB phase to produce dust within 1 Gyr. For example, ~1 $M_\odot$ stars with solar metallicity take ~10 Gyr to evolve into thermally pulsing (TP) AGB. If the initial mass is ~5 $M_\odot$, these stars can evolve into TP AGB and might be able to be the main dust producers in young galaxies within ~1 Gyr (Valiante et al. 2009). However, massive stars can evolve into Type II SNe in time spans under 20 Myr. Theoretical interstellar medium

continued

Late-Time Light Curves of Type II Supernovae continued

(ISM) dust models by Dwek & Cherchneff (2011) predict that an average 20 $M_{\odot}$ (initial mass) SN has to make at least ~0.1–1 $M_{\odot}$ of dust to be a viable source for the dust found in the QSO J1148+5251.

Since the discovery of SN 1987A, dust masses have been estimated in the ejecta of a handful of Type II SNe. However, there is large discrepancy between the model predictions and observations (from several × 10^{-4} to 0.02 $M_{\odot}$). The import of dust formation in Type II SNe ejecta is still unclear due to the paucity of observations. To properly assess dust formation by Type II SNe ejecta, it is essential to continue monitoring Type II SNe before and after dust formation started (i.e., day ~300, e.g., Kozasa et al. 2009), because other physical properties such as the nickel mass (^{56}Ni) and light echoes from circumstellar and interstellar dust can be measured and disentangled from dust production effects. The early epoch evolution of Type II SNe before day ~300 has been relatively well studied. However at present, the evolution beyond day 300 has been poorly measured. Therefore, to improve the current situation, Otsuka and collaborators have been monitoring Type II SNe mainly using the near-infrared (IR) high-angular resolution camera WHIRC (Meixner et al. 2010) mounted to the WIYN 3.5-m telescope; the Gemini/NIRI/GMOS; and the Wide Field Planetary Camera 2 (WFPC2), Advanced Camera for Surveys, and Near Infrared Camera and Multi-Object Spectrometer (NICMOS) on the Hubble Space Telescope.

Thanks to these instruments, excellent seeing, and stable sky conditions, Otsuka and collaborators were successful in detecting the light from the SNe alone and in measuring magnitudes with less contamination from nearby stars. Combining their data with previously published data, they examined light curves at *VRIJHK*-bands and measured the rate of fading of SNe, γ, during four phases, namely, days ~30–100 (plateau phase), ~150–300 (radioactive decay phase), ~300–800 (dust forming phase), and >800. The *J*-band light curves is shown in Figure 1. Theses light curves are based on the collaboration data (filled circles) and data from the literature for each object (open circles). The data after >600–1000 days are mainly from the former, and the data before this phase are mainly from the latter. The values in Figure 1 are de-reddened absolute magnitudes. As references, the light curves of SNe 1987A (Hamuy & Suntzeff 1990, Walker & Suntzeff 1991) and 1999em (Elmhamdi et al. 2003) are plotted, which are well-studied Type II SNe. In the WHIRC observations for SN 2002hh in the starburst galaxy NGC 6946, data for SN 2008S (e.g., Wesson et al. 2010) was obtained as well (Figure 2). SN 2008S is regarded as an SN impostor. The *JHK*-band light curves show that SN 2008S is quite different from Type II SNe: for example, there is no plateau phase and no clear level-off around day ~100. The SN 2008S may have evolved from a 6–8 $M_{\odot}$ AGB star and been formed not by Fe-core collapse but by O-Ne-Mg core collapse by electron capture during the AGB phase (Botticella et al. 2009).

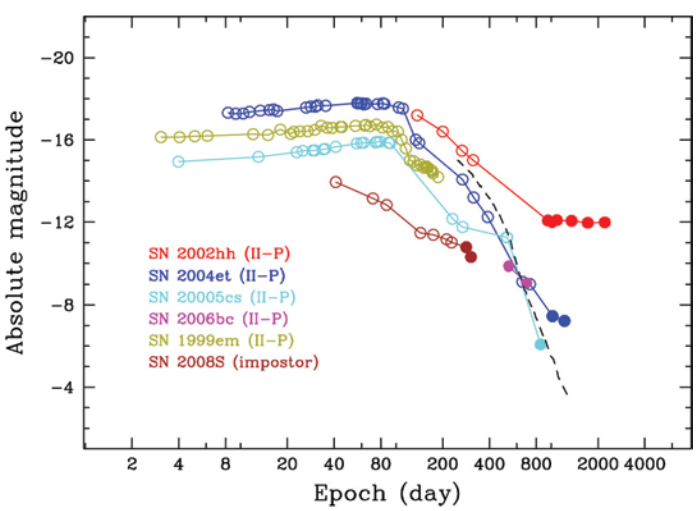


Figure 1: *J*-Band light curves of Type II SNe and an imposter SN 2008S on a de-reddened absolute magnitude scale. The open circles are from published papers, and the filled circles indicate our contributions. The broken lines are from published SN 1987A data.

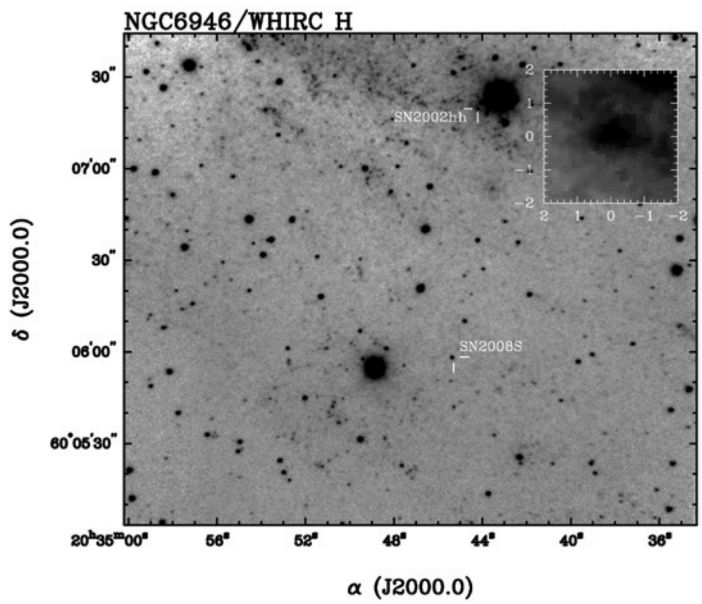


Figure 2: WHIRC view of the SNe 2002hh and 2008S field in the H-band. The positions of SNe 2002hh and 2008S are indicated by the white tick marks. A close-up image of SN 2002hh is presented in the inner box (2 arcsec × 2 arcsec). This image was taken in a 2008 observing run.

Light echoes, which may appear as flattening or increasing fluxes in the light curve, could arise during any of these phases depending on the location of the scattering material with respect to the SNe. The SNe 2002hh, 2003gd, 2004et, and 2006bc would have light echoes. The light curves of Type II SNe during the radioactive decay phase are powered by γ-rays generated from the radioactive decay of ^{56}Co to ^{56}Fe, at a rate corresponding to the *e*-folding lifetime of the ^{56}Co decay (t_{56} = 111.3 days). The expected decay rate at *V*, γ_V, is 0.96 ±0.12 of t_{56} (Patat et al. 1994). The estimated γ_{VRI} except for SNe 2002hh and 2005cs are in good agreements with Patat et al. (1994). Two SNe might have additional power sources in this phase. Analysis shows that γ_{JHK} are ~1–1.4 for all objects. Beyond ~300 days, the fading rates are steeper than the ^{56}Co decay, because the opacity to γ-rays is decreased and dust starts forming. This supports SN dust formation theory.

The light echo density around SN 2002hh (n_H ~ 400 cm^{-3}) is higher than a typical ISM density. This hydrogen density is closer to relatively dense

continued

Late-Time Light Curves of Type II Supernovae continued

gas density in such H II regions than that in interstellar space. Welch et al. (2007) suggests that most of the Spitzer mid-IR flux may have come from dust in the star formation region associated with the SN 2002hh precursor. In the case of SN 2004et, which has the light echo and is a member of NGC 6946, the apparent radius of the SN is ~0.1″. For an adopted 0.1″ radius in aperture photometry for SN 2002hh and a constraint that the inner radius of light echo is >0.1″, approximately 80% of the total flux is from the light echo as of day 1717 (based on HST/WFPC2 observations). The interstellar density around the other SNe is 1–70 cm^{-3}.

Estimated ^{56}Ni masses (0.8–14 × 10^{-2} $M_\odot$) were derived by comparing the SNe bolometric luminosity with SN 1987A (0.073 ±0.015 $M_\odot$; Arnett & Fu 1989). It appears to correlate with the progenitor masses of the sample, M_{prog} as shown in Figure 3a. Maeda et al. (2010) find relationships between the predicted ^{56}Ni mass (of order 10^{-2} $M_\odot$) and the SN progenitor masses; however, they focused on Type II SNe evolved from >20–50 $M_\odot$ progenitors (hypernovae). Otsuka and collaborators expected a similar relationship between the ^{56}Ni and progenitor masses in Type II SNe with progenitor masses of ~10–25 $M_\odot$. Figure 3a strongly supports the previous works. When they exclude the data of SN 2002hh (due to the large uncertainty of the ^{56}Ni mass), M(^{56}Ni) represents 0.34 × 10^{-2} × M_{prog}($M_\odot$). The ^{56}Ni mass derived from the bolometric luminosity could be an effective tool to estimate the SN progenitor mass.

Figure 3b shows the relation between the ^{56}Ni mass and the dust mass. Using the theoretical radiative transfer code MOCASSIN (Monte Carlo Simulations of Ionized Nebulae) (Ercolano et al. 2005), Otsuka and collaborators have been estimating dust masses for their sample except for SNe 1999bw, 1999em, and 2005cs. The dust mass in this diagram is the maximum value in an early phase within day ~800. If the correlation between the ^{56}Ni and progenitor masses is true and SN 2002hh is excluded, where the observations detected pre-existing dust rather than SN-origin dust, there is no relation or a very weak relation between the dust and progenitor masses within ~30 $M_\odot$. This diagram also implies that Type II origin dust mass is ~10^{-4} – 0.01 $M_\odot$ per SN at day <800 despite the progenitor mass.

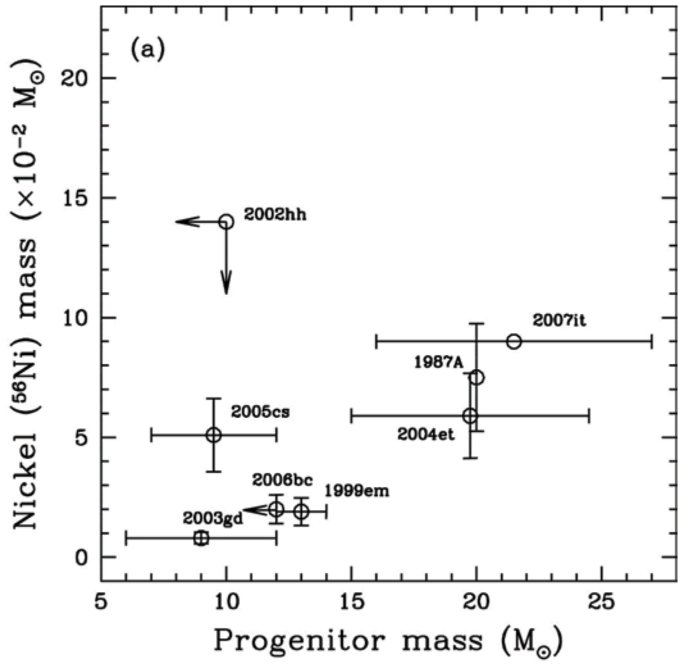


Figure 3a: The relationship between nickel and progenitor masses.

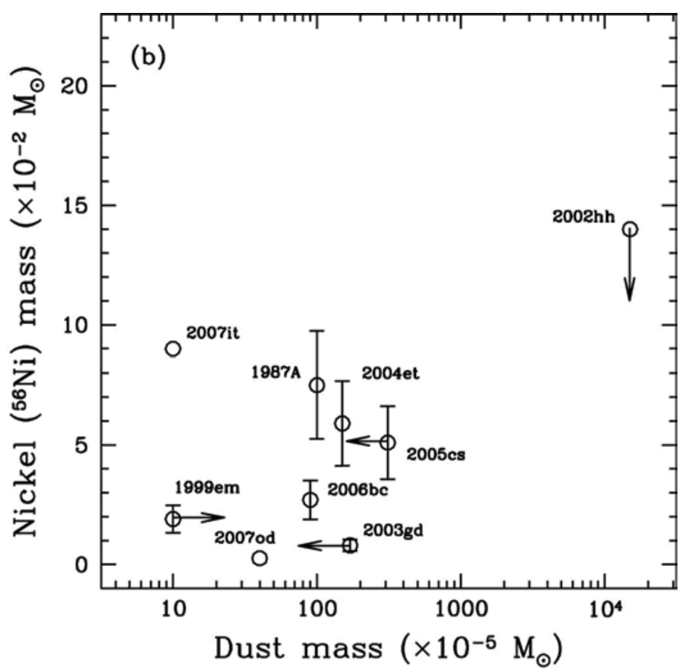


Figure 3b: The relationship between nickel and dust masses.

References

Arnett, W.D., & Fu, A. 1989, ApJ, 340, 396
Bertoldi, F., et al. 2003, A&A, 409, L47
Botticella, M.T., et al. 2009, MNRAS, 398, 1041
Dwek, E., & Cherchneff, I. 2011, ApJ, 727, 63
Elmhamdi, A., et al. 2003, MNRAS, 338, 939
Ercolano, B., Barlow, M.J., Storey, P.J. 2005, MNRAS, 362, 1038
Gehrz, R.D. 1989, Interstellar Dust, ed. L.J. Allamandola, & A.G.G.M. Tielens, IAU Symp., 135, 445
Hamuy, M., & Suntzeff, N.B. 1990, AJ, 99, 1146
Kozasa, T., et al. 2009, Cosmic Dust—Near and Far, ed. T. Henning, E. Grün, & J. Steinacker, 414, 43
Maeda, K., et al. 2010, MmSAI, 81, 151
Meixner, M., et al. 2010, PASP, 122, 451
Patat, F., Barbon, R., Cappellaro, E., & Turatto, M. 1994, A&A, 282, 731
Valiante, R., Schneider, R., Bianchi, S., Andersen, A.C. 2009, MNRAS, 397, 1661
Walker, A.R., & Suntzeff, N.B. 1991, PASP, 103, 958
Welch, D.L., et al. 2007, ApJ, 669, 525
Wesson, R., et al. 2010, MNRAS, 403, 474

NOAO at the Science Frontiers of the 2010 Decadal Survey

David Silva

The Astro2010 decadal survey report *New Worlds, New Horizons in Astronomy and Astrophysics* (NWNH), released in mid-August 2010, presents challenges and opportunities for NOAO over the next decade. Converting those potentialities into realities will depend in large part on funding actions made by the NSF Astronomical Sciences Division (Astronomy). In turn, those actions will be driven by NSF programmatic priorities and discussions with the broader research community. A particularly important framework for those discussions will be the upcoming NSF Astronomy Portfolio Review.

A vital NOAO role in these deliberations is to deliver to NSF and the community a strong Long-Range Plan that offers a focused, efficient, and cost-effective response to decadal recommendations for ground-based science. The most recent NOAO Long-Range Plan (LRP) can be found under News & Reports on the NOAO home page (*www.noao.edu*).

Over the next five years (and beyond), our LRP describes how NOAO and the research community it serves will have major leadership roles providing, operating, and utilizing unique capabilities and facilities for the three NWNH Science Objectives: Cosmic Dawn, New Worlds, and Physics of the Universe. These concepts and designs are the result of decade-long planning and optimization, completed in concert with NSF support and community input from a wide variety of sources including the Renewing Small Telescopes for Astronomical Research, Access to Large Telescopes for Astronomical Instruction and Research, and Future of NOAO committees.

Key areas of leadership include:

Characterization of dark energy and dark matter in the early universe will more accurately constrain the development of structure—the essential precursor to formation of galaxies and all that they contain. Three major new NOAO surveys, the Dark Energy Survey (DES) at the Blanco 4-m (2012–2017), the Big Baryon Oscillation Spectroscopic Survey (BigBOSS) at the Mayall 4-m (2017–2021), and the Large Synoptic Survey Telescope (LSST) (2019–2028), will provide the community with the essential data foreseen in NWNH and other national planning reviews, e.g., the Particle Astrophysics Scientific Assessment Group of the Department of Energy's High Energy Physics Advisory Panel and the NASA *Beyond Einstein: From Big Bang to Black Hole*s reviews. NOAO scientists and community scientists have a long history of key discoveries in these areas using NOAO facilities. The discoveries of anomalous galaxy disk rotation (Rubin, Ford, and collaborators) and giant luminous arcs in massive clusters (Lynds and Petrosian) helped establish the ubiquity of dark matter in the Universe. During the 1990s, NOAO scientists and facilities played a key role in the initial discovery of the accelerating Universe and, hence, the universal presence of dark energy.

Exploration and characterization of the time-domain will detect the vast majority of asteroids potentially hazardous to life on Earth, reveal Galactic evolution, map the structure of the Milky Way, and provide urgently needed statistics on supernovae, including especially the rarest. NOAO and Gemini facilities already are used heavily for follow-up observations of time-variable objects found by other facilities, e.g., Swift, Palomar Transit Factory, and Catalina Sky Survey. The DES and (dramatically) LSST will each increase the number of transient triggers and the pressure for follow-up support, which may be facilitated in the future by a closer relationship with Gemini.

Exoplanet characterization and the study of their parent stars will reveal the composition of exoplanet atmospheres and the extent of the habitable zones of their parent stars. The Gemini Planet Imager (GPI) will become available during this LRP period and will allow scientists to characterize dozens of Jovian-class planets through a combination of key projects and principal investigator-class investigations. Meanwhile, precise determination of the physical properties of hundreds of parent stars identified by NASA Kepler and other missions/surveys will be possible using the new generation of optical (Mayall/KOSMOS, Blanco/COSMOS, Gemini/GHOS) and near-IR (Gemini/FLAMINGOS-2, Blanco/TripleSpec) spectrographs that will be deployed during this LRP period.

In-depth knowledge of the nature of stellar populations in our Milky Way and its numerous dwarf satellites will be a major arena of exploration enabled by BigBOSS on the Mayall. As has been amply demonstrated by the Sloan Digital Sky Survey (SDSS) and the community exploitation of its stellar spectra (obtained during grey and bright time when the primary dark time project could not be executed), well-understood massive samples of medium-resolution spectra allow us to determine the basic parameters describing the stars (temperature, surface gravity, and metallicity), as well as characterize their [alpha-element/Fe] and [C/Fe] ratios. An essentially unlimited number of interesting stellar targets from the SDSS and PanSTARRS photometric catalogs will already be in place in the era of BigBOSS. Accurate radial velocities from BigBOSS, coupled with exquisite parallax distances and proper motions to be obtained with the Gaia mission (which will not obtain radial velocities for stars fainter than 16th magnitude, while BigBOSS will be able to deliver quality spectra to fainter than 20th magnitude), will enable full space motions to be determined for truly enormous numbers of stars. This powerful combination of six-dimensional phase-space information with chemical abundances, sometimes referred to as Galactic Archaeology, will provide detailed knowledge of the early stages of galaxy formation and chemical evolution at a level of detail not approachable by any other means.

This leadership will be enabled by already established scientific and technological collaborations with university-based groups (e.g., Ohio State, Cornell, and our WIYN, SOAR, and SMARTS partners, etc.), other US-led observatories (e.g., Gemini, Keck, and other operations of 3- to 10-m-class telescopes), other US national science centers (Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, National Center for Supercomputing Applications, SLAC), major international science collaborations (e.g., LSST, DES, BigBOSS) and, especially, our dynamic and world-leading user community.

continued

NOAO at the Science Frontiers continued

Finally, experience teaches us a fundamental lesson. **Unknown unknowns**, sudden and unexpected breakthroughs, so-called black swans—impossible to predict, but often the most important—will emerge in the coming decade. Discovery of the ubiquitous presence of dark matter and dark energy are the quintessential illustrations of this lesson. Because such discoveries are unpredictable, NOAO deploys excellent general-purpose instruments and then, through an open telescope allocation process, unleashes creative minds to use those instruments for exploration. A strong national observatory dedicated to open-access research affiliated with other strong US-dominated facilities, such as Gemini, maximizes the likelihood that the right minds, regardless of who they are or where they work, will connect to the right instruments to make those big leaps forward.

Since the 2005–2006 Senior Review, NOAO has laid a strong foundation for leadership at the NWNH Science Frontiers through support from NSF and continuous engagement with a broad set of scientists in the national and international community. We look forward to a decade where NOAO, Gemini, and the rest of the US Optical/Infrared System work together with an expanded research community as well as NSF and other funding sources to build on existing infrastructure in a cost-effective manner to enable transformational science.

To enable community discussion, we have created an online forum at ast.noao.edu/node/162. *Comments entered there will be posted immediately. Comments sent to* currents@noao.edu *will not be posted unless requested. We look forward to hearing from you!*

Dr. Timothy Beers to Become Associate Director for KPNO

David Silva

NOAO is delighted to announce that Dr. Timothy Beers has agreed to become the next NOAO Associate Director for KPNO. His official start date is 10 October 2011. In his new role, Beers will be responsible for the suite of research facilities on Kitt Peak. These include the Mayall 4-m telescope, the WIYN 3.5-m telescope, and several smaller facilities. Kitt Peak also hosts tenant observatories and provides services to several of them. In addition to these responsibilities, the associate director for Kitt Peak also works closely with the NOAO director and the other associate directors in developing and implementing the NOAO strategic plan.

Beers brings to the position a broad array of experience and insight. He is currently a professor in the Department of Physics and Astronomy at Michigan State University (MSU) as well as co-founder and associate director of the Joint Institute for Nuclear Astrophysics (JINA), an NSF-funded Physics Frontier Center that brings together the work of nuclear physicists and astronomers at MSU, the University of Notre Dame, and The University of Chicago. He led JINA's participation in SEGUE, The Sloan Extension for Galactic Understanding and Exploration, a medium-resolution spectroscopic survey of 240,000 stars in the Galaxy. He and his group developed the software pipeline for the survey, an effort that produced publicly available abundance estimates for over 200,000 stars, a first for such large samples.

Dr. Timothy Beers will assume the mantle of NOAO Associate Director for KPNO 10 October 2011.

Beers' experience and enthusiasm for surveys that produce massive data sets is particularly welcome as NOAO moves into the era of the DES, BigBOSS, and LSST. At the same time, as a long-time user of facilities at Kitt Peak, Cerro Tololo, and many other observatories, he understands the needs of individual investigators. Beers has been a tireless advocate for a strong national observatory in many venues, including as co-chair of the Future of NOAO committee in early 2009. He is joining NOAO at a moment of great opportunity with full knowledge of the associated challenges ahead.

Welcome, Tim!

Phoenix Returning to Kitt Peak

Ken Hinkle

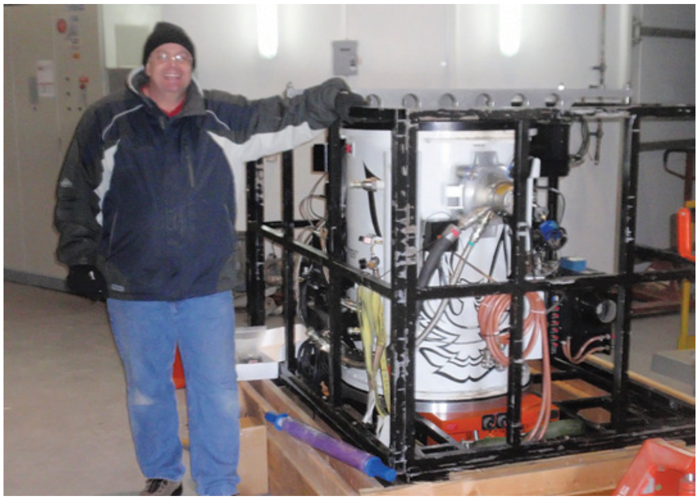


Figure 1: Ron George (NOAO) with Phoenix in its shipping frame in the loading area of Gemini South. Phoenix is being transferred from Gemini South for eventual use on Kitt Peak. (Image credit: Ken Hinkle, NOAO/AURA/NSF.)

Figure 2: Phoenix loaded in its crate and on the truck about to leave Gemini South for Tucson, 5 August 2011. (Image credit: Pablo Diaz, Gemini.)

Phoenix, the NOAO high-resolution, 1–5-micron infrared spectrograph, was built in the mid 1990s for use on the Kitt Peak 2.1- and 4-m telescopes. Due to a factor of two improvement in the typical delivered image quality at the Gemini 8-m telescopes as compared to non-adaptive optics (AO) 4-m-class telescopes, Phoenix is also an excellent match to Gemini telescopes, and it was sent to Gemini South in late 2000. In exchange for the use of Phoenix, Gemini provided an Aladdin II detector for the instrument, a significant upgrade from the Aladdin I used for most runs at Kitt Peak.

Use of Phoenix at Gemini increased steadily over the decade it was offered. Phoenix was consistently the second-most requested and scheduled instrument following the Gemini Multi-Object Spectrograph. In the period of 2007–2010, there were 69 Phoenix users. In 2009 and 2010, Phoenix use increased to about 20 programs per semester. Science topics spanned the range from atmospheres of outer planets, orbits for cool dwarfs, chemistry of the interstellar medium, stellar abundances in local group galaxies, and outflows in active galaxies. However, as part of planned changes in instrumentation, Gemini decided in 2011 to remove Phoenix from its instrument list. In 2011A, Gemini notified NOAO that it was terminating the Phoenix joint-use contract.

NOAO plans to ship Phoenix back to Tucson in August 2011. An attempt in June to pack Phoenix for shipment (Figure 1) was stopped by heavy snowfall on Cerro Pachón. Our visit to the summit in July was more productive (Figure 2). On arrival in Tucson, Phoenix will be reassembled in the lab and tested. The computer and array controller on Phoenix are from the 1980s and predate the instrument. Updating these components would allow enhancements in both operation and reliability. Regardless of whether this upgrade goes forward or not, Phoenix will be scheduled for use on Kitt Peak. Unfortunately, Phoenix will not be back in Tucson until after the 2012A Call for Proposals; please watch the KPNO Web site for developments.

KOSMOS and COSMOS Updates

Jay Elias

A detailed status update on the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) and its twin, the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS) would be out of date by the time you read this article! So rather than provide such a report, this article indicates where you can find more up-to-date information on both instruments and includes a brief overview to provide an incentive to click on those links. The policy for applying for KOSMOS use at the Mayall telescope in semester 2012A is outlined as well.

Capabilities

KOSMOS and COSMOS are nearly identical adaptations of the OSMOS spectrograph developed by The Ohio State University for the MDM Hiltner 2.4-m telescope. KOSMOS will be deployed on the Mayall 4-m telescope at KPNO, and COSMOS will be deployed on the Blanco 4-m telescope at CTIO (see the March 2011 *Newsletter* for more background). Current information on OSMOS can be found at *www.astronomy.ohio-state.edu/~martini/osmos/*; we expect KOSMOS and COSMOS performance to be similar to that of OSMOS, scaled by aperture.

continued

KOSMOS and COSMOS Updates continued

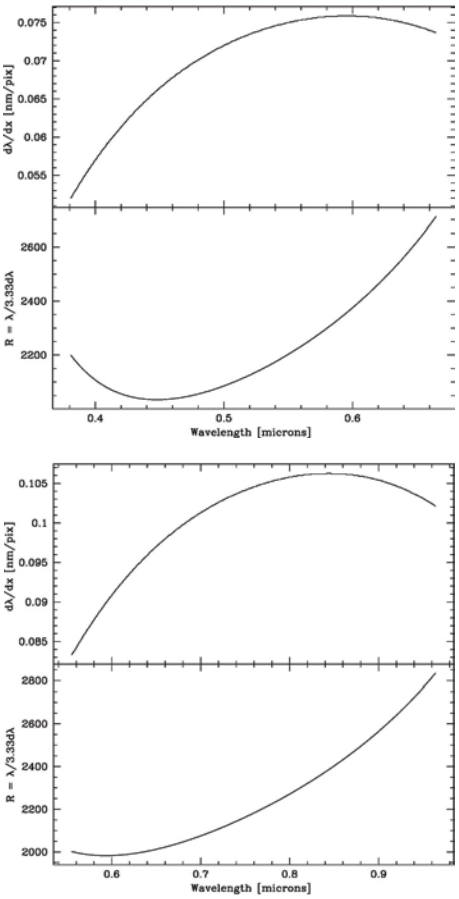


Figure 1: Dispersion curves for the blue (top) and red (bottom) grisms. The resolution shown is specified for a 1-arcsec slit, but the slits that will be provided will actually be 0.6, 0.9, 1.2, and 1.8 arcsec wide, plus a wider slit for photometric calibrations. The instrument image quality should allow use of the 0.6-arcsec slit for those willing to accept the associated light losses at the slit.

The initial complement of dispersers provided with KOSMOS and COSMOS will provide resolution of ~2400 for a 3-pixel slit (0.9 arcsec), as shown in Figure 1. There will be a "red" and "blue" Volume-Phase Holographic (VPH) grism in each instrument; wavelength coverage is fixed, but the coverage in long-slit mode can be shifted somewhat to the red or blue by using an off-axis slit. Both instruments will support a multi-object (slit mask) mode as well.

Spectral coverage is ~280 nm for the blue grism and ~400 nm for the red grism. The central wavelengths are ~525 nm and ~760 nm, respectively. By offsetting the long slit position in the focal plane, the center wavelength is shifted by roughly ±35 nm in the blue and ±50 nm in the red. Peak efficiency of the dispersers is designed to be at the center wavelength; for these VPH grisms, the peak efficiency will remain at the new center wavelength for the offset slit positions. Appropriate blocking filters are available for the red grism. The available long slits provide these specific offsets and do not provide intermediate offsets; more options may become available eventually, but they will not be offered in 2012A.

Eventually, both instruments will have two associated charge-coupled device (CCD) detectors: an e2v CCD identical to those installed in the Mosaic upgrade at KPNO and a thick Lawrence Berkeley National Laboratory (LBNL) CCD that will provide enhanced red response, and proposers will be able to request either one. The KOSMOS e2v detector has been delivered, but we are still working on optimizing performance of the controller and have been using an engineering grade array for KOSMOS integration. The science grade array will become available during commissioning and, therefore, also will be available for semester 2012A. We have purchased the LBNL CCDs for both instruments, but these will probably not be implemented until partway through the 2012A semester. Users should not plan on using the LBNL CCD when they request KOSMOS time for the 2012A semester.

The shortest wavelength that is accessible in principle is ~350 nm, though it remains to be seen whether the "as-delivered" optics will perform well this far into the ultraviolet. The effective limiting wavelength should be somewhere between 350 and 370 nm. The longest available wavelength will be ~1020 nm, although the e2v CCD will not have much response this far into the red.

Instrument throughput should be between 1.5 and 2 times better than the RC Spectrograph, though this may be offset by slit losses in poor seeing. The higher figure is the goal for the instrument, but until we have information on the "as-built" optics coatings, we cannot be sure of achieving that.

The multi-object field is nominally 10 arcmin in diameter, but we strongly recommend using only a central rectangle (approximately 5 × 10 arcmin) for more uniform wavelength coverage. The imaging field is also 10 arcmin in diameter; any KPNO 4-inch-square filter can be used. At the present time, we do not contemplate supporting pure imaging proposals in 2012A, but users could contemplate using a narrowband filter for acquisition.

Note that the Mayall Atmospheric Dispersion Compensator (ADC; Risley prisms) *does not* cover the full KOSMOS field, so users will need to work without it (orient at the parallactic angle) or restrict themselves to a field <5 arcmin. Current limits on the cass rotator require large rotations to be done at the zenith, so observations at any position angle are possible, but overheads in observing time may be significant.

Figure 2: KOSMOS (right) and COSMOS (left) in the final stages of electrical and mechanical integration at The Ohio State University in Columbus, Ohio. The spectrographs are shown on their handling carts in the up-looking position, which is the same way they will mount in the cass cages of the 4-m telescopes using an adapter that is not shown. The Dewars install on the bottom of the instruments. Various covers are not yet installed in these photos.

continued

KOSMOS and COSMOS Updates continued

The most current information on the KOSMOS/ COSMOS capabilities can be found at *www.noao.edu/nstc/kosmos/*. Relevant technical documentation is posted there as well.

Schedule

As of early August, we were waiting for final delivery of the optics, which had been figured but not coated, nor assembled at the vendor. We were working with the vendor on the details of the anti-reflection coatings for the lenses. The first telescope commissioning will occur during the second half of this semester (2011B), and the instrument should be available in semester 2012A. Watch the KOSMOS Web site for schedule updates.

However, given that the first telescope run will occur after the deadline for proposal submission, and that commissioning may well be incomplete at the time the Telescope Allocation Committee meets, we are adopting the following policy for requesting KOSMOS (please see the 2011A Call for Proposals for the definitive rules):

Proposers should write only proposals that can be carried out with the RC Spectrograph or the Multi-Aperture Red Spectrometer. Proposers who would be interested in using KOSMOS if it becomes available should indicate this in their technical section, describing as well how their proposal would be adapted to the KOSMOS capabilities listed above, for the same amount of observing time.

If, in our judgment, KOSMOS is ready for shared risk use during 2012A, we will contact scheduled observers and confirm their continued interest. We may end up making only a subset of capabilities available during the semester (e.g., long slit but not multi-object spectroscopy mode).

Because the two instruments are nearly identical, COSMOS integration has been proceeding largely in parallel with KOSMOS, and the performance should be nearly identical as well. Commissioning will take place following DECam commissioning at CTIO, probably toward the end of semester 2012A. We expect to be able to offer it in semester 2012B; details will be provided in the Call for Proposals for that semester and in updates on the KOSMOS home page (see link above).

The WIYN One Degree Imager—an Update

Todd Boroson

Since the start of 2011, the One Degree Imager (ODI) project has been under review. Although almost all of the hardware was complete by mid 2010, the detectors have proven to be a problem. The detectors are orthogonal transfer arrays (OTAs). Each of the 64 OTAs is a 4000 × 4000 imager, which is itself divided into 64 500 × 500 cells, each of which can be read out independently. The orthogonal transfer nature of these devices means that the pixels in each cell can be shifted either vertically or horizontally also. Thus, the concept for ODI is to dedicate some cells to video rate readout of guide star data and to shift the pixels in the cells around it in response to that data.

In October 2010, an external review of ODI was held at the request of the WIYN Board. The review panel identified a number of technical and programmatic concerns, but also came to the conclusion that, with a limited set of performance requirements, the project could be successful. At that point, the Board decided to stop most of the work on the instrument and initiate a phase of restructuring and replanning. The time since then has been spent working in three areas: detector development, software and data management, and development of a new overall plan for completion. This phase will end with a full report to the WIYN Board in October 2011.

The new plan has the initial deployment of the instrument with a partially filled focal plane. Rather than the full 64 OTAs, the partial focal plane would have at least ten OTAs, distributed sparsely over the full one-degree field of view. This would permit many of the early steps of instrument integration, characterization, and optimization to be done before the full complement of detectors is produced. If the Board permits a restart of the project in October, the partial focal plane instrument could be installed on the telescope for the first time in August 2012.

Detector development has continued, guided by very conservative decisions. A new lot of OTAs was produced, and it appears that these detectors will be suitable for the partial focal plane. They have one remaining significant problem, however, which still must be overcome for the fully functioning instrument; their output amplifiers glow at a level that will compromise scientific exposures. The amplifiers can be turned off, but not when they are run in the video rate mode that will be required for the full "electronic tip-tilt" correction. Thus, the partial focal plane version will operate with only a limited number of these guide-star cells active. The team is now working on identifying the cause of the glow.

The software and data management challenge is considerable, as the instrument will generate 2-GB images when the full focal plane is deployed. The approach that is being pursued is a system developed as a joint effort involving NOAO and the Indiana University Pervasive Technology Institute (PTI). This will include a file transfer system through which all raw images will go to PTI, an automatic pipeline that runs on the NSF-funded TeraGrid, an archive, and a user portal. Ultimately, the portal will allow ODI primary investigators and archival researchers to run analysis software on data at PTI and to download cutouts, catalogs, and other results.

If all goes well, ODI will be installed on the WIYN telescope next summer. The steps following the commissioning of the partial focal plane are uncertain for both technical and resource reasons. Possibilities include immediate replacement of the partial focal plane with a full one or the reconfiguration of the partial focal plane into a more compact configuration, using the same detectors, for scientific use.

Launching a Laser & Acquiring a Laser Guide Star: A SAM LGS Mode Update

Nicole van der Bliek, Steve Heathcote & The SAM Team

Since the publication of the March 2011 *NOAO Newsletter*, the SOAR Adaptive-optics Module (SAM) project has passed two major milestones on the path to full deployment of the Laser Guide Star system: first, laser propagation on the sky, and second, closure of the adaptive-optics (AO) loop using the laser guide star.

In the March 2011 issue, we reported that all the components of the SAM Laser Guide Star (LGS) system, i.e., Laser Box, Beam Transfer Optics, and Laser Launch Telescope (LLT), plus the accompanying electronics had been installed at the SOAR telescope and that we had successfully fired the laser for the first time, inside the SOAR dome, on January 28.

Most of the SAM team then took a well-deserved summer vacation returning in March, with fresh energy, to continue testing SAM in LGS mode. As well as further tuning of the hardware, this involved implementing the various measures required to ensure safe operation of the laser, coordinating with the Chilean air traffic control authorities to ensure aircraft safety, and the US Laser Clearing House to protect satellites. On 16 March 2011, at 02:53 UTC, the first SAM on-sky laser propagation took place and the return flux was imaged with the SOAR Optical Imager (SOI) (see Figure 1).

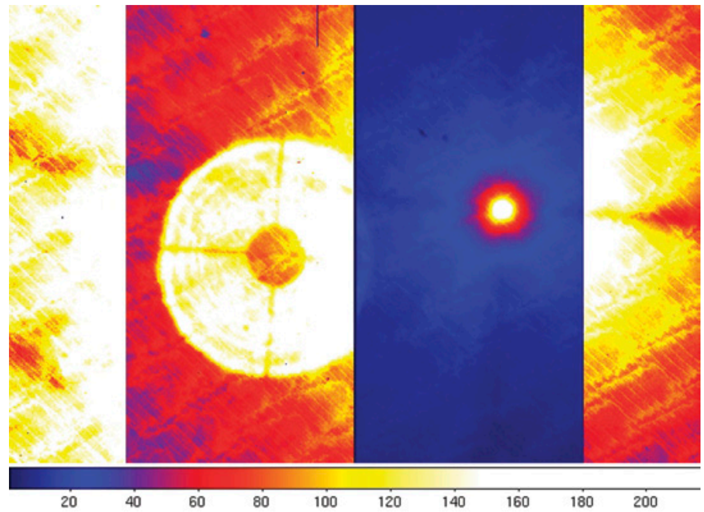


Figure 1: The laser spot imaged with SOI. The SOAR telescope was focused to 7 km to have an in-focus laser spot. Next to the laser spot is an out-of-focus image of a bright star.

During the following engineering run in April, we were able to fine-tune the pointing of the LLT so that the laser spot fell within the field stop of the wavefront sensor (WFS), and on April 15, we closed the AO loop on the laser guide star for the first time. Figure 2 shows some examples of the improvement in image quality achieved when the AO loop is closed.

In all, three servo loops have to be closed for LGS operation of SAM. The AO loop uses measurements of the laser guide star made with the SAM WFS to correct high order aberrations by adjusting the shape of the deformable mirror. A second loop uses the tip-tilt signal measured by the SAM WFS to maintain the pointing of the LLT. Finally, atmospheric tip-tilt and telescope tracking errors are monitored using the SAM's guide probes to track one or two natural guide stars and then are corrected by controlling SOAR's tip-tilt mirror. Having tested each of these systems separately, all three were successfully made to work together for the first time in May.

A significant amount of fine-tuning and tweaking of the system still remains to be done, including some rework of the LLT, so that we expect to be fully occupied for the remainder of 2011 and well into 2012 commissioning SAM in LGS mode, learning about the system, and understanding its full capability. Stay tuned.

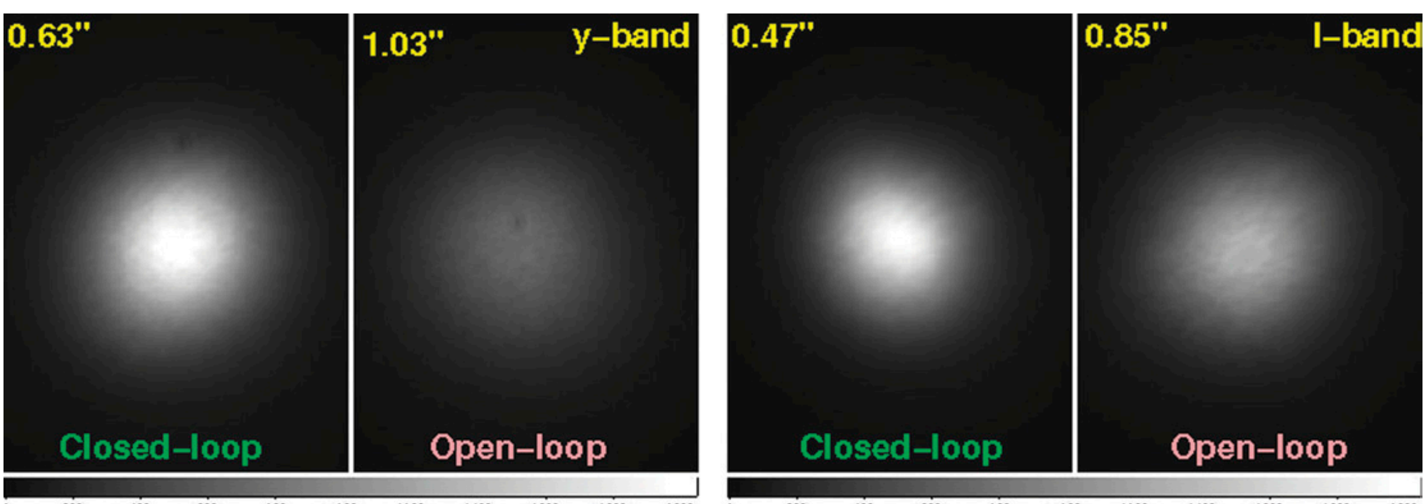


Figure 2: 16 April 2011. The loop was closed on the laser guide star on April 15. The next night the improvement of the image quality in closed-loop was documented by images of bright stars. Side-by-side comparison of point spread functions in the green and red are shown in the image, with full width half-maximum indicated.

A New Infrared Spectrograph for NOAO South

Ron Probst and David James

The ReSTAR process is NOAO's ongoing response to the US community's need for access to a balanced suite of high-performance science capabilities on telescopes with less than a 6-m aperture. High priority has been given to rapid provision of new workhorse spectrographs on 4-m telescopes with community access. NOAO is meeting this need by building versions of existing instruments together with university partners. NOAO has received NSF funds to construct a copy of the infrared spectrograph TripleSpec for use in the Southern Hemisphere. Three versions of this spectrograph were originally planned (one reason for the name TripleSpec). Two are in use on the Astronomy Research Consortium (ARC) 3.5-m and Palomar Observatory 200-inch (5-m) Hale telescopes, with a third under construction for one of the W. M. Keck Observatory 10-m telescopes. The infrared (IR) instrument group at Cornell University, led by Terry Herter, built the Hale TripleSpec and is partnering with NOAO on a fourth copy. John Wilson (University of Virginia), who led the optics design and procurement for the ARC and Hale instruments, is doing the same for the NOAO instrument.

Figure 1: Joint project team discussion. Clockwise from top center: Terry Herter (Cornell); David James (NOAO, project scientist); Ron Probst (NOAO, systems engineer); John Wilson (U. of Virginia); Cornell graduate students Everett Schlawin and Ryan Lau; Chuck Henderson (Cornell, project engineer); and David Sprayberry (NOAO, NSTC head of program). (Image credit: Mark Trueblood, NOAO/AURA/NSF.)

This moderate-resolution, single-object spectrograph is designed to support a broad range of science with design simplicity and operational robustness. It has the following principal features:

- Simultaneous wavelength coverage of 0.8–2.4 microns
- Reimaging fore-optics match telescope *f*/# to instrument
- Single, fixed collimator-disperser-camera unit
- Resolution R ~ 3000
- Slit width @ 1 arcsec, slit length = 37 arcsec
- Pixel sampling of 1 arcsec = 2.4 pixels
- IR slit viewer/guider with ~ 4 × 4 arcmin field of view

The NOAO version, TripleSpec 4, slated for the Blanco 4-m is being considered for the Southern Astrophysical Research (SOAR) 4.1-m telescope. The SOAR telescope's excellent image quality, operational flexibility, and year-round scheduling for all its facility instruments are a good match to scientific needs and the TripleSpec's capabilities. Either telescope-instrument combination will provide an exciting new capability for the US community.

Figure 2: Inspecting the IR spectrometer FORCAST (Faint Object Infrared Camera for the SOFIA Telescope) in the Cornell lab. Terry Herter (left) listens as David James (right) makes a point. FORCAST was just back from a recent series of commissioning flights on the Stratospheric Observatory for Infrared Astronomy (SOFIA). It has a lot of design commonality with the TripleSpec series. (Image credit: Mark Trueblood, NOAO/AURA/NSF.)

All the principals met in early July at Cornell University for a kickoff project meeting. Following a modest level of redesign to match SOAR's *f*/16.6 input and a careful review of the project plan and cost to stay within the fixed budget, we expect construction to start early in calendar year 2012 with delivery to the telescope in late 2014.

Dark Energy Camera Update

Alistair Walker & Tim Abbott

The Dark Energy Camera (DECam) is a new, wide-field facility imager for the CTIO Blanco 4-m telescope, covering three square degrees of the sky per single exposure. In exchange for providing the instrument and a reduction pipeline, the Dark Energy Survey (DES) Consortium will conduct a five-year survey using 30 percent of the telescope time; for details of the survey, see *www.darkenergysurvey.org/*. DECam has previously been described in the March 2010 and March 2011 *NOAO Newsletters* (pages 10 and 17, respectively), so here we restrict ourselves to presenting progress over the past six months.

During this period, there have been two reviews. In April, CTIO hosted the Integration and Installation meeting in La Serena, which included a review of our plans for installing the camera on the telescope. This was followed by a Directors' review at Fermilab in May. In both cases, the panels have provided invaluable guidance for the forthcoming tasks.

The intensive test phase with the DECam Imager on the telescope simulator at Fermilab was successfully completed in April, finishing with several "nights" of simulated observing to exercise DECam hardware and software. This was followed by the packing up of almost all the DECam components with the exception of the Imager and its electronics. The Imager was returned to the clean room for removal of the engineering grade CCDs and installation of 62 2K × 4K and 12 2K × 2K science-grade CCDs. This task was accomplished successfully (see Figure 1), and by the end of July, tests were underway to verify performance for each of the devices, with shipment of the Imager to Chile to follow.

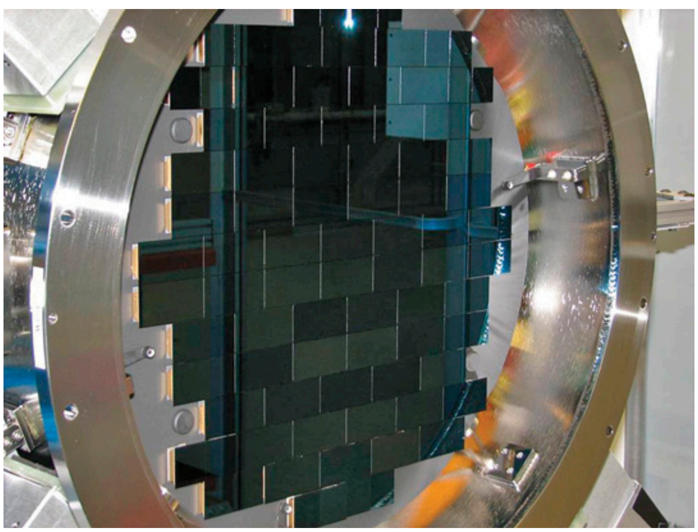


Figure 1: The Dark Energy Camera (DECam) focal plane with all 74 science-grade CCDs installed. On the Blanco Telescope, the 45 cm diameter focal plane covers 3 square degrees of sky, (12 times the area of the Full Moon). The fully depleted back-illuminated CCDs were made at LBL and packaged, tested, and installed at Fermilab. (Image credit: Juan Estrada, Fermilab).

In the meantime, several large shipments have arrived at Cerro Tololo. Following the installation of the *f*/8 mirror changer in January (see March 2011 *Newsletter*), next to arrive was the Radiometric All Sky Infrared Camera (RASICAM) (Figure 2), built at SLAC by Peter Lewis and Howard Rogers under the supervision of Rafe Schindler. Its arrival coincided with one of the most severe winters we have experienced for many years; however, RASICAM has survived wind and snow well! Over the next few months we will commission the camera, comparing its cloud images taken in the 10-micron window with CCD images from the Tololo All Sky Camera, which is sited nearby.

Figure 2: Radiometric All Sky Infrared Camera (RASICAM), built at SLAC by Peter Lewis and Howard Rogers under the supervision of Rafe Schindler, and installed at CTIO. (Image credit: Alistair Walker, NOAO/AURA/NSF.)

Figure 3: Liquid Nitrogen system for cooling DECam. The system is installed in and on top of the old console room in the Blanco dome. (Image credit: Tim Abbott, NOAO/AURA/NSF.)

continued

Dark Energy Camera Update continued

Following along, we received three large shipments, two by air and the other by sea, of all the hardware associated with cooling DECam, the major part of which is the Liquid Nitrogen flow system, which cools the DECam focal plane, together with the DECam hexapod support system, plus the shutter and filter changer system. Figure 3 shows the Liquid Nitrogen system now installed in and on top of the old console room in the Blanco dome. It is being filled with cryogen for the first time, in parallel with CTIO staff being trained how to operate the equipment by the engineering team led by Herman Cease with Rolando Flores and Andrew Lathrop (all Fermilab), with DECam Project Manager Brenna Flaugher and scientist Tom Diehl also present.

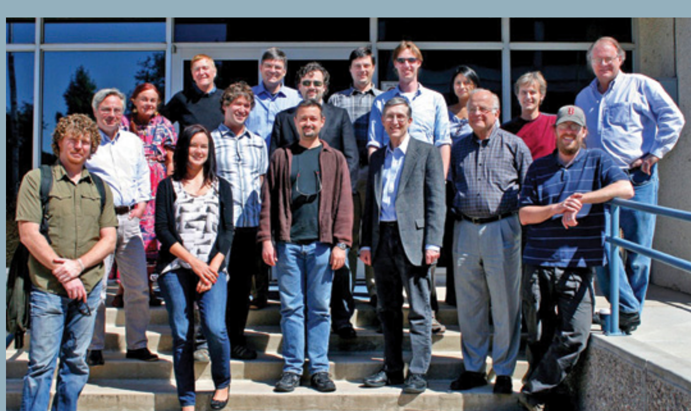
An exciting arrival was two completed filters: Sloan Digital Sky Survey (SDSS) z and Y. Despite a delay of two months due to the devastating earthquake and subsequent rolling power cuts, Asahi Spectra (Japan) has now completed three of the five DECam filters, the third being SDSS i. Tracking this express shipment from Tokyo to Santiago was a little nerve racking, with stops in Alaska and Tennessee followed by an ominous "now in Brazil, delayed for reasons beyond our control"! This proved to be caused by ash from Volcano Puyehue restricting flights, and so, after a final stop in Argentina, the filters finally made it to Chile. With 62-cm diameters, these are the largest astronomical filters ever made.

The other major DECam component not yet discussed is the five-element optical corrector. All lenses are now in the Optics Laboratory at the Department of Astronomy, University College London, where a small team led by Peter Doel is carefully installing the lenses in their cells and then aligning the cells in the barrel. This work must be done with exquisite care as the tolerances on alignment and tilt of the lenses are very stringent. This phase of the project defines the critical path.

Together with all of this DECam-related activity, there has been great progress on associated facilities development. We single out for mention the remodeling of the ground floor of the Blanco dome, where the console and computer rooms have been enlarged and modernized (Figure 4) in a project under the leadership of Ron Lambert. Ron also was responsible for a project to build all 25 DECam computers, which have all been installed in the new computer room with the DECam software successfully installed on them.

Finally, we turn to the Blanco telescope itself. The telescope was shut down in March to re-aluminize the primary mirror. Upon removing the mirror, it was found with no failed radial supports for the first time in its history, reassuring us that the repair of two years ago was entirely successful. The final coat on the mirror is probably the best we have seen yet with very low scattering and a reflectivity near that of pure aluminum.

Figure 4: (left to right) Ricardo Venegas, Andrea Kunder, and Alberto Alvarez enjoy the remodeled console room on the ground floor of the Blanco 4-m telescope. This project was funded by the American Reinvestment and Recovery Act of 2009. (Image credit: Nicole van der Bliek, NOAO/AURA/NSF.) NL



LSST Science Collaborations at Work

On March 21 and 22, the LSST Transient and Variable Stars science collaboration met at the NOAO headquarters in Tucson. Members of the collaboration were able to interact not only with LSST Project staff but also with NOAO scientific staff members who are developing time-domain projects related to LSST. During this highly productive meeting, examples of many kinds of variables were collected to be inserted into LSST image simulations in order to test recovery of transient objects. NOAO will continue to host meetings of LSST science collaborations in order to further the scientific progress of the project. (Image credit: Emily Acosta, NOAO/AURTA/NSF.)

2012A NOAO Call for Proposals Due 30 September 2011

Verne V. Smith & Dave Bell

Standard proposals for NOAO-coordinated observing time for semester 2012A (February 2012–July 2012) are **due by the evening of Friday, 30 September 2011, midnight MST.**

The facilities available this semester include the Gemini North and South telescopes, Cerro Tololo Inter-American Observatory (including SOAR), Kitt Peak National Observatory (including WIYN), and community-access time with the MMT 6.5-m telescope, the 200-in (5-m) Hale Telescope at Palomar Observatory, and the CHARA interferometer at Mt. Wilson.

A formal Call for Proposals is available at *ast.noao.edu/observing/proposal-info* as a self-contained, downloadable pdf document that contains all information necessary to submit an observing proposal to NOAO. Included in this document are the following:

- How to prepare and submit a proposal for an observing program
- Deadlines
- Descriptions of classes of programs, such as normal, survey, or long-term, as well as the criteria of evaluation for each class
- Who may apply, including special guidelines for thesis student proposals, or travel support for classical observing on the Gemini telescopes
- Changes and news or updates since the last Call for Proposals
- Links to Systems facilities Web pages
- How to acknowledge use of NOAO facilities in your papers

Previous information on various Web pages that contain all of the information within the Call for Proposals document also remains available at *www.noao.edu/noaoprop*.

There are four options for submission:

Web Submission – The Web form may be used to complete and submit all proposals. The information provided on the Web form is formatted and submitted as a LaTeX file, including figures that are "attached" to the Web proposal as encapsulated PostScript files.

File upload – A customized LaTeX file may be downloaded from the Web proposal form after certain required fields have been completed. "Essay" sections can then be edited locally and the proposal submitted by uploading files through a Web page at *www.noao.edu/noaoprop/submit/*.

Email submission – A customized LaTeX file may be downloaded from the Web proposal form after certain required fields have been completed. "Essay" sections can then be edited locally and the proposal submitted by email. Please carefully follow the instructions in the LaTeX template for submitting proposals and figures. Please use file upload instead of email if possible.

Gemini Phase I Tool (PIT) – Investigators proposing for Gemini time **only** may optionally use Gemini's tool, which runs on Solaris, RedHat Linux, Windows, and Mac platforms and can be downloaded from *www.gemini.edu/sciops/P1help/p1Index.html*.

Note that proposals for Gemini time may also be submitted using the standard NOAO form and that proposals that request time on Gemini plus other NOAO facilities **MUST** use the standard NOAO form. PIT-submitted proposals will be converted for printing at NOAO and are subject to the same page limits as other NOAO proposals. To ensure a smooth translation, please see the guidelines at:
www.noao.edu/noaoprop/help/pit.html.

Help with proposal preparation and submission is available via the addresses below:

Web proposal materials and information	*www.noao.edu/noaoprop/*
TAC information and proposal request statistics	*www.noao.edu/gateway/tac/*
Web submission form for thesis student information	*www.noao.edu/noaoprop/thesis/*
Request help for proposal preparation	*noaoprop-help@noao.edu*
Address for submitting LaTeX proposals by email	*noaoprop-submit@noao.edu*
Gemini-related questions about operations or instruments	*gemini-help@noao.edu*
	www.noao.edu/usgp/noaosupport.html
CTIO-specific questions related to an observing run	*ctio@noao.edu*
KPNO-specific questions related to an observing run	*kpno@noao.edu*
MMT-specific questions related to an observing run	*mmt@noao.edu*
Hale-specific questions related to an observing run	*hale@noao.edu*

Delayed Call for New NOAO Survey Programs

The National Optical Astronomy Observatory (NOAO) allows astronomers to use NOAO facilities to obtain large, homogeneous datasets aimed at addressing significant scientific problems by proposing to the NOAO Survey program. The call for new Survey proposals is traditionally issued on an annual basis with a mid-September deadline. This year, however, NOAO will delay the call by six months, but anticipates announcing the opportunity to propose for new surveys at the end of 2011, with a likely deadline of mid-March 2012.

The six-month delay is motivated by the desire to let surveys use the capabilities that are being deployed in 2012, including the return of NEWFIRM to the Kitt Peak Mayall 4-m. Note that as DECam (CTIO Blanco 4-m) will be under commissioning during 2012, it will not be available for surveys for the expected March 2012 call. The availability of Flamingos-2 (Gemini South) and KOSMOS (Mayall 4-m) for the next Survey call is as yet unclear. Watch the NOAO Web pages for more information. The call will be announced in the *NOAO Newsletter,* as well as on the NOAO proposal Web page: *ast.noao.edu/observing/proposal-info*. [Article updated 9/9/2011.]

Update on DECam Installation & Blanco 4-m Availability: Blanco Shutdown in 2012A

Chris Smith

In the previous *Newsletter*, we reported that CTIO was planning to begin installation of the Dark Energy Camera (DECam) on the Blanco 4-m telescope in late September. Due to the complexity of this installation, which involves significant work to the telescope structure, it will require several months of telescope shutdown while we replace the top-end cage and install the new imager. We anticipated that only four to eight weeks of time would be available to the community in 2011B and that commissioning and science verification would continue into 2012A.

As a result of slips in the delivery schedule of the DECam optics and planning constraints around the 2011 holiday season, the delivery and installation of DECam has been delayed by several months. As of early August, we plan to begin the installation shutdown in early January 2012. Given the heavy oversubscription for time on the Blanco in 2011B, there are a sufficient number of highly ranked proposals to fill the newly available time in this semester, so the telescope is being scheduled with those 2011B proposals through to early January, and proposers are being alerted.

Availability of DECam and the Blanco in 2012A

The delays in camera installation mean that the installation and commissioning now fall in the period of January through August 2012, almost completely in the 2012A semester. This period includes three months (mid-January through mid-April) during which we must disassemble the telescope in order to remove and replace the prime focus cage, the most significant change made in the telescope's almost 40-year history. During the following three months, we will re-commission the whole telescope, starting with the *f*/8 instrumentation and finishing with commissioning the DECam system.

We anticipate roughly four weeks of community time in 2012A with *f*/8, during which we will make Hydra and ISPI available for community use, although probably via service or remote observing to maintain flexibility in the telescope and DECam commissioning schedule. More details will follow in the 2012A Call for Proposals (see *ast.noao.edu/observing/proposal-info*).

Community Access to the Blanco in 2012B and Beyond

In July/August 2012, we plan to begin science verification (SV) observations with DECam. The SV observations will include a significant amount of community science. We will announce the details of the SV activities and how to propose for SV projects in the 2012B Call for Proposals.

In September 2012, the Dark Energy Survey (DES) will commence observations. In the September through January period, the community will have access to no less than 25% of the time (roughly one week per month). Although there will be a few DES nights scheduled in February, we anticipate largely normal community access in the A semesters during the duration of the DES survey (2012 to 2016).

Although community access is limited, the DES will be providing imaging data in all available filters over 5,000 square degrees, which is much of the sky available in the B semester. This data will have only a one-year proprietary period. So if your observation involves imaging of selected fields during the B semester, it is possible that the data you need will be taken by the DES and will be available after one year.

Availability of the CTIO 1.0- and 0.9-m Telescopes in 2012A

Charles Bailyn

We may curtail some activities at the 1.0-m and 0.9-m telescopes due to financial limitations. Therefore, proposers should indicate clearly if they require one of these telescopes rather than the other, and why. If no such discussion is included, we will assume that the program can be executed on either telescope. We may also curtail service observing on the 0.9-m telescope, so proposers for service programs who might be able to carry out the project with a traditional user run should make this clear. Otherwise, we will assume that service proposals can only be executed in service mode. Proposers are strongly encouraged to consult the SMARTS Web pages prior to proposal submission for the latest information.

Mayall 4-m Telescope News

Dick Joyce

Over the period of July 11–August 15, the Mayall telescope was shut down to carry out a number of maintenance projects which required the telescope to be out of service for a number of nights. These ranged from long-term repair work to efforts designed to increase the telescope operation efficiency and image quality.

We decided to defer aluminization of the primary mirror to next year. During this shutdown, the primary was washed, a procedure that has historically decreased scattering and returned the reflectivity to within one to two percent of a freshly coated surface.

The major project was the completion of the crack repairs to the dome rails, which involved cleaning out the grout under the crack, air arc cleaning of the crack, and rewelding. New grout was then installed under the repaired crack. Will Goble notes that we have repaired a total of 19 cracks over the past few years, and the two repaired this summer should complete the job.

Since the primary was not removed, there was extra time to investigate the procedures for alignment of the secondary mirror and on-sky wavefront evaluation to optimize the image quality at the R-C focus. Should the Big Baryon Oscillation Spectroscopic Survey (BigBOSS) instrument be installed at the Mayall, this latter procedure will be very important because switching between prime focus BigBOSS and cassegrain operation will involve removal and installation of the entire secondary fixture on the front of the BigBOSS cage on a moderately frequent basis.

We also carried out a complete census of the cables in the Cassegrain rotator wrap-up, with the goal of determining if any may be removed to decrease the size and weight of the wrap-up. Since the eventual goal of efficient operation of the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) is to be able to rotate the instrument with the telescope at any position, not just at zenith, it will be necessary to find a way to ensure that the cables can be accommodated during rotation in a safe manner. Approximately 20 of the 60 cables in the wrap-up were removed, and tests of the rotator were carried out to ensure that operation away from the zenith will be possible with KOSMOS.

Standard maintenance of the guider rotator and recoating of some of the guider mirrors was also carried out.

On the instrumentation front, we note that NEWFIRM will be returning from Cerro Tololo later this fall and will be recommissioned on the Mayall 4-m telescope beginning in late January 2012. It will be offered for observing in the 2012A semester, although the recommissioning effort will be ongoing in early February.

We expect to begin testing and commissioning of KOSMOS during the fall of this year. See "KOSMOS and COSMOS Updates" in the System Science Capabilities section of this issue for more information.

WIYN 0.9-m Telescope News

Hillary Mathis

We would like to update the community on the status of the WIYN 0.9-m telescope. The past year has seen a number of positive changes and improvements at the venerable 0.9-m telescope, and we continue to operate at a fairly efficient level. A number of improvement and maintenance projects carried out in recent months have led to gains in overall operations. In addition, the past year has been busy with the commissioning of the new and improved Mosaic camera, three new partners joining the consortium, and continued work toward the completion of a new CCD imager for the 0.9-m telescope.

Mosaic 1.1, which had been recently upgraded and commissioned at the Mayall 4-m telescope, was brought to the 0.9-m telescope for commissioning in January 2011. The commissioning went very smoothly, and the weather cooperated to allow us to complete all of our verification

continued

WIYN 0.9-m Telescope News continued

science objectives in five nights. New users have been very happy with the ease of use of Mosaic 1.1 with its new software setup and are *very* excited about the 19-s readout time. We offered Mosaic 1.1 as a shared-risk instrument in semester 2011A, and it is currently being offered as a fully supported instrument in 2011B. Any member of the general user community can apply to use Mosaic 1.1 on the 0.9-m telescope through the regular NOAO time allocation process.

The 0.9-m Consortium has grown in the past year with the addition of three new partner institutions. We are happy to welcome Austin Peay State University, Rochester Institute of Technology, and Haverford College to our consortium. Our new partners have been very enthusiastic about the observing and educational opportunities opened up via their access to the telescope. The consortium is pleased to add new partners with a diverse range of interests and talents who will help us operate our mostly volunteer-based consortium.

We are continuing to make progress on bringing our new camera, the Half-Degree Imager (HDI) to the telescope. HDI is being built around a 4K × 4K monolithic CCD. The chip has been purchased from e2v, and testing of the detector has begun. We are currently completing negotiations with a vendor to package the CCD and provide a turn-key instrument. The completed HDI will deliver a field of view of 29.4 arcmin on a side (more than double the areal coverage of the current S2KB CCD) with 0.43-arcsec/pixel image scale. We expect readout times to be well under 30 seconds. We hope to be able to offer it to the public starting in 2012B.

For more information on the WIYN 0.9-m telescope, please refer to the home page at *www.noao.edu/0.9m*.

Community Access Time Available in 2012 with CHARA

Steve Ridgway

NOAO and Georgia State University are announcing a third opportunity for observations with the Center for High Angular Resolution Astronomy (CHARA) optical interferometer array at Mt. Wilson Observatory. About 50 hours will be available during calendar year 2012. Observations will be carried out by CHARA staff.

Requests should be submitted using the standard NOAO proposal form by selecting "CHARA" in the telescope list and entering "nights requested" as a decimal assuming 10 hours/night (e.g., 1.6 nights = 16 hours). Proposals must be submitted by the standard 2012A deadline of 30 September 2011. Note that this one-time call covers all of calendar year 2012, as opposed to the six-month period of February–July 2012 for other resources in the 2012A proposal cycle. For more information, see *www.noao.edu/gateway/chara/*.

System-Wide Observing Opportunities for Semester 2012A: Gemini, MMT, and Hale

Knut Olsen, Dave Bell & Verne V. Smith

Semester 2012A runs from 1 February 2012 to 31 July 2012, and the NOAO System Science Center (NSSC) encourages the US community to propose for observing time using all of the ground-based, open-access, system-wide facilities available during this semester. This article summarizes observing opportunities on telescopes other than those from KPNO, CTIO, WIYN, and SOAR.

The Gemini Telescopes

The US user community has about 50 nights per telescope per semester on the Gemini North and Gemini South telescopes, which represents the largest piece of open-access observing time on 8-m-class telescopes. The Gemini Observatory provides unique opportunities in observational and operational capabilities, such as the ability to support both classically- and queue-scheduled programs.

In an effort to increase interactions between US users and the Gemini staff, as well as observing directly with the telescopes and instruments, **NOAO strongly encourages US proposers to consider classical programs, which can be as short as one night, on the Gemini telescopes. NOAO will cover the travel cost to observe at Gemini for one observer.**

US Gemini observing proposals are submitted to and evaluated by the NOAO Time Allocation Committee (TAC). The formal Gemini "Call for Proposals" for 2012A will be released in early September 2011 (close to the publication date of this *Newsletter* issue), with a US proposal deadline of Friday, 30 September 2011. As this article is prepared well before the release of the Call for Proposals, the following lists of instruments and capabilities are only our expectations of what will be offered in semester 2012A. Please watch the NSSC Web page (*www.noao.edu/nssc*) for the Gemini Call for Proposals, which will list clearly and in detail the instruments and capabilities that will be offered.

NSSC anticipates the following instruments and modes on Gemini telescopes in 2012A:

continued

Observing Opportunites for Semester 2012A continued

***Gemini North*:**

- NIFS: Near-infrared Integral Field Spectrometer.
- NIRI: Near Infrared Imager.
- ALTAIR adaptive optics (AO) system in natural guide star (NGS) mode, as well as in laser guide star (LGS) mode. ALTAIR can be used with NIRI imaging, NIFS integral field unit (IFU) spectroscopy, NIFS IFU spectral coronagraphy, and GNIRS.
- Michelle: mid-infrared (7–26 μm) imager and spectrometer, which includes an imaging polarimetry mode.
- GMOS-North: Gemini Multi-Object Spectrograph and imager. Science modes are multi-object spectroscopy (MOS), long-slit spectroscopy, IFU spectroscopy and imaging. Nod-and-Shuffle mode is also available.
- GNIRS: Gemini Near Infrared Spectrograph offers a wide variety of spectroscopic capabilities including long-slit (single order) spectroscopy within the 1.0–5.4 μm range. The instrument can be used with adaptive optics over most of its wavelength range.
- All of the above instruments and modes are offered for both queue and classical observing, except for LGS, which is available as queue only. **Classical runs are now offered to programs that are one night or longer and consist of integer nights.**
- Details on use of the LGS system can be found at *www.gemini.edu/sciops/instruments/altair/?q-node/10121*, but a few points are emphasized here. Target elevations must be >40 degrees and proposers must request good weather conditions (Cloud Cover = 50%, or better, and Image Quality = 70%, or better, in the parlance of Gemini observing conditions). Proposals should specify "Laser guide star" in the Resources section of the Observing Proposal. Because of the need for good weather, LGS programs must be ranked in Bands 1 or 2 to be scheduled on the telescope.
- Time trades will allow community access to:
  Subaru: 4–8 nights (all instruments offered).

Gemini South:

- T-ReCS: Thermal-Region Camera Spectrograph mid-infrared (2–26 μm) imager and spectrograph.
- GMOS-South: Gemini Multi-Object Spectrograph and imager. Science modes are MOS, long-slit spectroscopy, IFU spectroscopy and imaging. Nod-and-Shuffle mode is also available.
- NICI: Near-Infrared Coronagraphic Imager. NICI is available for general user proposals, although its use is restricted to good seeing conditions.
- FLAMINGOS-2 is being refurbished at the La Serena base facility prior to being taken back to the telescope to finish its commissioning and is not expected to be available for general scientific use in 2012A.
- All modes for GMOS-South, T-ReCS, and NICI are offered for both queue and classical observing. **As with Gemini North, classical runs are now offered to programs with a length of at least one or more integer nights.**

Detailed information on all of the above instruments and their respective capabilities is available at *www.gemini.edu/sciops/instruments/instrumentIndex.html*.

We remind the US community that Gemini proposals can be submitted jointly with collaborators from other Gemini partners. An observing team requests time from each relevant partner. All multi-partner proposals must be submitted using the Gemini Phase I Tool (PIT).

Note that queue proposers have the option to fill in a so-called "Band 3" box, in which they can reconfigure their program execution if it is scheduled on the telescope in Band 3. Historically, it has been found that somewhat smaller than average queue programs have a higher probability of completion if they are in Band 3, as well as if they use weather conditions whose occurrences are more probable. Users might want to think about this option when they are preparing their proposals.

Efficient operation of the Gemini queue requires that it be populated with programs that can effectively use the full range of observing conditions. Gemini proposers and users have become increasingly experienced at specifying the conditions required to carry out their observations using the on-line Gemini Integration Time Calculators for each instrument. NSSC reminds you that a program has a higher probability of being awarded time and of being executed if ideal observing conditions are not requested. **The two conditions that are in greatest demand are excellent image quality and no cloud cover. We understand the natural high demand for these excellent conditions, but wish to remind proposers that programs that make use of less than ideal conditions are also needed for the queue.**

NOAO accepts Gemini proposals via either the standard NOAO Web proposal form or the Gemini PIT software. For additional instructions and guidelines, please see *www.noao.edu/noaoprop/help/pit.html*.

TSIP Open-Access Time on MMT

As a result of awards made through the National Science Foundation (NSF) Telescope System Instrumentation Program (TSIP), telescope time is available to the general astronomical community at the following facility in 2012A:

- ***MMT Observatory***
  Up to 12 nights (6 bright) of classically-scheduled observing time are expected to be available with the 6.5-m telescope of the MMT Observatory. We have a total of 28 nights on MMT, which we expect to take at up to ~10–12 nights per semester in 2012. Bright time requests (more than 10 days from new moon) are particularly encouraged and should have a higher probability of being scheduled. MMT is using the TSIP funds to finish development of the Binospec optical multi-object spectrograph. For further information, see *www.noao.edu/gateway/mmt/*.

ReSTAR Observing Time on the Hale Telescope

Funding for the Renewing Small Telescopes for Astronomical Research (ReSTAR) proposal was provided by the NSF for FY10, and one part of this award was used to procure 23 nights per year, over three years, on the 200-in Hale Telescope at Palomar. The 2012A allocation is as follows:

- ***Hale Telescope***
  Ten nights of classically-scheduled observing time will be available with the 200-in Hale Telescope at Palomar Observatory. For more information, see *www.noao.edu/gateway/hale/*.

Lists of instruments that we expect to be available in 2012A can be found following this article. As always, investigators are encouraged to check the NOAO Web site for any last-minute changes before starting a proposal.

If you have any questions about proposing for US observing time, feel free to contact us:
kolsen@noao.edu, *dbell@noao.edu*, or *vsmith@noao.edu*.

CTIO Instruments Available for 2012A

Spectroscopy	Detector	Resolution	Slit
CTIO BLANCO 4-m [1]			
Hydra + Fiber Spectrograph	SITe 2K×4K CCD, 3300–11,000Å	700–18,000, 45,000	138 fibers, 2" aperture
SOAR 4.1-m			
OSIRIS IR Imaging Spectrograph [2]	HgCdTe 1K×1K, JHK windows	1200, 1200, 3000	3.2', 0.5', 1.2'
Goodman Spectrograph [3]	Fairchild 4K×4K CCD, 3100–8500Å	1400, 2800, 6000	5.0'
CTIO/SMARTS 1.5-m [4]			
Cass Spectrograph	Loral 1200×800 CCD, 3100–11,000Å	<1300	7.7'
CHIRON	e2v CCD 4K×4K, 420–870 nm	80,000 (with image slicer)	2.7" fiber

Imaging	Detector	Scale ("/pixel)	Field
CTIO BLANCO 4-m [1]			
ISPI IR Imager	HgCdTe (2K×2K 1.0–2.4μm)	0.3	10.25'
SOAR 4.1-m			
SOAR Optical Imager (SOI)	e2v 4K×4K Mosaic	0.08	5.25'
OSIRIS IR Imaging Spectrograph	HgCdTe 1K×1K	0.33, 0.14	3.2', 1.3'
Spartan IR Imager [5]	HgCdTe (mosaic 4-2K×2K)	0.068, 0.041	5.2', 3.1'
Goodman Spectrograph [3]	Fairchild 4K×4K CCD	0.15	7.2' diameter
CTIO/SMARTS 1.3-m [6]			
ANDICAM Optical/IR Camera	Fairchild 2K×2K CCD	0.17	5.8'
	HgCdTe 1K×1K IR	0.11	2.0'
CTIO/SMARTS 1.0-m [7,8]			
Direct Imaging	Fairchild 4K×4K CCD	0.29	20'
CTIO/SMARTS 0.9-m [7,9]			
Direct Imaging	SITe 2K×2K CCD	0.4	13.6'

[1] In 2012A, the Blanco 4-m telescope will be available to users for a limited amount of time only. Please see the article by Chris Smith, "Update on DECam Installation & Blanco 4-m Availability: Blanco Shutdown in 2012A" in this section of the *Newsletter*.

[2] The spectral resolutions and slit lengths for the OSIRIS imaging spectrograph correspond to its low-resolution, cross-dispersed, and high-resolution modes, respectively. In the cross-dispersed mode, one is able to obtain low-resolution spectra at JHK simultaneously.

[3] The Goodman Spectrograph is available in single-slit mode. Imaging mode is also available, but only with U, B, V, and R filters.

[4] Service observing only.

[5] Spartan is available in the low resolution mode. The high resolution mode is commissioned, but has seen very little use. Spartan should be preferred to OSIRIS for most **imaging** applications.

[6] Service observing only. Proposers who need the optical only will be considered for the 1.0-m unless they request otherwise. Note that data from both ANDICAM imagers is binned 2×2.

[7] In 2012A, observing time and services at the 0.9- and 1.0-m telescopes might be reduced. For more information, please see the article by Charles Bailyn, "Availability of the CTIO 1.0- and 0.9-m Telescopes in 2012A."

[8] Classical observing only. Observers may be asked to execute up to 1 hr per night of monitoring projects that have been transferred to this telescope from the 1.3-m. In this case, there will be a corresponding increase in the scheduled time. No specialty filters, no region of interest.

[9] Classical or service, alternating 7-night runs. If proposing for classical observing, requests for 7 nights are strongly preferred.

Gemini Instruments Available for 2012A*

GEMINI NORTH	Detector	Spectral Range	Scale ("/pixel)	Field
NIRI	1024×1024 Aladdin Array	1–5µm R~500–1600	0.022, 0.050, 0.116	22.5", 51", 119"
NIRI + Altair (AO- Natural or Laser)	1024×1024 Aladdin Array	1–2.5µm + L Band R~500–1600	0.022	22.5"
GMOS-N	3×2048×4608 CCDs	0.36–1.0µm R~670–4400	0.072	5.5' 5" IFU
Michelle	320×240 Si:As IBC	8–26µm R~100–30,000	0.10 img, 0.20 spec	32"×24" 43" slit length
NIFS	2048×2048 HAWAII-2RG	1–2.5µm R~5000	0.04×0.10	3"×3"
NIFS + Altair (AO- Natural or Laser)	2048×2048 HAWAII-2RG	1–2.5µm R~5000	0.04×0.10	3"×3"
GNIRS	1024×1024 Aladdin Array	0.9–2.5µm R~1700, 5000, 18,000	0.05, 0.15	50", 100" slit (long) 5"–7" slit (cross-d)

GEMINI SOUTH	Detector	Spectral Range	Scale ("/pixel)	Field
GMOS-S	3×2048×4608 CCDs	0.36–1.0µm R~670–4400	0.072	5.5' 5" IFU
T-ReCS	320×240 Si:As IBC	8–26µm R~100, 1000	0.09	28"×21"
NICI	1024×1024 (2 det.) Aladdin III InSb	0.9–5.5µm Narrowband Filters	0.018	18.4"×18.4"

EXCHANGE	Detector	Spectral Range	Scale ("/pixel)	Field
MOIRCS (Subaru)	2×2048×2048 HAWAII-2	0.9–2.5µm R~500–3000	0.117	4'×7'
Suprime-Cam (Subaru)	10×2048×4096 CCDs	0.36–1.0µm	0.2	34'×27'
HDS (Subaru)	2×2048×4096 CCDs	0.3–1.0µm R<90,000	0.138	60" slit
FOCAS (Subaru)	2×2048×4096 CCDs	0.33–1.0µm R~250–7500	0.104	6' (circular)
COMICS (Subaru)	6×320×240 Si:As	8–25µm R~250, 2500, 8500	0.13	42"×32"
IRCS (Subaru)	1024×1024 InSb	1–5µm R~100–20,000	0.02, 0.05	21"×21", 54"×54"
IRCS+AO188 (Subaru)	1024×1024 InSb	1–5µm R~100–20,000	0.01, 0.02, 0.05	12"×12", 21"×21", 54"×54"

* Availability is subject to change. Check the NOAO and Gemini Calls for Proposals and/or the Gemini Web pages for up-to-date information.

KPNO Instruments Available for 2012A

Spectroscopy	Detector	Resolution	Slit Length	Multi-object
Mayall 4-m				
R-C CCD Spectrograph [1]	T2KA/LB1A CCD	300–5000	5.4'	single/multi
MARS Spectrograph	LB CCD (1980×800)	300–1500	5.4'	single/multi
KOSMOS [2]	e2v CCD	2400	up to 10'	single/multi
Echelle Spectrograph [1]	T2KA CCD	18,000–65,000	2.0'	
FLAMINGOS [3]	HgCdTe (2048×2048, 0.9–2.5mm)	1000–1900	10.3'	single/multi
WIYN 3.5-m [4]				
Hydra + Bench Spectrograph [5]	STA1 CCD	700–22,000	NA	~85 fibers
SparsePak [6]	STA1 CCD	400–13,000	IFU	~82 fibers
2.1-m				
GoldCam CCD Spectrograph	F3KA CCD	300–4500	5.2'	
FLAMINGOS [3]	HgCdTe (2048×2048, 0.9–2.5mm)	1000–1900	20.0'	
Imaging	**Detector**	**Spectral Range**	**Scale ("/pixel)**	**Field**
Mayall 4-m				
CCD MOSAIC 1.1	8K×8K	3500–9700Å	0.26	35.4'
NEWFIRM [7]	InSb (mosaic, 4, 2048×2048)	1–2.3µm	0.4	28.0'
SQIID	InSb (3-512×512 illuminated)	JHKs	0.39	3.3'
FLAMINGOS [3]	HgCdTe (2048×2048)	JHKs	0.32	10.3'
WIYN 3.5-m [4]				
Mini-Mosaic [8]	4K×4K CCD	3300–9700Å	0.14	9.3'
WHIRC [9]	VIRGO HgCdTe (2048×2048)	0.9–2.5µm	0.10	3.3'
2.1-m				
CCD Imager [10]	T2KB/STA2 CCD	3300–9700Å	0.305	10.4'
SQIID	InSb (3-512×512 illuminated)	JHKs	0.68	5.8'
FLAMINGOS [3]	HgCdTe (2048×2048)	JHKs	0.61	20.0'
WIYN 0.9-m				
CCD MOSAIC 1.1 [11]	8K×8K	3500–9700Å	0.43	59'

[1] T2KA is default CCD for RCSP and ECH. T2KB now serves as T2KA's backup. LB1A may be requested for RCSP if appropriate.

[2] Proposers should only write proposals for RCSP or MARS. But an interest in adapting the proposal to use KOSMOS may be expressed. See the KOSMOS article in this *Newsletter* for more details.

[3] FLAMINGOS Spectral Resolution given assuming 2-pixel slit. Not all slits cover full field; check instrument manual. FLAMINGOS was built by the late Richard Elston and his collaborators at the University of Florida. Dr. Anthony Gonzales is currently the PI of the instrument.

[4] Owing to a delay in the One Degree Imager (ODI), we expect 2012A to be a normal semester with the instrument complement as listed in the table. Repairs to the WIYN dome, which suffered damage during a winter storm in January 2010, may necessitate closing the facility for some nights in the 2012A semester. For current information regarding the status of the WIYN telescope and instruments, see *www.wiyn.org/observe/status.html.*

[5] One-degree field with two fiber bundles of ~85 fibers each. "Blue" (3") and "Red" (2") fibers.

[6] Integral Field Unit, 80"×80" field, 5" fibers, graduated spacing.

[7] NEWFIRM will be recommissioned in February 2012. Permanently installed filters include J, H, and Ks. See *www.noao.edu/ets/newfirm* for further information, filter availability, and policy on filter changes.

[8] Plans are underway to upgrade MiniMo. This upgrade will include new detectors, electronics, and operating system. Please see *www.wiyn.org/observe/status.html* prior to submitting your proposal to check on the status of the upgrade plan.

[9] WHIRC was built by Dr. Margaret Meixner (STScI) and collaborators. Proposals requiring use with WTTM should explicitly state this; new users of WTTM are advised to consult KPNO support staff for details.

[10] T2KB is the default CCD for CFIM. STA2, with MONSOON controller, is available on request, following laboratory development and some commissioning during 2011A. Its main advantages are better DQE than T2KB, especially in U and B, and faster readout. The field is somewhat smaller; 10.2'(RA) × 6.6'(DEC), pixel scale is same as for T2KB. Potential users should contact KPNO support staff for details.

[11] Availability at WIYN 0.9-m is strongly dependent on Mayall 4-m scheduled use.

MMT Instruments Available for 2012A

	Detector	Resolution	Spectral Range	Scale ("/pixel)	Field
BCHAN (spec, blue-channel)	Loral 3072×1024	R~800–11,000	0.32–0.8µm	0.3	150" slit
RCHAN (spec, red-channel)	Loral 1200×800	R~300–4000	0.5–1.0µm	0.3	150" slit
MIRAC-BLINC (mid-IR img, PI inst)	256×256 DRS MF/HF		2–25µm	0.054–0.10	13.8"–25.6"
Hectospec (300-fiber MOS, PI)	2 2048×4608	R~1000–2500	0.37–0.92µm		60', 1.5"×300
Hectochelle (240-fiber MOS, PI)	2 2048×4608	R~34,000	0.38–0.9µm		60', 1.5"×240
SPOL (img/spec polarimeter, PI)	Loral 1200×800	R~300–2000	0.38–0.9µm	0.19	19"
ARIES (near-IR imager, PI)	1024×1024 HgCdTe	R~3000–60,000	1.1–2.5µm	0.02–0.10	20"–100"
SWIRC (wide n-IR imager, PI)	2048×2048 HAWAII-2		0.9–1.8µm	0.15	5'
CLIO (thermal-IR AI camera, PI)	512×1024 HAWAII-1		3–5µm	0.03	15"×30"
MAESTRO (optical echelle, PI)	4096×4096	R~28,000–93,000	0.32–1.0µm	0.15	
PISCES (wide n-IR imager, PI)	1024×1024 HgCdTe		1–2.5µm	0.026–0.185	0.5'–3.2'
MMTPol (AO n-IR polarimeter, PI)	1024×1024 HgCdTe		1–5µm	0.043	25"

Hale Instruments Available for 2012A

	Detector	Resolution	Spectral Range	Scale ("/pixel)	Field
Double Spectrograph/Polarimeter	1024×1024 red, 2048×4096 blue	R~1000–10,000	0.3–1.0µm	0.4–0.6	128" long, 8"×15" multi
TripleSpec	1024×2048	R~2500–2700	1.0–2.4µm	0.37	30" slit

CHARA Instruments Available for 2012

	Beam Combiner	Resolution	Spectral Range	Beams
The CHARA Array consists of six 1-m aperture telescopes with baselines from 30 to 330 meters.	Classic, Climb	Broadband	H or K	2 or 3
	MIRC	40	H or K	6
	VEGA	6000/30,000	45nm in 480–850nm	2 or 3

Changes Made to the ORP

The KPNO Observing Run Preparation (ORP) form has been redesigned to better suit the needs of our observers and support staff. Check it out at *www.noao.edu/kpno/forms/orp-form/noao-orp.html* the next time you need to submit an ORP!

Participating in the SMARTS Consortium

Charles Bailyn & Todd Henry

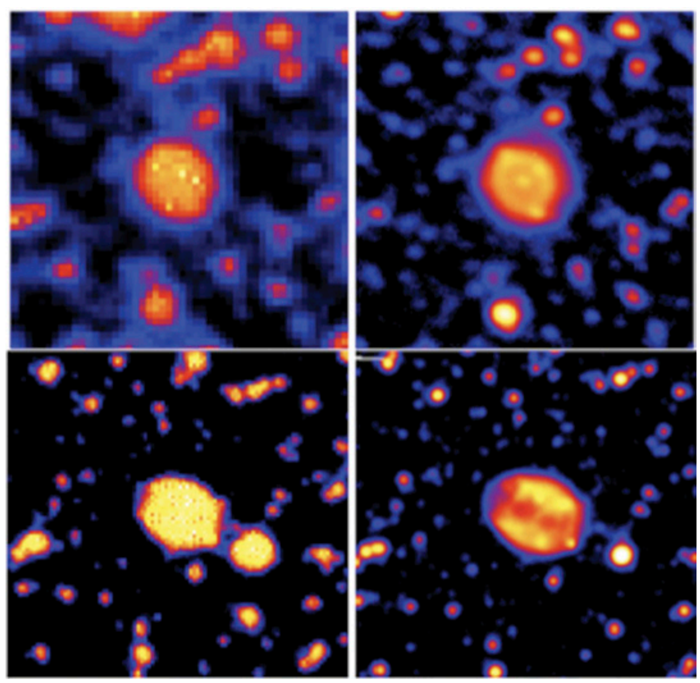
The Small and Moderate Aperture Research Telescope System (SMARTS) Consortium would like to remind all NOAO users that they or their institutions can join SMARTS at a variety of levels. Possible membership can be acquired for single use observing runs that span a few days or weeks, or distributed observing over one or more semesters for time-domain science. Guaranteed time on the CTIO 1.5-, 1.3-, 0.9- or Yale 1.0-m telescopes can be purchased by individual members for as little as a few thousand dollars, up to major partners contributing $50K to $100K per year or more. Capabilities of the SMARTS telescopes include imaging at optical and infrared wavelengths and low- and high-resolution spectroscopic observations. Astronomers may opt for user time for which they travel to the telescope, or service observations done by SMARTS staff for which observing cadences are highly flexible. Partnerships can be with institutions, with individuals, or with groups of individuals. We also welcome international partners. SMARTS is particularly useful for graduate and undergraduate training and observing experience. Please see *www.astro.yale.edu/smarts*, or contact Charles Bailyn at *charles.bailyn@yale.edu* or Todd Henry at *thenry@chara.gsu.edu* for details about how to become a SMARTS member.

After Twelve Years of Mosaic II…

Andrea Kunder

The NOAO community bids farewell to the soon-to-be decommissioned Mosaic II optical imager of the Cerro Tololo Inter-American Blanco 4-m Telescope. After twelve years of outstanding performance, this optical, wide-field imager with its 36 × 36 arcmin field of view and 0.27-arcsec pixels will be retired in late 2011. The Mosaic II imager saw first light in July 1999 and replaced the Big Throughput Camera (BTC) previously used on the Blanco 4-m telescope. The decommissioning of the Mosaic II imager is due to the construction of the next generation of wide-field imagers, the Dark Energy Camera (DECam), which will take over the throne at the Blanco prime focus.

"Having been involved at the beginning of the mosaic project, helping deploy first Mosaic I, and later Mosaic II, it is very rewarding to see how successful and productive the two instruments have been," says SOAR Director Steve Heathcote about his experience with Mosaic II. He added, "In some semesters, more than 50% of the allocated time went to Mosaic II, its users going away with gigabytes of data." Mosaic II has been especially valuable to the astronomy community due to the large number of optical filters that are available for use (~25), the large number of photometric nights for imaging (~220 per year) and its wide field of view. The accompanying image shows the greatly improved image quality that is easily achieved with Mosaic II. "Not only have we seen important advances in astrophysics as a result of programs that have taken advantage of Mosaic II," states Alistair Walker, also one of the first Mosaic II instrument scientists, "but our work with Mosaic II has paved the way for state-of-the-art, wide-field cameras, such as DECam."



PPA1800-2904 (top) and H2-36 (bottom). Compare the photographic SHS image on the left (taken in Hα) with the higher resolution Mosaic II image on the right (taken in [O III] λ5007). Note the improved ability to discern the bipolar core in H2-36 and the shell structure revealed around the central star of compact MASH PN PPA1800-2904. (Image credit: Anna Kovacevic.)

Mosaic II will continue to live on, not only in our hearts, but also through the NOAO Science Archive (*www.noao.edu/sdm/archives.php*), which hosts much of the data that has been taken over the years, pipeline-reduced, and available to download for free. A full description of Mosaic II can be found on the Mosaic II Web pages, *www.ctio.noao.edu/mosaic*.

continued

After Twelve Years of Mosaic II continued

```
End of Run Report: .Blanco 4-m.MosaicII
-----------------------------------------------------------------
Telescope:                                  Blanco 4-m
Instrument:                                 Mosaic II

Date, beginning of first night of run: 1999 B
Date, beginning of last night of run:  2011B

General disposition of run:
Total Nights:                               1694.5
Unique Runs:                                489
Unique Programs:                            355
Time lost to technical problems:            just a little
Portion of goals achieved:                  more than ever expected
----
Comments, recommendations, suggestions:
Only a camera with a wider field of view, faster read out time and fewer arcon crashes would improve on
Mosaic II.
----
```

While there are too many interesting results to list in this article, the following ones are some of the highlights.

"Astrometric and Photometric Follow-up of Newly Discovered Small NEOs"

J. Masiero, A. Mainzer, J. Bauer, T. Grav, J. Larsen, R. McMillan & E.L. Wright

The Wide-field Infrared Survey Explorer (WISE), in the course of conducting an all-sky four-color mid-infrared survey, became the leading observer of small Solar system objects in the year 2010. While many of these objects were previously known, newly discovered objects, especially those asteroids that pass close to the Earth known as near-Earth Objects (NEOs), required prompt astrometric follow-up to enable precise calculation of their orbital elements. The unique combination of wide field-of-view, large aperture, and location in the Southern Hemisphere offered by CTIO with Mosaic-II provided a critical component to our follow-up program of the smallest, darkest and most unusual NEOs observed by WISE/NEOWISE. Photometric observations of these objects further enabled us to determine albedos and preliminary spectral classifications for these newly discovered objects. This project, combined with WISE and data from a suite of other follow-up observatories, has allowed us to measure with the highest precision to date the number of asteroids passing close to the Earth and thus the hazard they pose. Simultaneously, physical characterization has provided an avenue to understand the origin of the NEOs and the orbital evolution of the Solar system as a whole.

"A New [O III] Galactic Bulge Planetary Nebulae Luminosity Function"

Anna V. Kovacevic, Quentin A. Parker, George H. Jacoby, Rob Sharp, Brent Miszalski & David J. Frew

The Planetary Nebulae Luminosity Function (PNLF) distance technique is an important standard candle for observational cosmology and has already provided accurate distances to 62 galaxies as near as the Magellanic Clouds and as far away as the Coma cluster (>100Mpc). We have successfully used the Mosaic-II camera on the CTIO 4-m Blanco telescope in July 2008 and June 2009 to obtain narrowband [O III] photometry of 435 Planetary Nebulae in the Galactic bulge to perform detailed studies with which to construct a new PNLF. This is the largest (~60 square degrees), uniform [O III] survey of the inner Galactic bulge ever undertaken and provides observations for ~80% of known PN in this region. Three hundred and eighty-three of these PN were being observed in [O III] for the first time, so these observations have provided a significant advance for PN studies in the Galactic bulge. The excellent resolution of our data allows for not only a robust set of homogeneous fluxes and angular diameters, but greater details into their intricate, otherwise undetermined PN morphologies.

"The Monitor Project: Rotation Periods and Occultations of Young Low-Mass Stars with Mosaic-II"

Suzanne Aigrain, Jonathan Irwin, Simon Hodgkin, Estelle Moraux, Jerome Bouvier, Leslie Hebb, Adam Miller, Jayne Birkby & Aleks Scholtz

We used Mosaic-II between 2005 and 2007 to obtain time-series photometry of three young open clusters: NGC2362, NGC2516, and M50 as part of the Monitor project (Aigrain et al. 2007; Irwin et al. 2007a). Candidate cluster members were selected from color-magnitude diagrams, constructed using deep Mosaic I- and V-band images, and their I-band light curves were searched for sinusoidal modulation (indicative of rotational modulation of star-spots), eclipses, and transits. The rotation period results provided very valuable constraints on the angular momentum evolution of low-mass stars from the TTauri stage to the early main-sequence (Irwin & Bouvier 2009, Irwin et al. 2007b, 2008, 2009). We were also able to identify several dozen candidate eclipsing binaries and planetary transits, most of which were followed up using FLAMES/GIRAFFE on the VLT. (Miller et al. 2008; Birkby et al. 2009). Analysis of additional Mosaic-II observations of NGC 2547, obtained in 2009 to extend the rotation period coverage to very low mass stars, is also ongoing.

References

Aigrain, S. et al. 2007, MNRAS, 375, 29
Irwin, J. et al. 2007a, MNRAS, 375, 1449
Irwin, J. et al. 2007b, MNRAS, 377, 741
Irwin, J. et al. 2008, MNRAS, 384, 675
Miller, A.A. et al. 2008, MNRAS, 387, 349
Irwin, J. et al. 2009, MNRAS, 392, 1456
Birkby, J.L. et al. 2009, AIPC, 1094, 832
Irwin, J. & Bouvier, J. 2009, IAUS, 258, 363

Students Needed for the 2012 REU Program at Kitt Peak

Ken Mighell

Each summer, a group of talented college students come to Tucson to participate in astronomical research at Kitt Peak National Observatory (KPNO) under the sponsorship of the National Science Foundation (NSF) Research Experiences for Undergraduates (REU) Program. Like the parallel program at Cerro Tololo (see accompanying article, "Students Wanted for 2012 CTIO REU Program"), the KPNO REU program provides an exceptional opportunity for undergraduates considering a career in science to engage in substantive research activities with scientists working at the forefront of contemporary astrophysics.

Each REU student is hired as a full-time research assistant to work with one or more NOAO staff members on specific aspects of major, on-going research projects at NOAO. These undergraduates gain observational experience with KPNO telescopes and develop expertise in astronomical data reduction and analysis as part of their research activities. They also take part in a weekly lecture series and a five-day field trip to New Mexico to visit National Solar Observatory (NSO) at Sacramento Peak and the Very Large Array in Socorro.

At the end of the summer, the students share their results with the Tucson astronomical community in oral presentations. As part of their internship experience, all six of our 2011 REU participants will present posters describing their astronomical research projects at the January 2012 American Astronomical Society meeting in Austin, Texas.

We will have six REU positions during the summer of 2012. Student participants must be citizens or permanent residents of the United States to meet NSF requirements.

The KPNO REU positions are full-time for 10–12 weeks between June and September, with a preferred starting date of early June. The salary is $700 per week, with additional funds provided to cover travel to and from Tucson. Further information about the KPNO REU 2012 program, including the online application form, can be found at *www.noao.edu/kpno/reu* this October. Completed applications (including official transcripts and at least two letters of recommendation) must be submitted to KPNO no later than Friday, 27 January 2012.

KPNO REU students, NSO REU students, NSO Akima students, and an NSO RET teacher visiting KPNO on 3 June 2011. (Left to right): Nick Jimenez (KPNO REU), Jennifer Takaki (NSO Akami), Brittany Johnstone (NSO REU), Morgan Rehnberg (KPNO REU), James Linden (NSO Akami), Philip Adams (NSO REU), Vivienne Baldassare (KPNO REU), Joanna Taylor (KPNO REU), Christine Welling (KPNO REU), Alisa Fersch (KPNO REU), and Catherine Love (NSO RET). (Image credit: Ken Mighell, NOAO/AURA NSF.)

Students Wanted for 2012 CTIO REU Program

Katie Kaleida & Nicole van der Bliek

The Cerro Tololo Inter-American Observatory (CTIO) offers six Undergraduate Research Assistantships in La Serena, Chile, during the Chilean summer (northern winter semester) through the NSF-funded Research Experiences for Undergraduates (REU) program. The CTIO REU program provides an exceptional opportunity for undergraduates considering a career in science to engage in substantive research activities with scientists working at the forefront of contemporary astrophysics. Student participants will work on specific research projects in close collaboration with members of the CTIO scientific and technical staff, such as galaxy clusters, gravitational lensing, supernovae, planetary nebulae, stellar populations, star formation, variable stars, and interstellar medium. The CTIO REU program emphasizes observational techniques and provides opportunities for direct observational experience using CTIO's state of the art telescopes and instrumentation.

Participants must be enrolled as full-time undergraduate students during the REU program, and must be citizens or permanent residents of the United States.

The program will run for 10 weeks in 2012, from approximately January 15 to March 24. A

continued

one-week observing run on Cerro Tololo and a field trip to another observatory in Chile are included in the program, and a modest stipend and subsidized housing are provided. In addition, the students usually attend the American Astronomical Society (AAS) winter meeting the year following their REU program, in this case, the January 2013 AAS meeting in Long Beach, California.

Complete applications, including applicant information, official transcripts, and two or three letters of recommendation should be submitted no later than 1 October 2011. For more information (and an application) please check: *www.ctio.noao.edu/REU/reu.html*. Women and candidates from underrepresented minorities are particularly encouraged to apply.

Mayall Standing Strong after Winter Ice Damage

John Dunlop

This past winter we had record low temperatures that impacted the 4-m Mayall telescope. On February 5, following several nights of record freezes that sent temperatures plummeting to a low of approximately −15° C, a very large crack appeared on one of the main support columns of the Mayall 4-m support structure (see Figure 1). Staff immediately evacuated the building and shut down telescope operations to protect personnel and minimize the potential for future damage from dome rotation. KPNO engineering staff began their investigation by utilizing a thermal imaging camera and discovered columns of ice inside four of the sealed primary column supports, including the one that was cracked (see Figure 2). How water got into those four sealed columns but not in the 16 other identical ones is a mystery.

The structural engineering firm M3 was immediately brought in to help determine the general stability of the Mayall structure, while staff began efforts to identify the extent of the cracking. Following the advice of both KPNO staff and M3 engineers, weep holes were drilled into the columns containing ice, and warming measures were put in place to thaw the ice and drain the water to reduce the potential for more cracks. With these preliminary efforts done, M3 proceeded to develop a structural model of the building to determine the impact of the damaged member and the stability of the structure under various loading conditions. They determined that the building should be safe in winds up to 90 mph, even if the cracked column were entirely removed. Their analysis also indicated that, as the wind loads increased, the redistribution of loading would begin to induce member stresses above the code-mandated limits.

Figure1: Cracked column on Mayall 4-m telescope. (Image credit: Kitt Peak Facilities, NOAO/AURA/NSF.)

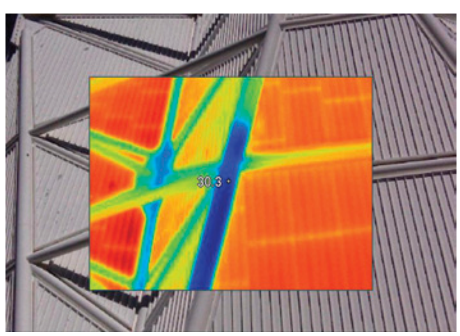


Figure 2: Thermal picture of the ice plug in cracked column. (Image credit: W. Goble, NOAO/AURA/NSF.)

Figure 3: Repair of Mayall 4-m telescope column with strongbacks. (Image Credit: Kitt Peak Facilities, NOAO/AURA/NSF.)

While M3 was developing the engineering evaluation, KPNO staff initiated efforts to do a detailed inspection of the crack in the one-inch thick steel column. This inspection showed the crack to be more extensive and that it also intruded into the inside of the building where it was covered with asbestos fireproofing. Determining the full extent of the crack required a time-consuming effort to ensure proper removal of the asbestos to mitigate the hazard.

continued

Mayall Standing Strong continued

As the full extent of the crack was revealed, M3 began to develop the repair requirements, and KPNO staff initiated efforts to work with the various contractors. The plans included proper removal of the hazardous lead primer on the column surfaces to allow for welding efforts followed by installation of a full-length repair sleeve along the column over the repaired crack. This work required the removal of a portion of the siding and some of the supporting steel members that were attached to the columns. While the initial engineering analysis indicated there was no imminent structural risk to the building, telescope operations were suspended because of the dome-motion-induced stresses that could potentially widen or extend the cracks.

The first step in the repair process was to stabilize the crack by attaching "strong-backs" to the column, essentially, band-aid like strips welded across the cracks to strengthen the area during the repair efforts (see Figure 3).

These efforts allowed the telescope to return to service on March 9, while the more extensive repairs continued over the following months with general completion by mid-May. M3 engineers, KPNO staff, and the associated contractors worked closely together to ensure a prompt response and completion of repair efforts (see Figure 4). M3 has submitted a final report, and KPNO staff will be implementing several of their recommendations over the coming months.

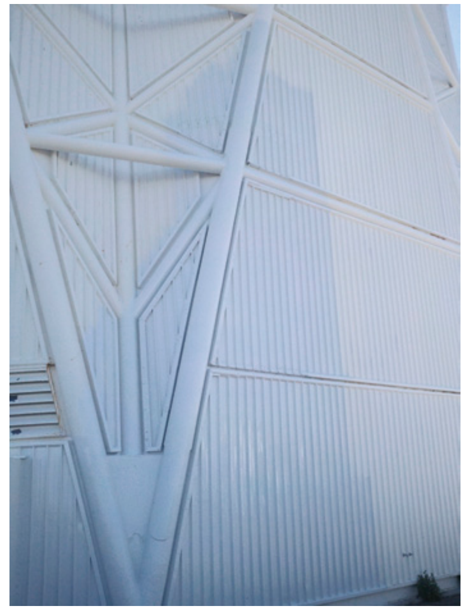


Figure 4: Finished repairs of cracked column on Mayall 4-m telescope. (Image Credit: Kitt Peak Facilities, NOAO/AURA/NSF.)

American Recovery and Reinvestment Act, an NOAO Update

Bob Blum

The 2006 NSF Senior Review recommended that NOAO telescopes and infrastructure be renewed because these facilities play a significant role in the open-access system for ground-based optical/infrared (O/IR) astronomy and are scientifically productive. Following that report, NOAO embarked on several programs that are bearing fruit today. To renew capabilities "inside the dome," NOAO organized the Renewing Small Telescopes for Astronomical Research (see March 2008 *NOAO/NSO Newsletter*) program, which now is delivering new instruments to NOAO 4-m focal planes (see *www.noao.edu/system/restar/*).

Additionally, in 2009, NOAO submitted a proposal to the NSF seeking funds through the American Reinvestment and Recovery Act of 2009 (ARRA) to address a large range of critical infrastructure renewal needs at KPNO and CTIO. These needs go well beyond focal planes and touch on all aspects of the operations at NOAO that ultimately affect NOAO's ability to provide forefront research capabilities to the entire US community. NOAO's ARRA proposal was generously funded by the NSF at $5.5M. A nominal three-year plan was initiated in four locations: Cerro Tololo, La Serena, Kitt Peak, and Tucson. We are happy to present an update on these activities after two years of work.

Cerro Tololo and Cerro Pachón

A host of projects have been begun and completed on these mountaintops in Chile. The Cerro Tololo 4-m telescope has seen renovation and enhancement in observing support areas including uninterruptible power supply systems, a modernized control room (see Figure 1), a modernized computer room (to support the Dark Energy Camera, DECam; see Figure 2), instrument handling facilities for the NEWFIRM wide-field infrared imager and DECam support, a new backup generator (see Figure 3) and critical repair of the main power frequency converter, and a new entrance way to the Blanco telescope (see Figure 4) to guard against falling ice/snow. Major renovations to the dorms on Tololo also have been done with roof repairs completed (see Figure 5) and an interior renewal coming.

At Cerro Pachón, we have installed a new emergency generator (see Figure 6) to supply electricity to the dorms in case of power outages (this supports Gemini and SOAR and eventually LSST as well). A major addition has been provided to the Pachón dorms in the form of a kitchen and dining facility (see Figure 7), again serving all AURA centers on Pachón.

continued

ARRA, an NOAO Update continued

Figure 1: Before (left) and after (right) view of the updated console (observing) room at the Blanco telescope. The modern room provides a comfortable and efficient space for observers. (Image credit: NOAO/AURA/NSF.)

Figure 2. Old (left) and new (right) computer room at the Blanco telescope. The upgrade provides a modern, efficient space for DECam computing resources as well as the rest of the Blanco and instrument computers. (Image credits: Enrique Figueroa, NOAO/AURA/NSF.)

Figure 3: New backup generator for Cerro Tololo installed near the summit. (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

Figure 4: Left: View of the new Blanco 4-m telescope entrance. The vestibule provides safety from falling ice/snow, which can accumulate on the side and top of the dome in winter. It also makes for a more energy efficient doorway. Right: The new 4-m cooling system chiller installed below the summit. (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

Figure 5: Main dorm and dining facility on Cerro Tololo with the roof before (left) and after (right) repairs. (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

continued

ARRA, an NOAO Update continued

Figure 6: New building (left) to house the new Cerro Pachón emergency generator (right). (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

Figure 7: Construction begins (left) on the new dining facility on Cerro Pachón just below the existing dorms. Snow (right) has slowed the project this winter, but only for a month or two. (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

La Serena

By design, the NOAO stimulus package was meant to support roughly 75% mountaintop renovation and 25% base facility. In La Serena, key projects include renewing meeting rooms, lab equipment, machine shop equipment (see Figure 8), the vehicle fleet (see Figure 9), and security features around the base compound (*recinto*) (see Figure 10) among others.

Figure 8: New Computer Numerical Control (CNC) machine for the La Serena shop. (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

Figure 9: New vehicles for transport between La Serena and Cerro Tololo (buy North American! Drive South American!). (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

Figure 10: Before (left) and after (right) views of the main entrance to the La Serena base facility, which includes CTIO, SOAR, Gemini, and soon LSST buildings. The new main gate was needed because the city installed a traffic light just below, but without a signal for the observatory entrance! The recessed gate allows traffic to enter without stopping on busy Calle Cisternas. (Image credit: Enrique Figueroa, NOAO/AURA/NSF.)

continued

ARRA, an NOAO Update continued

Kitt Peak

Kitt Peak took a different approach to stimulus projects than Cerro Tololo due to differing needs. The plan includes just a few major projects instead of a larger number of moderate-sized projects. The stimulus funds will be used to develop a complete renovation of the mountain water catchment and distribution facility to repair it and bring it up to code (see Figure 11. A second major project is to build a new instrument handling facility for which designs are ready, a site has been selected, and we are awaiting a final decision from NSF to go ahead. The water system project has been estimated and put out for bid, and it is expected that work will begin soon. A modest but important third project was to purchase and install a new lift at the Kitt Peak Visitor Center (see Figure 12). The new lift provides access to the Visitor Center telescope for those who cannot use the stairs.

Figure 11: Kitt Peak pump house for the water distribution system. This facility will undergo a major renovation in FY12. The project has been developed and is out for bid to external contractors (some of whom are shown here reviewing the existing pumps, piping, and filters that will be replaced). The total project is valued at approximately $1M. (Image credit: Kate Foster, NOAO/AURA/NSF.)

Figure 12: A view of the new access lift at the Kitt Peak Visitor Center. (Image credit: Robert Blum, NOAO/AURA/NSF.)

Tucson

The main headquarters facility in Tucson has seen important upgrades and improvements to basic systems. The main computer room has been upgraded with a more extensive, dedicated system of coolers (computer room air handlers) that allow the building main system to be used more efficiently (see Figure 13). The old electrical distribution system has been replaced with a modern one (see Figures 14 and 15) that will allow for significant energy savings. A third large project will see the renewal and upgrade of the main building environmental control system. A small project involved the purchase and installation of a new CNC machine for the Tucson shop (see Figure 16).

With these changes on both mountaintops and headquarters facilities, NOAO's ability to provide forefront research capabilities to the entire US community can continue for some time to come.

Figure 13; New Tucson main computer room air handling unit. (Image credit: John Dunlop, NOAO/AURA/NSF.)

Figure 14: Old transformer at the Tucson main facility being removed (left). Installed new transformer (right), which is part of the electrical distribution system upgrade. (Image credit: Kate Foster, NOAO/AURA/NSF.)

continued

ARRA, an NOAO Update continued

Figure 15: Old (left) and new (right) electrical distribution control panel in the main Tucson building. (Image credit: Kate Foster, NOAO/AURA/NSF.)

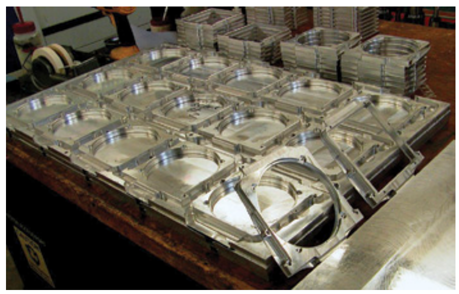


Figure 16: (left) New CNC machine installed in the Tucson shop. This machine already has seen significant use fabricating parts for the One Degree Imager (ODI) and ReSTAR Phase 1 COSMOS and KOSMOS spectrographs. (right) KOSMOS and COSMOS slit and filter wheel cells produced by the new Hurco CNC machine in the Tucson shop. (KOSMOS will be deployed in the fall of 2011 on the Mayall 4-m.) (Image credit: Roger Repp, NOAO/AURA/NSF.) NL

Astronomy Night on the National Mall

Rob Sparks

The second annual Astronomy Night on the National Mall in Washington, D.C., was held 9 July 2011. Astronomy Night was organized by Don Lubowich of Hofstra University as part of their astronomy public outreach program. Major astronomical facilities from around the country, including the National Optical Astronomy Observatory, were invited to participate. The activity took place on the National Mall between Fourth Street and Seventh Street outside the National Air and Space Museum.

NOAO hosted a booth featuring the Galileosocope. A number of Galileoscopes were set up for the public to observe the Moon, Saturn, double stars, and star clusters. The Galileoscope is a small telescope kit developed by NOAO for the International Year of Astronomy 2009 that enables people to recreate Galileo's historic observations. Several Galileoscopes were raffled off throughout the evening (over 350 people entered the drawing for the Galileosocopes).

A variety of other organizations had telescopes set up and activities for the public as well as exhibits, hands-on activities, and multimedia presentations. Solar telescopes were set up to view the Sun early in the evening. The National Air and Space Museum opened their Public Observatory as well. Over 1500 people attended the event throughout the evening.

Astronomy Night on the National Mall, 9 July 2011. (Image credit: Rob Sparks, NOAO/AURA/NSF.)

The Society of Amateur Radio Astronomers (SARA) set up a small radio telescope that observed the Sun and also had a variety of demonstrations involving radio waves. A popular demonstration let people observe radio emissions given off by their own bodies!

continued

Astronomy Night on the National Mall continued

Another highlight of the evening was K. Lynn King, an actress from the Delaware Astronomical Society, dressed as Caroline Herschel. She shared stories of observing with Caroline's brother, William Herschel, and Caroline's contributions to astronomy.

"The crowds really started to pick up after dark. At one point there were about three dozen people waiting in line to view Saturn through my telescope. Many people commented on how Saturn doesn't look 'real' or how it 'looks like a photograph' through the telescope," said Don Miro of the National Capital Astronomers. Don Miro also expressed, "This kind of 'sidewalk' public outreach reaches many families and tourists who may not make it out to the darker sites and hopefully will spark an interest in science in some of the young participants."

"Bringing Hofstra's program to the National Mall gives us a very special opportunity to encourage children to pursue their interest and science and promote public understanding of science," Lubowich said. He added further, "Gazing at the rings of Saturn or the Moon's craters and mountains captures the imagination, no matter how old you are." Lubowich plans to make this an annual occurrence and is already planning for the 2012 event.

Astronomy Night on the National Mall coincided with the Smithsonian Institution's Folklife Festival, which featured concerts on the Mall beginning at 6 pm. In addition, the US Army Band Downrange performed at 8 pm on the west front of the US Capitol.

Other organizations represented at Astronomy Night included Hofstra University, the Space Telescope Science Institute, Goddard Space Flight Center, the National Capital Astronomers, the Northern Virginia Astronomy Club, the National Science Foundation, and the National Air and Space Museum.

NEWFIRM's Stay in the South

Roberto de Propris, Ron Probst, Lori Allen & Nicole van der Bliek

After a year and a half of very intense use at the Blanco 4-m telescope, the NEWFIRM wide-field infrared imager will leave CTIO at the end of October 2011. It will return to service on KPNO in semester 2012A.

NEWFIRM arrived on Cerro Tololo on 1 April 2010 and, after five weeks of hard work by the NEWFIRM team and CTIO Telescope Operations group, the instrument was installed on the telescope on 11 May 2010. Installation was followed by a brief period of commissioning and science verification. On 26 May 2010, NEWFIRM was handed over to the first scheduled scientific users.

During the remainder of 2010A, through 2010B and 2011A, and into 2011B, NEWFIRM has been scheduled for almost half of the available nights, 240.5 in total (see table), spread over 52 observing runs serving 43 programs. Some of these programs were to complement surveys undertaken in the Northern Hemisphere, such as the photometric redshift survey led by Pieter van Dokkum (Yale University) using NEWFIRM at KPNO with a custom filter set. Inspired by discoveries from this survey, van Dokkum and his group extended this work at CTIO in a wide-field search for exceptionally massive galaxies at $z > 2$.

Another example of a large program is that by Kelson et al. to carry out a wide-area, deep, spectrophotometric survey of galaxy and structure evolution from $z = 1.5$ to the present. Kelson and his group are combining low-resolution spectroscopic data obtained with the Inamori-Magellan Areal Camera and Spectrograph at Magellan with photometric data obtained with NEWFIRM.

NEWFIRM also has been used extensively on the Blanco 4-m telescope to study star formation regions. Examples of such programs are those led by Probst (NOAO), to obtain deep H_2 images of star-forming regions in the Magellanic Clouds, and by Megeath et al. (University of Toledo) to obtain deep, near-infrared images of the Orion A Molecular Cloud.

The last scheduled observing night on the Blanco 4-m telescope for NEWFIRM is 12 October 2011. It will then be packed and shipped back to KPNO, where it should be ready for installation on the Mayall 4-m telescope at the beginning of 2012A.

NEWFIRM Usage on Blanco 4-m Telescope

2010A	36 Nights
2010B	85 Nights
2011A	77 Nights
2011B	42.5 Nights
Total Nights:	**240.5**
Unique Programs	**43**
Unique Runs	**52**

Astronomy Camps XXIV

D. W. McCarthy, Jr. (University of Arizona)

For the third year, three one-week-long Astronomy Camps were held at Kitt Peak throughout June 2011 (Figure 1). The Camps immersed students in astronomy and motivated them to continue exploring science, math, engineering, and technology. June's events engaged 76 teenagers from 25 US states, six countries, and the Tecnológico de Monterrey school. These students obtained data with the 2.3-m Bok, 0.9-m WIYN, 1.3-m Robotically Controlled Telescope (RCT), 12-m Arizona Radio Observatory (ARO) radio, 16-inch roll-off-roof, and 20-inch Visitor's Center telescopes.

Figure 1: Astronomy Camp's shirt design follows the night sky theme of the National Park System.

Campers engaged in a variety of daytime activities. Ms Silvana Ayala (University of Texas at El Paso) led a creative writing workshop. Ms Kate Follette (University of Arizona) and Hector Saldivar (California State Polytechnic University, Pomona) posed daily problems to improve critical thinking and physical intuition. Dr. Deborah Fields (University of Pennsylvania) and Mr. Jeff Regester (Greensboro Day School) led a hands-on workshop in "e-Textiles" to develop skills in building and programming circuits (Figure 2).

Figure 2: A student team programs its e-Textiles project to sequence the lighting of light-emitting diodes sewn into a shirt.

Every day we used the McMath-Pierce Solar Telescope to view sunset and to discuss atmospheric optics and solar physics (Figure 3). Campers monitored sunspots, studied "seeing" and dispersion, and observed transient phenomena.

Each night Campers first became dark-adapted during a music selection and discussion led by graduate student Matthew Whitehouse (U of A). Then they engaged in hands-on astronomy. Beginning Campers used portable observing equipment as well as the 16- and 20-inch telescopes belonging to the Kitt Peak Visitor Center. Additionally, they mapped velocities in the galaxy M82 using the ^{12}CO line with the 12-m ARO radio telescope.

Advanced Campers undertook three "Key Projects" as described in Figures 4–7. Two projects were arranged by Dr. John Moustakas (University of California, San Diego) with help from Brandon Swift (U of A) and outside astronomers. Another was led by Wayne Schlingman (U of A) with help from Ewan Douglas (Boston University). The Campers also proposed their own observations as summarized in Figures 8–10. They interacted with the Camp's staff, teamed together to research their chosen topic, and wrote observing proposals for internal review and scheduling.

Astronomy Camp is sponsored by The University of Arizona Alumni Association. Our Web site (*astronomycamp.org*) describes opportunities and highlights the accomplishments of ~2500 alumni. Ms Emily Joseph (Planetary Science Institute), Janet Howard (NASA Solar System Ambassador), Jason Fields (Aerospace Corporation), and Ann and Wyatt Schlingman greatly assisted in all phases of the Camps. We are grateful to the entire staff and management of Kitt Peak and the National Solar Observatory, especially to Nanette Bird, Mike Hawes, Dawn Clemons, Claude Plymate, Dave Murray, and all the Mayall 4-m telescope operators. Scholarship funds to support students were provided by Camp alumni and the Hess Campership of the Dudley Observatory. The RCT Consortium graciously enabled us to use their telescope.

This article makes use of data products from the Wide-field Infrared Survey Explorer, which is a joint project of the University of California, Los Angeles, and the Jet Propulsion Laboratory/California Institute of Technology, funded by NASA.

Figure 3: (above) Marina Ruelas Hernández views the Sun with protective eyewear from inside the East Auxiliary observing room of the McMath-Pierce telescope. Light from the telescope's main beam reflects from the tertiary mirror and passes over her head toward a viewing screen (right).

continued

Astronomy Camps XXIV continued

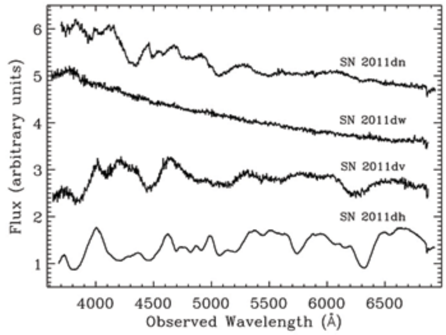


Figure 4: Key Project #1. Campers obtained spectra of new supernovae at the Bok telecope. Professor Doug Leonard (San Diego State University) then classified those spectra. Advanced Campers were the first to "type" the top three supernovae and were each acknowledged in the resulting Central Bureau Electronic Telegrams (CBET) telegrams (#2746, 2755, 2756). From top to bottom: Types Ia, II/IIb, Ia, IIb.

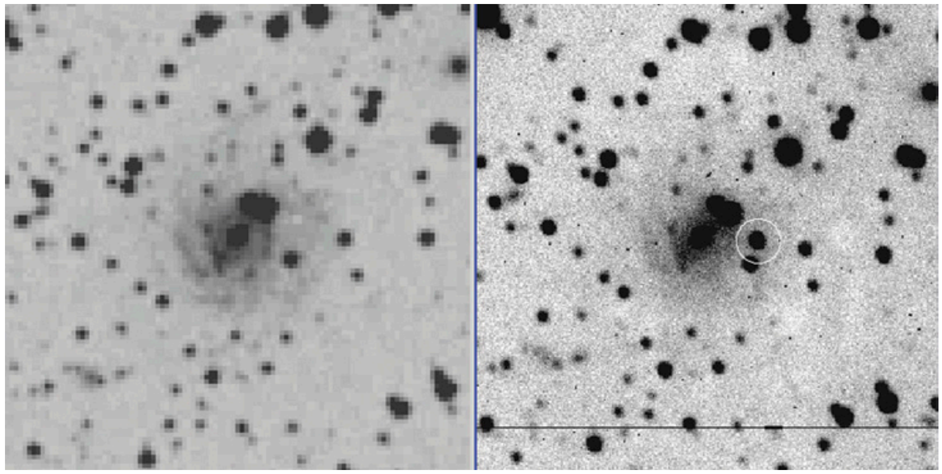


Figure 5: Key Project #1. Before and after images of SN 2011dn. (Left) Digitized Sky Survey image. (Right) V-band image from the RCT.

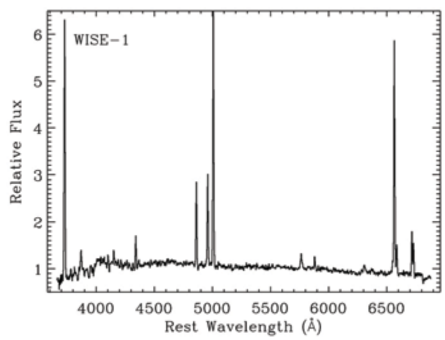


Figure 6: Key Project #2. Campers obtained spectroscopic observations of candidates for low metallicity Blue Compact Dwarf (BCD) galaxies in collaboration with scientists from the Wide-field Infrared Survey Explorer (WISE) team. BCD candidates, such as the one above, were confirmed with an ~40% success rate. The graph shows the de-redshifted spectrum with principle emission lines of [O II] λ3727; [O III] λλ4959,5007; Hβ λ4861, and Hα λ6563.

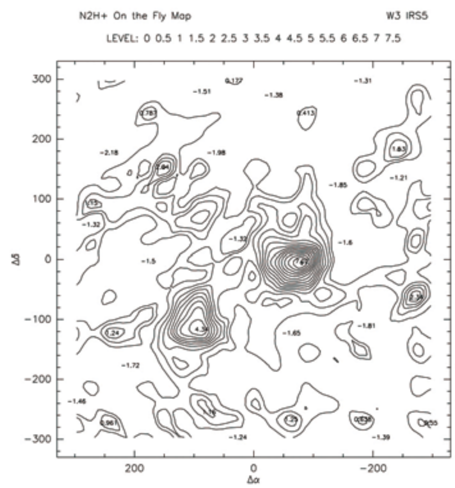


Figure 7: Key Project #3. Campers used the 12-m ARO telescope to map cold dense molecular material in the star-forming region W3 IRS5 in N_2H^+ (J = 1–0; 3.22 mm).

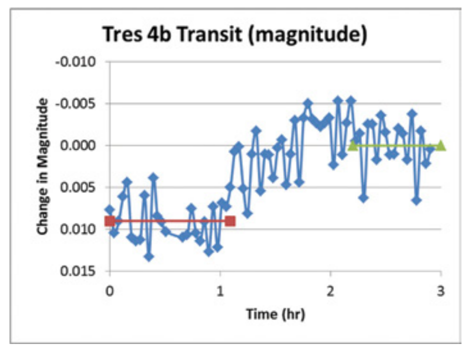


Figure 8: Ms Rayna Rampalli observed the transit of a hot-Jupiter extrasolar planet (TrES-4b), using the 20-inch Visitors Center telescope. The eclipse depth of 10 milli-mag (0.83%) indicates the planet's radius is 1.7 R_{Jup}. This radius was known to be surprisingly high, indicating a low density of 0.3 gm/cm^3.

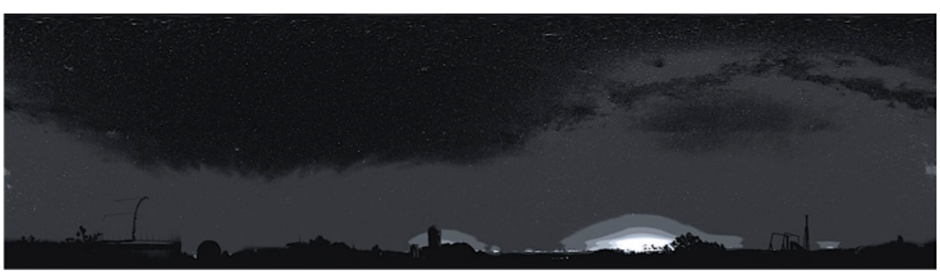


Figure 9: Map of sky brightness obtained by Astronomy Campers. Ms Teresa Jiles brought the automated sky brightness mapping equipment from the National Park Service so Campers could undertake an all-sky light pollution survey. Low altitude haze was caused by smoke from forest fires.

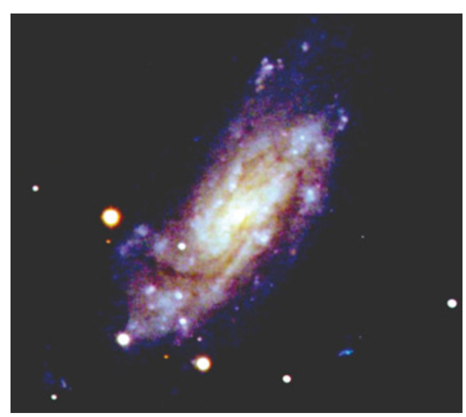


Figure 10: With assistance from Ms Vanessa Bailey and Nathan Stock (U of A) and Dr. Eric Hooper (University of Wisconsin-Madison), four students measured the amount of dark matter in the galaxy NGC 4559. With data from the 0.9-m WIYN (BVR image above), 12-m ARO, and the 2.3-m Bok telescopes, they measured the stellar mass, gas mass, and total mass, respectively.

The 2011 Tohono O'odham Horse Camp

Lori Allen & Alfredo Zazueta

On a beautiful weekend in June, the 2011 Horse Camp was held on Kitt Peak for the fifth year. Approximately 25 youths from the Schuk Toak and neighboring districts of the Tohono O'odham Nation, along with several adult chaperones and a dozen or more horses, camped at the picnic grounds from Friday noon until Sunday noon.

Horse Camp is run by Mr. Silas Johnson, Sr., who created the program to help Tohono

Figure 1: (Left to right)) Silas Johnson, Alfredo Zazueta, and Miko Zazueta place staffs signifying the cardinal directions. (Image credit: Nanette Bird, NOAO/AURA/NSF.)

Figure 2: Hector Rios leads campers on a trail ride. (Image credit: Alfredo Zazueta, NOAO/AURA/NSF.)

O'odham youth build personal confidence and self esteem and to connect with and strengthen traditional O'odham values (Figure 1). Silas holds several Horse Camps throughout the year, serving the eleven districts of the Tohono O'odham nation. Of the Kitt Peak Horse Camp, Si said, "My prayer and my dream is to have this every year for the children."

Among the adults helping with Horse Camp were two Kitt Peak employees who are members of the Tohono O'odham Nation, Alfredo Zazueta and Hector Rios (Figure 2). "Being there first hand, you can really see the growth in the children," said Alfredo. "And being on Kitt Peak is always good," He added. Hector wishes he'd been able to participate in something like horse camp when he was young; "The values Si teaches are important and need to be passed on."

A star party, hosted by the NOAO Education and Public Outreach division, was held Saturday night. Four University of Arizona undergraduates who work at NOAO set up telescopes, gave tours of the night sky, and fielded many interesting and challenging questions about the universe and the relevance of astronomy to our daily lives.

45 Years of Observing at Kitt Peak

Howard Bond (Space Telescope Science Institute)

It's hard to believe that it's been 45 years since a very green young graduate student from the University of Michigan showed up for his first observing run at Kitt Peak, but the calendar doesn't lie. It was back in June 1966, and for me, it was a case of love at first sight. The affair continues all these decades later.

My first run was with the No. 4 16-inch telescope, in whose little dome I spent so many happy nights (all of them were photometric back in those days, or at least that's how I remember it now) doing Stromgren photometry of metal-deficient stars for my PhD thesis. [Editor's note: Today this dome, adjacent to the WIYN telescope, houses a public visitor telescope.] To keep me company, there was a small radio in the dome on which you could listen to American Airlines' "Music 'til Dawn" classical-music program. It was John Graham who drove me up to the mountain and introduced me to the state-of-the-art equipment for photoelectric photometry. It was cutting-edge, with an amazing integrating circuit, digital voltmeter, and punched-paper-tape output that saved you from the tedious labor of measuring pen deflections on reams of strip-chart recorder paper.

I came back to Kitt Peak the next year to obtain spectra of my stars with the Meinel spectrograph on the No. 1 36-inch. [Editor's note: The WIYN telescope now stands where the No. 1 36-inch was located.] It was pure joy to use such a modern, fast instrument, which could obtain spectra of 9th-magnitude stars in a few tens of minutes. This was so much faster than the 90 minutes or more needed to observe the same stars with the antique 37.5-inch reflector back in Ann Arbor, even if you got a clear night. And the excitement I still feel about those days back in the 60s

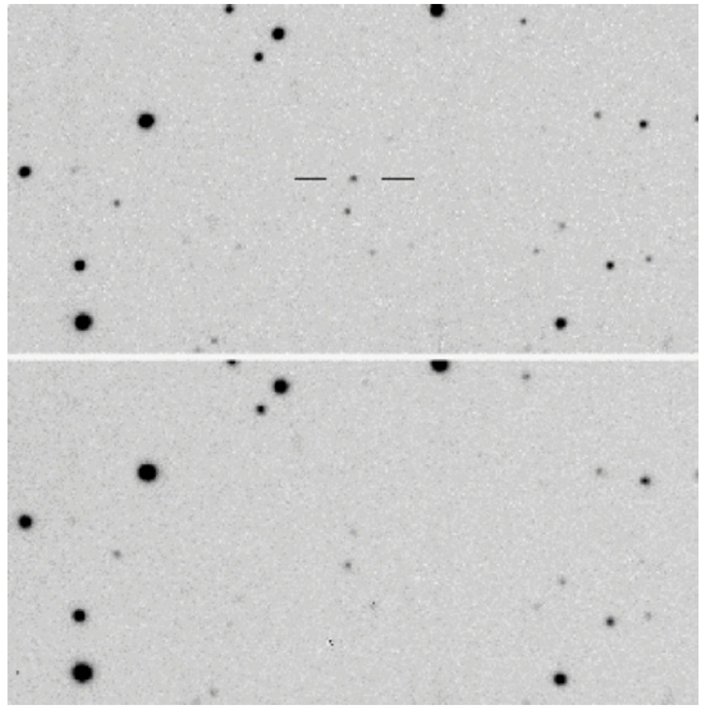
continued

45 Years of Observing at Kitt Peak continued

is not diminished at all by the fact that a 36-inch telescope today could obtain spectra of the same stars in a matter of a few seconds, with no need to take thumbnail-sized plates down to the darkroom to develop them in order to actually see the spectra.

The advent of the National Observatories in the late 50s and early 60s was a sea change in the way observational astronomy was done in the US. No longer did a person need to be among the privileged few with access to a handful of private observatories. If you were a grad student at a Midwestern campus, you no longer needed to struggle with poorly equipped telescopes at mediocre observing sites. Instead, your thesis advisor could call up the Kitt Peak director (this was long before the modern idea of a Time Allocation Committee was introduced), ask for some observing time, and in a few weeks you would be flying out to Arizona for your observing run!

Well, as I write this, the old memories flood back. Sitting in the mountain library one afternoon—yes, in those days, long before the Internet, we spent a lot of afternoons there—and having Helmut Abt and Allan Sandage walk in, positively glowing with scientific energy, legendary god-like figures to a fresh grad student. Swapping jokes and stories with John Huchra on a humid night out in the parking lot. The gentle Art Hoag, whom a colleague rightly called "the salt of the earth." Having a serendipitous conversation with colleagues at Kitt Peak dinnertime, which led to the discovery of AM Herculis variables. Cloudy nights, with a cook on duty to whip up cheeseburgers on demand, and sometimes a few rounds of low-stakes poker in the lounge next to the kitchen. Al Grauer and I hunched in the darkness on a cold, windy night over a feebly illuminated teletype outputting a stream of numbers every 10 seconds—this was back in the mythological era when astronomers actually worked on the platform out under the real stars—and realizing we had discovered a short-period binary nucleus in a planetary nebula. Volleyball after dinner on summer evenings—yes, there used to be enough telescopes on Kitt Peak and enough astronomers on the mountain to form two teams. Participating in the most important astronomical discovery of 1997 (sorry about the immodesty): the identification of the optical counterpart of GRB 970508, first gamma-ray burst to have its redshift measured, a discovery possible only with the wide field of view of a 36-inch telescope (see figure).



Discovery images for the optical counterpart of GRB 970508, obtained with the KPNO 0.9-m telescope. These are V-band frames obtained on 10 May 1997 UT (top, 1800 s exposure) and 9 May 1997 (bottom, 600 s). Each frame is 138 arcsec high. The GRB counterpart is the variable source marked in the top frame, which brightened by 1 mag between May 9 and 10. For more information, see *www.noao.edu/noao/noaonews/sep97/node2.html.* (Image credit: Howard Bond, STScI/AURA/NSF.)

I spent the first part of my career at an institution, Louisiana State University, that lacked its own ground-based observing facilities at a top-notch observing site. Without access to the NOAO facilities, it is unlikely that I would have had a successful career in observational astronomy. My gratitude to those visionaries of the 1950s who conceived the National Observatories and founded the Association of Universities for Research in Astronomy is measureless. And I'm already planning my next observing trip to Kitt Peak.

Three Decades of Coudé Feed Observing

Frank Fekel (Tennessee State University)

Although there are certainly several astronomers who have observed longer at Kitt Peak National Observatory (KPNO), I have now accumulated three decades of starlight on the mountain, almost exclusively with the Coudé Feed telescope (see figure). Over the years, I settled into a typical pattern of three observing runs per year, one each in spring, summer, and fall, while adding a winter run on rare occasions. The beginning of my time at KPNO in the early 1980s was the end of an era, as the astronomical community transitioned from photographic plates, whose forte was extensive wavelength coverage, to digital, solid state detectors with their linearity and greatly enhanced quantum efficiency. Through the decades, I went from observing at the extremes of ambient outside temperature and constantly guiding my star on the spectrograph slit to the comfort of a warm room, converted from the old plate development room, and an automatic guider. Also, I eventually was able both to reduce and analyze my spectra while I was observing on the mountain and then send the digital data home via the World Wide Web. The Coudé telescope, spectrograph, and detector systems have been extremely reliable. On those rare occasions when I needed help, the support staff came to my rescue. In particular, Daryl Willmarth's knowledge and general guidance have been indispensible to

continued

Three Decades of Coudé Feed Observing continued

successful observing runs. The support of the Coudé Feed operations by the various KPNO directors is greatly appreciated.

Access to this changing but stable environment has enabled me to work on long-term projects such as the orbits of symbiotic binaries and close multiple systems as well as a group of radial velocity standards for early-type stars. I should note that the unusual configuration of the Coudé Feed with its independent flat primary and off-axis parabola secondary in a tower across the access road allowed me to observe bright stars as far south as -48 degrees, within 10 degrees of the horizon, opening up much of the southern sky.

The passage of time always produces change. Once upon a time, night lunch was ordered and served hot at midnight. As budgets declined and personnel was reduced, the summer volleyball games after dinner became just a fond memory although the court is still there, ready and waiting. The Astronomer in Residence program, dubbed AIRHEAD, has come and gone. It enabled observers at the telescopes to provide feedback, both positive and negative, in person to a staff member. During some visits to Kitt Peak, it was a pleasant surprise to run into grad school colleagues and post-doc office mates from long ago, allowing me to reminisce and catch up on their lives. The frequency of such intersections has decreased these days.

While the ever increasing technology is in many ways a wonderful thing, there are also some losses. I suspect that the general interaction between those who observe at the various telescopes has decreased. During the good old days, cloudy nights produced a confluence of astronomers in the dining room area or lounge to swap stories and learn about observing

Coudé Feed Telescope used by Frank Fekel on Kitt Peak. (Image credit: Daryl Willmarth, NOAO/AURA/NSF.)

programs on other telescopes. Instead, today most of us are enamored with our laptops and checking the news on the Internet. That isolation is not necessarily good. Once, several years ago, an astronomer from the 2.1-m telescope who was looking for the computer room came into the Coudé area and turned on the room lights at night while I was observing. Since then, I have made it a practice to introduce myself and the Coudé area to the 2.1-m telescope observers.

Photos from an International Contest that Help You Touch the Sky

Connie Walker

Beauty, it is said, is in the eye of the beholder. When viewing a pristinely dark night sky, most people would agree as to its beauty. When people have lived most of their lives in urban locations and do not have the opportunity to view a starry night sky, pictures can be a good substitute.

The National Optical Astronomy Observatory in partnership with The World At Night organized the Second International Earth and Sky Photo Contest on the importance of preserving dark skies for the Dark Skies Awareness theme of Global Astronomy Month in April 2011. The University of Hawaii's Institute of Astronomy provided the technical support and server for photo submissions. The World At Night (TWAN) is a program to create and exhibit a collection of stunning photographs of the world's most beautiful and historic sites against a nighttime backdrop of stars, planets, and celestial events. Global Astronomy Month is an annual program coordinated by Astronomers Without Borders for the international astronomy community to share the beauty of the night sky with others and connect with astronomy enthusiasts around the world. Astronomers Without Borders holds international events based on the concept that the night sky is a common meeting place that imposes no boundaries between people.

Within the first three weeks of April 2011, 240 submissions to the photo contest were received from 58 photographers representing over 30 countries. The style of photography showed both the earth and the sky—combining elements of the night sky set against the earth's horizon as a backdrop of a notable location or landmark. This style of photography is known as landscape astrophotography. The contest was open to anyone of any age, anywhere around the world. Nearly 25% of the entries were from the United States. Other major contributors were Iran, Germany,

continued

Photos from an International Contest continued

and China. According to the contest theme of Dark Skies Importance, the submitted photos were judged in two categories: Beauty of the Night Sky and Against the Lights. The 10 winning images are those most effective in impressing people on how important and amazing the starry sky is and/or how bad the problem of light pollution has become.

Figure 1, "Isfahan Milky Way," by Mehdi Momenzadeh, is the second place winner in the category Against the Lights. The arc of the Milky Way rises above central Iran and it fades away toward the historic city of Isfahan. Figure 2, "A Starry Night of Iceland," by Stephane Vetter, is the first place winner in the category Beauty of the Night Sky. The arch of the aurora shines over Jökulsárlón, the largest glacier in Iceland. The Milky Way is framed by the dancing ring of Northern Lights. Prizes included a 127-mm and an 80-mm refracting telescope (first place), gift certificates for a few hundred dollars of telescope or camera equipment (second place), and two 10 × 42 Parks binoculars (third place). The sponsors that provided the contest prizes were Scope City, Canadian Telescopes, Explore Scientific, Dubai Telescope, Woodland Hills Camera and Telescopes, Lumicon International, Sky&Telescope, and Starizona.

Figure 1: "Isfahan Milky Way," by Mehdi Momenzadeh: Milky Way above central Iran.

Figure 2: "A Starry Night of Iceland," by Stephane Vetter: arch of the aurora over Iceland's largest glacier, Jökulsárlón.

The other winners in the Against the Lights category follow. First place: "Alps at Night," by Thomas Kurat, whose photo shows the starry sky above a misty Alpine valley and village lights in Austria. Third place: "Lisbon Sky Lights," by Miguel Claro from Portugal. The photo shows stars and the crescent moon trail over a landmark bridge in Lisbon dominated by the city's light pollution. Fourth place: "Venus above Reunion Island," by Luc Perrot. This French night-sky photographer made this image from Reunion Island in the southern Indian Ocean. Fifth place: "Lights from the Hidden City," by Ben Canales. The photo is taken from mountains near Portland, Oregon, and displays how the lights from the city illuminate clouds in the night sky.

The other winners in the Beauty of the Night Sky category follow. Second place: "Galactic View from Planet Earth," by Alex Cherney from Australia (figure 3). Third place: "Beauty of Southern Sky," by Luc Perrot. Fourth place: "The Great Wall at Night" by Xiaohua from China. The photo displays the Milky Way above one of the gates to the Great Wall of China. Fifth place: "Star trails above an Alien Lake," by Grant Kaye. The image shows star trails around the north celestial pole as captured from the bizarre-looking structures along the shores of Mono Lake in California. To view the 10 winning photographs, visit:
http://www.twanight.org/newTWAN/news.asp?newsID=6065.

Figure 3: "The Galactic View from Planet Earth," by Alex Cherney: the central bulge of the Milky Way galaxy is captured in a starry Australian night where the trees seem to be blown by a galactic breeze. More of Cherney's photographs appeared in an article on 13 July 2011 at:
http://www.dailymail.co.uk/sciencetech/article-2014312/Milky-Way-pictures-Alex-Cherneys-photos-galaxy-seen-naked-eye.html.

The first place photograph for the Beauty of the Night Sky category, "A Starry Night of Iceland," was featured as the Astronomy Picture of the Day on May 17. On the same day, all 10 winning photographs appeared in *National Geographic Daily News* at:
http://news.nationalgeographic.com/news/2011/05/pictures/110517-best-space-contest-science-astronomy-stars-auroras-night-sky/.

A few days later MSNBC.com featured all 10 images on their Picture Stories at *http://www.msnbc.msn.com/id/43100973#*. With this much media attention, stay tuned for the third annual Earth and Sky Photo Contest during the April 2012 Global Astronomy Month!

The National User Facility Organization

Robert Blum

The National User Facility Organization (NUFO) is a non-profit "users group" that represents the needs of US scientific and industrial users of US government-funded facilities. NUFO grew up principally around research facilities funded by the Department of Energy serving physicists, chemists, and material scientists. In the last several years, NSF-funded observatories have joined NUFO.

NOAO and the National Radio Astronomy Observatory (NRAO) are participating now in NUFO by taking part in sponsored events designed to raise the visibility of the observatories in the eyes of funding agencies and the Congress. Initially, the NOAO Users Committee was contacted by NUFO in order to obtain user statistics and other information relating to our user communities. To this end, we have appointed a "user administrator" to interface with NUFO and provide general information about the demographics of our user base (e.g., the number of individuals using NOAO facilities from each state in the Union). Given the positive advocacy of NUFO on behalf of US researchers, NOAO has been happy to participate at this level, and our coordination with NUFO is done in cooperation with the NOAO Users Committee. In fact, one of our User Committee members, Eric Gawiser, is a member of the NUFO steering committee.

NUFO holds regular annual meetings and sponsors special events to advocate for US science and facility users. In April of this year, NUFO sponsored a "User Science Exhibition" on Capitol Hill to show Congressional members and staff where research dollars are being efficiently spent. Each NUFO member presented a poster for their facility and sent users to talk with elected representatives and their staff. NOAO User Committee member Ian Dell'Antonio went to represent NOAO. An article in the NUFO online news summarizing the event may be found here: *www.nufo.org/news.aspx?id=21*. A pdf copy of the NOAO poster shown at the exhibition can be downloaded here:
www.nufo.org/facilities/posters/NOAO_Poster.pdf.

More information about NUFO, its activities, and annual meetings can be found on the NUFO Web site: *www.nufo.org/*.

CTIO Welcomes New Scientific Staff Members

Nicole van der Bliek

In the last quarter of 2011, we will be welcoming two new scientific staff members at CTIO: Catherine (Katie) Kaleida and Eric Mamajek.

Catherine (Katie) Kaleida is joining CTIO as a postdoctoral fellow, and she will be in charge of the CTIO summer student programs. She arrives on September 16, just in time for the Chilean national holidays. She is currently an astrophysics graduate student in the School of Earth and Space Exploration at Arizona State University in Tempe, Arizona. She is originally from Dunwoody, Georgia, and received a Bachelor of Science in Physics and Astronomy and a Bachelor of Arts in Studio Art from the University of Georgia in 2004. Her research focuses on stellar clustering at all size scales, from compact clusters to large stellar complexes, and the role those stellar groupings play in galaxy structure and evolution. Recently, she has been developing an automated method for selecting stellar groupings of all size scales and testing this method on the star clusters and stellar associations in NGC 4214. Katie is excited to continue this research and manage the CTIO summer student programs after completing her degree this August, and she hopes to get involved in instrument support during her time as a postdoc at CTIO.

Katie spends her free time rock climbing, making metal sculptures, salsa dancing, knitting, and attempting to grow vegetables in her backyard.

Eric Mamajek is joining CTIO as Associate Astronomer starting in October 2011. Eric completed his undergraduate degree at Pennsylvania State University in 1998 and finished his PhD at University of Arizona in 2004. He was a Clay Postdoctoral Fellow at the Harvard-Smithsonian Center for Astrophysics for four years and then an Assistant Professor of Physics & Astronomy at the University of Rochester from 2008 until 2011. Eric's primary research interests are the formation and evolution of planetary systems, circumstellar disks, stars, and stellar groups in our Galactic neighborhood. His more notable results include co-discovery of the nearby Eta Chamaeleontis cluster, discovery of the Mu Ophiuchus and 32 Orionis stellar groups (all within 200 parsecs), co-discovery of a new faint stellar companion to the famous multiple star Alcor (showing the Mizar-Alcor system to be the second-nearest known stellar sextuplet), co-discoverer of hundreds of new low-mass stellar members of the nearest OB association (Sco-Cen), and co-author of a well-cited set of activity-rotation calibrations for estimating ages for Sun-like stars.

Eric was born in Pittsburgh, Pennsylvania, in 1975, and grew up on an Appaloosa horse farm in southwestern Pennsylvania. He married his wife, Eleonora, in Santiago, Chile, in 2008, and their first child, Martin Gabriel, was born 16 May 2011.

Key Staff Retiring at CTIO: Fond Farewells

Robert Chris Smith

It is with a heavy heart that I write of the retirement of four staff members at CTIO who together have formed part of the backbone of the observatory for many, many years.

Oscar Saa

Pedro Vergara

Oscar Saa joined Tololo on 1 January 1970. His contract was for one month, but he stayed almost 42 years! Oscar served in several positions over the years, starting as an "assistant observer" and ending up in charge of all CTIO telescope operations. Most know him for his untiring support of visiting astronomers and also his ever-present enthusiasm for showing visiting guests around the telescopes and showing them the Southern Hemisphere sky at night.

Ricardo Venegas joined Tololo in December 1974 as a "support observer." By 1977, he was already the leader of the observing assistants and then headed up the whole observer support group for many years. Ricardo's careful instrument setup and helpful explanations set the standard on Tololo observer support for more than 30 years.

Pedro Vergara joined Tololo in June 1975 as a technician. Over the years, he became a leader in the La Serena instrument shop, making many of the precision components that went into the long list of instruments built at CTIO over the past three and a half decades.

And last, but not least:

Ricardo Aguirre joined Tololo in 1977 as a member of the facilities team, keeping the fundamental infrastructure of Tololo running so that we could focus on the stars. For over 30 years, Ricardo has always been available—quite literally day or night, holiday or vacation—to assist in the solution of emergencies: bad weather, critical machinery shutdowns, safety and security emergencies, inundations, and the myriad of critical emergencies that occurred with more frequency than we like to remember.

CTIO will not be the same without these key individuals, but we will strive to keep the "Tololino" legacy they have helped build (from almost the beginning!) alive and well.

Ricardo Venegas

Ricardo Aguirre

Bici-Tololo Bike Race

Andrea Kunder

The 2011 Bici-Tololo Bike Race, the ultimate pedal push for blue stragglers and the like, took place on 20 March 2011 with more than 50 participants, including CTIO Director Chris Smith. It was organized as a wilderness mountain bike ride, where participants experienced the extreme physical challenges that come with riding the Cordillera. Less than half of those registered actually completed the full 32.5 km course, which went from the Tololo Guard Post to the summit of Cerro Tololo. "When I bought a new bike with 27 gears, I never thought I'd use the bottom one and be looking for another!" said James Turner, the winner of the NOAO employees, who completed the race in 3 hrs, 32 min. "My legs will always remember this awesome experience," recalled Guillermo Cabrera, the first CTIO rider who completed the full race, with a time of 4 hrs, 8 min.

Many riders, such as myself, were picked up by the ambulance after having gone as far as their body would physically allow them and transported to the summit to watch the finishers. Dan Phillips—an outdoor enthusiast and housing manager for CTIO—said, "I had to lie down on the dirt road when I finally got off my bike, realizing I wasn't going to make the last 5 K to the summit. I have never been so physically exhausted in all my life." But every participant was a winner, regardless of how far they biked, and was awarded with a Bici-Tololo medal and an in-house-designed T-shirt. The weather and views from the summit were spectacular, and the riders and spectators enjoyed free tours of the telescopes, as well as a display by Andrei Tokovinin that showcased various rocks, minerals, and gems naturally available in the Elqui Valley. Empanadas, beverages, watermelon, and ice cream made from liquid nitrogen also were available. The race photographs taken by the official photographer, Tim Abbott, as well as the final results are available at:
www.ctio.noao.edu/~kunder/BCTOLOLO/.

The organizing committee consisted of Andrea Kunder, Dan Phillips, John Subasavage, Jen Subasavage, Eduardo Segovia, Peter McEvoy, Eugenio Encina, Eduardo Araya, and Ana Mikler. The event was only possible thanks to the many, many volunteers and support from the mountain and ground staff.

Figure 1: The starting kazoo goes off, and a stream of bikers are off for Tololo. CTIO Director Chris Smith takes up the rear. (Image credit: Tim Abbott.)

Figure 3: Tomi Vucina of Gemini and Wolnays Naudy of CTIO take a rest at hydration station #4 before the final ascent to Tololo. They finished in 4 hrs 33 min and 4 hrs 34 min, respectively. (Image credit: Eduardo Araya.)

Figure 5: Pete McEvoy of Gemini rides his bike through the balloon finish line. (Image credit: John Subasavage.)

Figure 2: Chris Smith approaches hydration station #1, where not only food and water await, but also fans to cheer on the bikers. (Image credit: Nancy Cortes.)

Figure 4: Bryan Miller of Gemini bikes hard while his family awaits him on the summit. (Image credit: John Subasavage.)

continued

Bici-Tololo Bike Race continued

Figure 6: Out of the AURA employees, James Turner (center), Dustin Fennel (left), and Guillermo Cabrera (right) are the first three finishers. (Image credit: Tim Abbott.)

Figure 7: All the Bici-Tololo participants on the Tololo summit. (Image credit: Tim Abbott.)

Staff Changes at NOAO North and South (1 February–15 August)

New Hires

Atlee, David	Postdoctoral Research Associate	NOAO North
Baldassare, Vivienne	KPNO REU summer student	NOAO North
Basarab, Brett	Summer Research Assistant	NOAO South
Correa, Ana María	Accountant	NOAO South
Diaz, Raul	Craftsperson, Kitt Peak	NOAO North
Fersch, Alisa	KPNO REU summer student	NOAO North
Guvenen, Blythe Christian	Public Program Specialist, Kitt Peak	NOAO North
Hernández, Diego	Safety Officer	NOAO South
Jimenez, Nick	KPNO REU summer student	NOAO North
McKercher, Robert	Publications Coordinator, LSSTC	NOAO North
Montijo Jr., Guillermo	Technical Associate I	NOAO North
O’Connell, Julia	Summer Research Assistant/Research Asst.	NOAO South
Rehnberg, Morgan	KPNO REU summer student	NOAO North
Ribero, Tiago	Postdoctoral Research Associate, SOAR	NOAO South
Rohl, Derrick	Summer Research Assistant	NOAO South
Schirmer, Karianne	Postdoctoral Research Associate, SOAR	NOAO South
Sherry, Bill	Postdoctoral Research Associate	NOAO North
Taylor, Joanna	KPNO REU summer student	NOAO North
Varas, Ricardo	Astronomers Special Transports Driver	NOAO South
Welling, Christine	KPNO REU summer student	NOAO North

continued

Staff Changes continued

Promotions

Andree, Skip	To Kitt Peak Telescope Operations Mgr.	NOAO North
Blum, Bob	To Astronomer	NOAO North
Dey, Arjun	To Astronomer	NOAO North
Knezek, Pat	To Director, WIYN	NOAO North
Matheson, Tom	Granted tenure	NOAO North
Najita, Joan	To Astronomer	NOAO North
Nuñez, Oscar	To Deputy NOAO A&F Operations Mgr.	NOAO South
Rojas, Mauricio	To Observer Support	NOAO South

New Positions

Rajagopal, Jayadev	WIYN Telescope Scientist, KPNO	NOAO North

Transfers

Rajagopal, Jayadev	From NOAO South to	NOAO North
Ridgway, Susan	From NOAO South to	NOAO North

Retirements/Departures

Aguirre, Ricardo	NOAO A&F Operations Mgr.	NOAO South
Bippert-Plymate, Teresa	Administrative Assistant II, LSST	NOAO North
Duffy, Justin	EPO Student Worker	NOAO North
Fullwood, Keana	Visitors Guide/Cashier (Kitt Peak)	NOAO North
Howell, Steve	Associate Astronomer	NOAO North
Montgomery, David	EPO Student Worker	NOAO North
Naudy, Wolnays	Mechanical Designer Draftsman ETS	NOAO South
Olson, Roy	Technical Writer	NOAO North
Saa, Oscar	Assistant-Advisor TELOPS Mgr.	NOAO South
Segovia, Eduardo	Accountant	NOAO South
Venegas, Ricardo	Head Observers Support TELOPS	NOAO South
Vergara, Pedro	Senior Instrument Maker ETS	NOAO South
Zaw, Pye Pye	EPO Student Worker	NOAO North

Deaths

Blanco, Victor	Former CTIO Director	NOAO South
Danielson, Carl	Former Electronics Facility Supervisor	NOAO North

2011 AURA Awards

Award for Service	Stephen Pompea	NOAO North

2011 NOAO Awards

Excellence Award – Science	Dickinson, Mark	NOAO North
Excellence Award – Service	Alvarez, Rodrigo	NOAO South
Excellence Award – Service	Jimenez, Monica	NOAO North
Excellence Award – Service	Stobie, Elizabeth (Betty)	NOAO North
Excellence Award – Team	*WIYN Storm Response Team*: Charles Corson, Mike Hawes, Fred Wortman, Alfredo Zazueta, David Montez, Bill Porter, Jim Phillips, Randy Feriend, Gene Carr	NOAO North