NOAO NEWSLETTER

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NATIONAL OPTICAL ASTRONOMY OBSERVATORY

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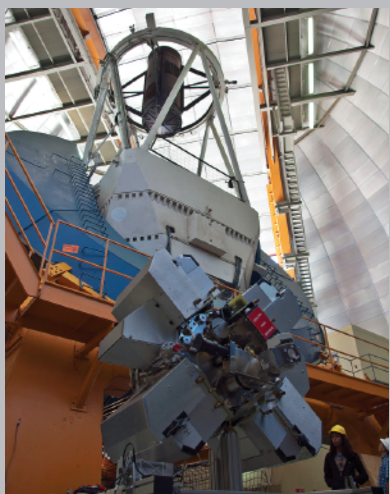
Science Highlights

System Science Capabilities

System Observing: Telescopes & Instruments

NOAO Operations & Staff

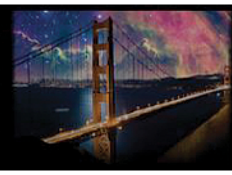
On the Cover



The Dark Energy Camera (DECam) is a liquid nitrogen cooled, 520-megapixel digital camera that is housed inside a high-vacuum Dewar; here, it poses in front of the CTIO Blanco 4-m telescope on which it will be mounted. For more information, see the related article on p. 11. (Image credit: Tim Abbott/ NOAO/AURA/NSF.)

Gemini Science Meeting 2012

San Francisco July 17-20 • Hilton San Francisco Financial District



The international science community is invited to participate in the 2012 Gemini Science Meeting in San Francisco, California, July 17–20, where current Gemini results and future plans will be discussed. The scientific focus will be on exoplanets, supermassive black holes, high-redshift galaxies, and future Gemini capabilities. Additional topics will cover a broad range of subjects, from the solar system to stars, Galactic structure and the Local Group, and transient events.

A Gemini Users' meeting will also be part of the program. For meeting details and to register, go to *www.gemini.edu/gsm12/*.

Late-Breaking News about Blanco

On 20 February 2012, an accident occurred at the CTIO Blanco 4-m telescope involving the telescope *f*/8 secondary mirror. Two CTIO staff were injured, and the mirror was damaged. Thankfully, our staff members are expected to fully recover. An analysis of the damage to the *f*/8 secondary is in progress.

As of this writing (February 21), it is not clear if the secondary mirror is repairable or not. We will continue to update our community as the recovery process continues. For more information and updates, visit: *www.ctio.noao.edu/noao/content/blanco-f8-secondary-incident*.

We do not expect the incident to significantly delay the installation and commissioning of the Dark Energy Camera (DECam) as the *f*/8 is not required for the installation or operation of the DECam system.

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The Nobel Prize in Physics for 2011 was awarded to Saul Perlmutter, Brian Schmidt, and Adam Riess for their discovery of the acceleration of the Universe. Facilities at NOAO and members of the NOAO staff played a key role for both teams in their quest to find high-redshift supernovae. In honor of this revolutionary work, it is fitting to rerun the following article from the September 2007 Newsletter *that describes the contributions NOAO made to these programs. The article pointed out several upcoming activities that would further enable investigation into the mysterious dark energy. The Dark Energy Camera (DECam) is no longer in the "near future," but rather is being assembled and installed on the Blanco at CTIO now. NOAO continues to foster other projects that will contribute to the study of dark energy, including the BigBOSS multi-object spectrograph for the Mayall and the Large Synoptic Survey Telescope, both of which will continue the ongoing effort at NOAO to facilitate great science.* Tom Matheson

The Role of NOAO in the Discovery of the Accelerating Universe

Tom Matheson & Chris Smith

The discovery of credible evidence for acceleration in the expansion rate of the Universe is certainly one of the more surprising cosmological results in modern astronomy.

The fact that two independent groups using Type Ia supernovae as distance indicators—the High-z Supernova Search (High-z SN) team, founded by Brian Schmidt of Australian National University and Nicholas Suntzeff of Cerro Tololo Inter-American Observatory (CTIO), and the Supernova Cosmology Project (SCP) led by Saul Perlmutter of the University of California at Berkeley—both arrived at the same conclusion helped to speed the acceptance of such an unexpected result.

Subsequent data from ground-based and space-based programs, including studies using tools other than SNe, have confirmed the initial results, although the nature of the "dark energy" that is apparently driving this acceleration is still uncertain. The first reports, though, were the product of essentially ground-based programs that relied heavily on the resources of the National Optical Astronomy Observatory.

At the time when the two groups were developing their programs, new observations of Type Ia SNe showed that they were not homogeneous standard candles. Early CCD observations of SN 1986G obtained at CTIO showed it to be unusual. In 1991, two SNe (the overluminous SN 1991T and the underluminous SN 1991bg) provided unquestionable evidence that SNe Ia are heterogeneous, with a spread of 2.5 magnitudes at peak brightness.

Fortunately, the Calan/Tololo SN survey had begun in 1989. This search was led by Mario Hamuy, Mark Phillips, Nicholas Suntzeff (all CTIO astronomers at the time), and Jose Maza (Universidad de Chile). They used the CTIO Curtis Schmidt camera to search for SNe, timing the observations to catch SNe soon after explosion. Most of the photometry of the newly discovered SNe was obtained with the CTIO 0.9-meter telescope, while the CTIO 1.5-meter and Blanco 4-meter telescopes provided most of the spectroscopy.

Analysis of this well-observed and well-calibrated SNe sample showed that the peak brightness of a Type Ia SN was correlated with the light-curve shape. Using the light curve, one could transform a relatively diverse set of Type Ia SNe into "calibratable" standard candles. Without this calibration, neither team could have obtained luminosity distances to high-redshift Type Ia SNe with the precision necessary to detect the subtle effect introduced by the acceleration of the expansion. These SNe also provided the low-redshift anchor for the cosmology derived from the high-redshift SNe. The Calan/Tololo survey was essential to the success of each cosmological program.

The techniques for finding high-redshift SNe began with a Danish group using the 1.5-meter telescope at ESO. They adopted a timing scheme similar to that used by the Calan/Tololo survey. Expanding on this, the SCP started using the Kitt Peak Mayall 4-meter and 2.1-meter telescopes for searches and photometry. With these facilities, they refined the strategy of observing blank fields to catch high-redshift SNe early in their development. These early runs often shared fields with other programs to extend the utility of the data, a practice continued with many later SNe searches.

In order to find large numbers of SNe at high redshift, both teams employed the wide-field imaging capability of the Blanco 4-meter telescope at CTIO. Initially, they used the prime-focus CCD camera, switching to the Big Throughput Camera when it became available. Previously obtained template images were subtracted from frames during SNe searches. Promising new objects could then be observed spectroscopically to securely identify the new object as a Type Ia SN. Multiple epochs of photometry (often with the Blanco 4-meter) produced light curves that could be anchored using the calibration provided by the Calan/Tololo sample.

The WIYN 3.5-meter telescope at Kitt Peak was used by the High-z SN team and the SCP to observe many of the high-redshift SNe found by the Blanco 4-meter telescope. One of the reasons that WIYN was particularly useful was that it was operating with a queue schedule at that time. For transient objects such as SNe, the ability to obtain observations on demand is a tremendous resource. Both teams explicitly acknowledged the importance of the WIYN queue observers to their projects.

continued

Role of NOAO continued

NOAO facilities continue to play an important role in studies of dark energy. The Blanco 4-meter is the host of the NOAO Survey project Equation of State: SupErNovae trace Cosmic Expansion (ESSENCE), which is searching for more high-redshift Type Ia SNe in order to constrain the equation-of-state parameter of dark energy (see *www.ctio.noao.edu/essence*). NOAO supports both ESSENCE and the Canada-France-Hawaii Telescope SN Legacy Survey in their use of the Gemini Observatory to obtain spectra of high-redshift SNe.

The Blanco Cosmology Survey (*www.cosmology.uiuc.edu/BCS*) will also attempt to constrain dark energy through observations of clusters of galaxies. In the near future, the Dark Energy Survey (*www.darkenergysurvey.org*) will build the 500-megapixel Dark Energy Camera for the Blanco, dramatically expanding survey capabilities for NOAO and its user community, and enhancing the observatory's historic place in the quest to understand the mystery of the accelerating universe.

Seeing Double: Using Gemini to Measure the Prevalence of Dual AGN

Michael Koss (University of Maryland & University of Hawai'i)

We now believe that super-massive black holes are likely to be at the center of most galaxies, but an important unsolved problem is determining how they grow to their present day masses. While it is well established that matter falling onto black holes is emitted as energy, the fueling process remains highly controversial. One of the leading theories is that disruptive events like galaxy mergers trigger active galactic nuclei (AGN) by sending large amounts of gas toward the black hole.

As the gas spirals inward during the merger, it becomes extremely hot and radiates huge amounts of energy. If the process of merging triggers the AGN, then there should be a time when AGN can be detected in both of the merging galaxies as a dual AGN. Over the last decade, a few nearby dual AGN have been found serendipitously in interacting galaxies. However, initial dual AGN surveys found that they are exceedingly rare, with studies based on quasars predicting that the dual AGN frequency was only 0.1% among AGN samples. This rarity poses a problem for the merger-driven AGN model.

A critical problem with assessing the actual frequency of dual AGN is the lack of high-quality multiwavelength data, especially for very close mergers. Large studies using mega data sets like the Sloan Digital Sky Survey (SDSS) suffer severe biases against detecting close dual AGN because of fiber collision limits. Additionally, previous studies, including one of ours using Gemini, found that many AGN are detected in the X-rays but not detected using optical emission line diagnostics even with high-quality spectra (Figure 1).

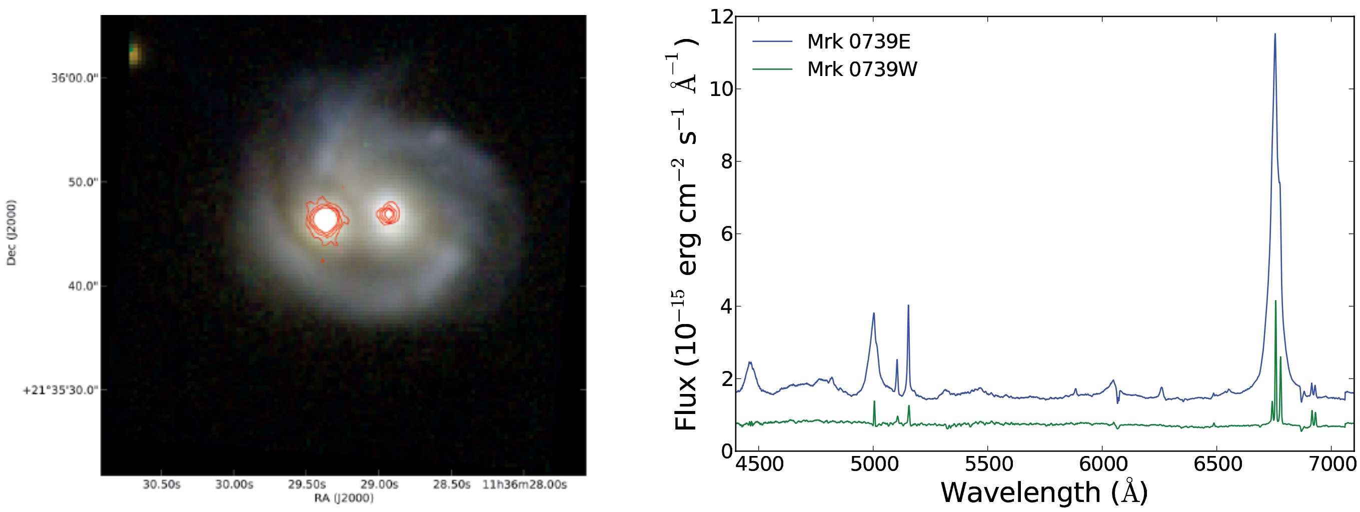

Figure 1: (Left) GMOS-N image of Mrk 739, a dual AGN with red Chandra contours overlaid. (Right) GMOS-N spectroscopy of both nuclei from a single, long slit observation. The high signal-to-noise Gemini-resolved spectra were critical to demonstrating that optical spectroscopy can sometimes misidentify AGN in close mergers. (Koss, M., et al. 2011, ApJL, 735, 42, reproduced by permission of the AAS.)

continued

Seeing Double continued

Our group had hypothesized that the dual AGN fraction may be much higher than current estimates if high-quality data could be obtained, particularly if the dual AGN was turning on only at small separations. We therefore turned to Gemini and Chandra for help. In our study, we started with a sample of AGN that was well studied in the X-rays from the all-sky survey of the Swift Burst Alert Telescope (BAT). We used Gemini for optical spectroscopy in extremely close mergers where accurately measuring nuclear emission from multiple nuclei is very difficult. Because we chose nearby objects, we were able to use Band 3 observations at Gemini. We also obtained high-resolution Chandra imaging to ensure that we could resolve double AGN in the X-rays.

The use of the Gemini Multi Object Spectrograph (GMOS) for optical spectroscopy was critical to measuring the dual AGN fraction because AGN are often obscured by large columns of gas and dust that will absorb even high-energy X-rays (Figure 2). The use of GMOS provided a very efficient all-purpose instrument for our observing program. We could adjust the central wavelength to obtain all the AGN diagnostic lines in a single setup as well as rotate the slit to obtain pairs of measurements at once. Additionally, we obtained imaging as part of the acquisition process to measure the stellar mass ratio of the two galaxy nuclei. This was important because we had hypothesized that major mergers would be more effective in producing dual AGN. Finally, because our targets were from an all-sky survey of bright X-ray-selected AGN spread across the sky, the use of GMOS-S and GMOS-N in queue mode allowed us to cover the majority of the targets.

Our study found that the dual AGN fraction is 8% at distances within 30 kpc for the 167 AGN in our sample. The majority of these dual AGN are found at scales <15 kpc, where the Gemini optical spectroscopy was critical for their detection. This dual AGN frequency is *10 to 100 times* that estimated from quasars or from double-peaked sources. Our results also found that in systems already hosting a single AGN, nuclear activity in companions is triggered in the majority of close-separation major mergers. Finally, we found that about 20% of dual AGN detected in the X-rays are not detected optically, which was smaller than previous estimates. These results are accepted to appear in an upcoming issue of the *Astrophysical Journal Letters*. Finally, we are continuing our study of dual AGN activation with GMOS with a survey of higher redshift AGN to test whether the dual AGN fraction increases with AGN luminosity.

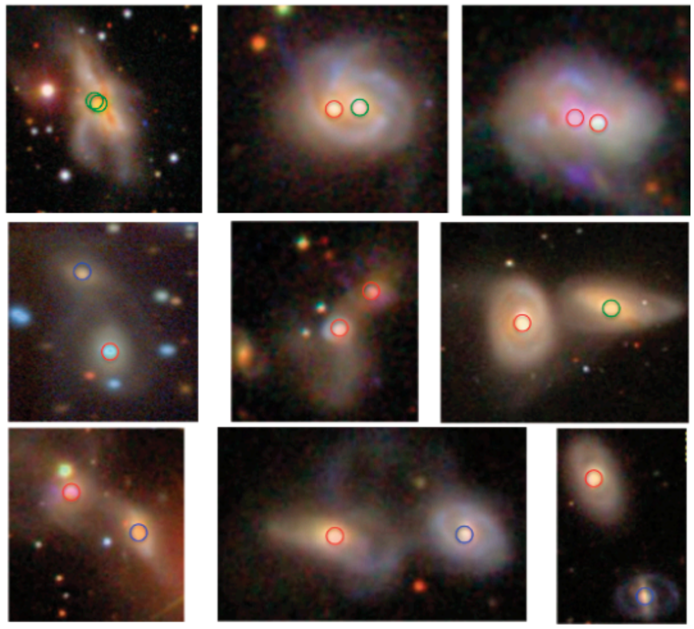

Figure 2: Samples of dual AGN from our study taken with the Kitt Peak 2.1-m telescope. Gemini GMOS spectroscopy was used in close mergers to identify potential dual AGN. Blue circles indicate cases where the AGN was not identified in the X-rays, but was identified using optical spectroscopy. Red circles indicate where there was X-ray and optical AGN detection. Green circles indicate where there was X-ray AGN detection but no optical detection. (Koss, M., et al. 2012, ApJL, Accepted, reproduced by permission of the AAS.)

The published results can be found in:

Koss, M., Mushotzky, R., Treister, E., Veilleux, S., Vasudevan, R., Miller, N., Sanders, D.B., Schawinski, K., and Trippe, M., *Chandra Discovery of a Binary AGN in Mrk 739*, ApJL 2011, 735, 42

Koss, M., Mushotzky, R., Treister, E., Veilleux, S., Vasudevan, and Trippe, M., *Understanding Dual AGN Activation in the Nearby Universe*, 2012, ApJL, Accepted

A Nearby Type Ia Supernova

Tom Matheson

In August 2011, the Palomar Transient Factory identified a new source that had appeared in the nearby spiral galaxy M101. This was the supernova SN 2011fe (see Figure 1), found just hours after explosion. It is the closest Type Ia supernova (SN Ia) since SN 1972E in NGC 5253. This proximity presents a great opportunity to observe this supernova in exquisite detail.

continued

Figure 1: An image of M101 obtained with the Mosaic CCD camera at the KPNO 4-m telescope shows SN 2011fe as the bright, bluish star in the upper-right portion of the disk of M101. (Image credit: T.A. Rector, University of Alaska Anchorage; H. Schweiker & S. Pakzad, NOAO/AURA/NSF.)

Type Ia supernovae (SNe) are thermonuclear explosions that touch on many aspects of astrophysics, including stellar evolution, nuclear astrophysics, and galactic chemical enrichment. In recent years, though, SN Ia have become especially important in their role as the best method for determining cosmological distances. From SN Ia distance determinations came the first evidence for dark energy (Riess et al. 1998, Perlmutter et al. 1999), a revolution that has changed cosmology in the last decade and was recognized with the Nobel Prize for Physics in 2011. Subsequent tests using Type Ia SNe have shown that the equation-of-state of the Universe is consistent with a cosmological constant (e.g., Astier et al. 2006, Wood-Vasey et al. 2007, Sullivan et al. 2011). At this stage, the limiting factors in the precision of the SN results are the systematics of the SNe themselves (e.g., Hicken et al. 2009, Conley et al. 2011). Therefore, one of the best ways to improve the precision of the cosmological results is to improve our understanding of the properties of Type Ia SNe.

Photometry of SNe Ia in the near-infrared (NIR) has shown even greater promise for use as a standard candle. The effects of extinction are greatly reduced, and they appear to have relatively constant peak magnitudes in the *J*, *H*, and K_s band-passes (e.g., Meikle et al. 2000; Krisciunas et al. 2004a,b, 2007). The scatter in the NIR Hubble diagram is ~0.15 mag, independent of the light-curve shape corrections necessary for optical bands (e.g., Krisciunas et al. 2004a, Wood-Vasey et al. 2008, Folatelli et al. 2010). Motivated by this, scientists at NOAO began a Director's discretionary time program to observe SN 2011fe with the WIYN High-Resolution Infrared Camera (WHIRC), an NIR camera at the WIYN 3.5-m telescope on Kitt Peak, taking advantage of the WIYN design that allows for the use of the NIR camera even when other instruments are scheduled for a given night.

Although a later-than-usual monsoon season disrupted some of the early observations, we were able to obtain a well-sampled and high-quality set of NIR light curves (Figure 2). Using the template light curves of Wood-Vasey et al. 2008, we derive values at the epoch of *B*-band maximum for *J*, *H*, and K_s of 10.62 ± 0.11, 10.85 ± 0.12, and 10.68 ± 0.13 mag, respectively. There are several calibrations of the absolute magnitudes of SNe Ia in the NIR, with a range of 0.25 mag in the *H* band. (The *H* band is best constrained and shows the least scatter.) Using the calibration from Wood-Vasey et al. 2008, we derive a distance modulus for M101 of 28.92 ± 0.12 mag, which is 0.1 to 0.2 mag shorter than distances to M101 derived from Cepheids. The calibration of the SNe Ia is contingent upon the cosmology used, mainly that H0 is 72 km/s/Mpc. A value of H0 that is 10% lower would make the SN distance more consistent with the Cepheids. This SN is just one object in a class that exhibits a small but significant intrinsic spread in peak magnitudes; so while it may not demonstrate conclusively that a lower value of H0 is warranted, it does suggest that there is still much work to be done on the local distance scale and the calibration of SNe Ia.

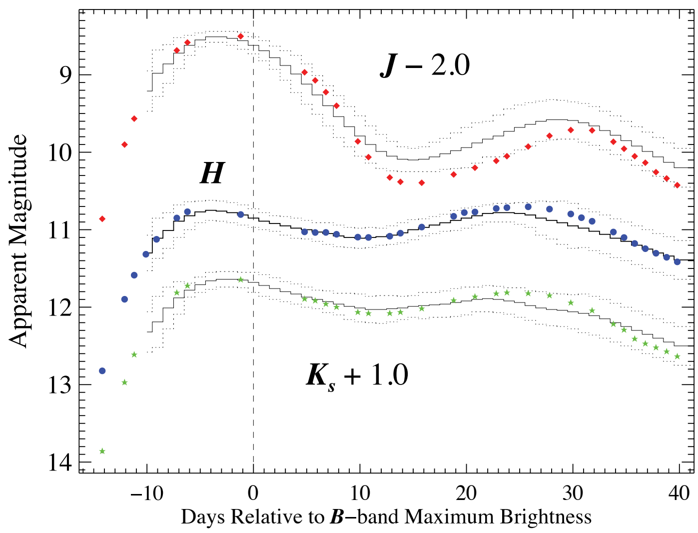

Figure 2: Light curves of SN 2011fe in *J* (red diamonds), *H* (blue circles), and K_s (green stars). Error bars are smaller than the plotted symbols. The *J*-band points are offset by -2.0 mag while the K_s-band points are offset by +1.0 mag. The templates of Wood-Vasey et al. 2008 along with their 1-s envelopes are plotted for each passband. Note that our *J* filter is significantly different than the 2MASS *J* filter used for the Wood-Vasey et al. 2008 template. The vertical dashed line marks the epoch of *B*-band maximum.

A forthcoming paper will explore this in more detail. We thank all of the observers at WIYN who contributed to this project.

Sleeping Giants: Record-Breaking Black Holes Discovered

Nicholas McConnell & Chung-Pei Ma (University of California, Berkeley)

Nicholas McConnell, Chung-Pei Ma, and collaborators Karl Gebhardt (University of Texas Austin), Tod R. Lauer (NOAO), James Graham, Shelley Wright (both of UC, Berkeley and University of Toronto), Jeremy Murphy (UT Austin), and Doug Richstone (University of Michigan) discovered the most massive black holes to date, in two giant galaxies at the hearts of galaxy clusters. Crucial data for the discovery were obtained with the Gemini Multi Object Spectrograph (GMOS) on Gemini North. These surprisingly massive black holes defy predictions based on correlations between black hole mass and stellar velocity dispersion or bulge luminosity. Their discovery may point to a different evolutionary track for black holes in the Universe's most massive galaxies.

Black holes have been detected at the centers of approximately 60 nearby galaxies, based on the dynamics of gas or stars in the vicinity of each black hole. Their masses range from millions of solar masses, such as the black hole at the center of our Milky Way (Ghez et al. 2008, Gillessen et al. 2009), up to 6.6 billion solar masses for the black hole in M87 (Gebhardt et al. 2011). Black hole masses show remarkable correlations with both the stellar velocity dispersion and luminosity of the host elliptical galaxy or spiral bulge (Gebhardt et al. 2000; Ferrarese & Merritt, 2000) (Figure 1): that is, the bigger the galaxy, the bigger the black hole. Data at the highest mass end, however, have been scarce.

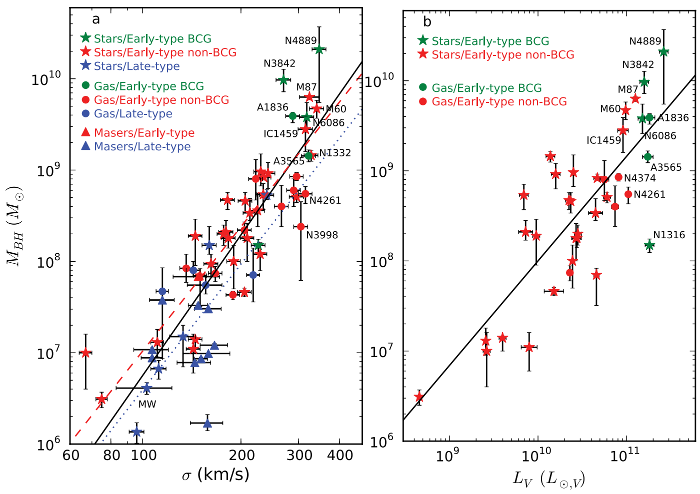

Figure 1: In the local Universe, black hole masses correlate with host galaxies' stellar velocity dispersions (left) and luminosities (right). This figure illustrates the galaxies with direct dynamical measurements of black hole masses based on masers (triangles), stars (stars), or gas (circles) from publications through August 2011. (Figure is courtesy of Nature.)

McConnell and collaborators set out to hunt for massive black holes in Brightest Cluster Galaxies (BCGs). These are giant ellipticals lying near the centers of galaxy clusters and are good candidates for hosting the most massive black holes because they are the most massive galaxies in the local Universe. Only a few of the world's largest telescopes, including Gemini North and South, can resolve the center of a BCG and also collect enough starlight to permit meaningful observations. After much effort, this team achieved a breakthrough in 2011, discovering two black holes with unprecedented masses in the local Universe: a 9.7-billion-solar-mass black hole in the galaxy NGC 3842, the BCG of Abell cluster 1367; and one with comparable or higher mass in NGC 4889, the BCG of the Coma cluster (Abell 1656).

The measurements are based on analysis of the stellar motions near the centers of the two galaxies, using data from GMOS on Gemini North and instruments at Keck Observatory in Hawai'i and McDonald Observatory in Texas. The most essential data for measuring the black holes in NGC 3842 and NGC 4889 were obtained with the integral-field unit (IFU) on GMOS. Figure 2 shows velocity dispersion maps for both galaxies, derived from GMOS data. Queue-mode observations ensured that the team's data were obtained with the best seeing conditions atop Mauna Kea. The scientists were ultimately able to resolve stellar kinematics at angular scales of 0.4 arcsec, corresponding to approximately 200 pc at the distances of NGC 3842 and NGC 4889. Data from the OH suppressing infrared imaging spectrograph (OSIRIS) IFU at Keck helped confirm the stellar motions at similar spatial resolutions, and the Visible Integral-field Replicable Unit Spectrograph - Prototype (VIRUS-P) IFU at McDonald Observatory recorded spectra at the outskirts of each galaxy. The mass of each black hole was determined by comparing the high-resolution and wide-field measurements of stellar kinematics to theoretical galaxy models with stars, a black hole, and a dark matter halo. The models were further constrained to reproduce the images from the Hubble Space Telescope and the KPNO Mayall 4-m telescope.

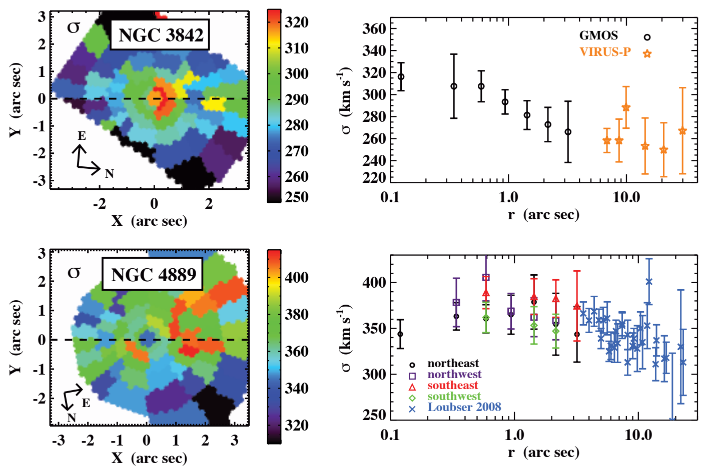

Figure 2: Two-dimensional measurements of stellar motions from the GMOS IFU on Gemini North were crucial for determining the black hole masses in NGC 3842 and NGC 4889. The left panels illustrate the Gaussian dispersion in the line-of-sight stellar velocities from millions of stars, as measured in numerous regions near the center of each galaxy. The right panels show velocity dispersion versus radius after averaging over multiple polar angles, and include data from other instruments at larger radii. In the bottom right panel, the inner-velocity dispersion trend for each quadrant of NGC 4889 is plotted separately.

The discovery of 10-billion-solar-mass black holes in NGC 3842 and NGC 4889 provides circumstantial evidence that some giant elliptical galaxies in the local Universe were once the very brightest quasars. The most massive black holes powering quasars at high redshift have been estimated to weigh 10 to 20 billion solar masses (Vestergaard et al. 2008),

continued

Record-Breaking Black Holes Discovered continued

but, until now, had not been seen in present-day galaxies. Besides being the new record holders, the masses of the black holes in NGC 3842 and NGC 4889 lie systematically above the global power-law fits indicated by the straight lines for the correlation between black hole masses and galaxy properties (Figure 1). These scaling relations help theorists constrain models for how galaxies are assembled and assess the contributions of galaxy mergers and gas accretion to black hole growth.

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Direct Evidence for Helium Variations in Omega Centauri

Andrea Dupree (Harvard-Smithsonian Center for Astrophysics)

Color-magnitude diagrams surprisingly suggest that some globular clusters may contain multiple epochs of star formation. This result upsets the paradigm that clusters are chemically homogeneous and their stars coeval. Variations in the helium abundance are thought to cause the observed multiple main sequences. This conjecture has been tested directly with high-resolution near-infrared spectra using Phoenix on Gemini South (Dupree, Strader, and Smith 2011).

Omega Centauri (Figure 1) is arguably the largest and most massive cluster in the Milky Way, as well as being the "poster child" for having a complex stellar population. The color spread along the red giant branch, noted some 45 years ago (Woolley 1966, Geyer 1967), was conjectured to result from a spread in the [Fe/H] abundance (Freeman & Rodgers 1975). Subsequent studies identified several subgroups of different metallicities. Hubble Space Telescope observations by Anderson (1997), and later Bedin et al. (2004), of a double main sequence in Omega Cen demonstrated that two populations of unevolved dwarf stars coexist in the cluster. This suggests that multiple populations could form intrinsically, rather than resulting from evolutionary processes. Norris (2004) suggested that the double main sequence could occur if one main sequence (the "blue" sequence) contained substantially more helium than the other main sequence (the "red" sequence). Enhanced helium could arise from material processed at high temperatures in a first generation of stars that subsequently formed the second generation. Several other clusters have subsequently been found to have multiple main sequences, making this a general problem.

Figure 1: Color image of Omega Cen from the Hubble Advanced Camera for Surveys. (Image credit: NASA, ESA, and the Hubble Heritage Team-STScI/AURA.)

The production of a second generation of helium-enriched stars presents theoretical challenges. All of the helium from the first generation of stars must be both mixed homogeneously and incorporated into the second generation. It is not at all clear from chemical models that the requisite amounts of helium can be produced. The bifurcation of the main sequence suggests that two separate and distinct bursts of star formation must have occurred.

Detection of Helium

It is difficult to detect helium spectroscopically in the cool stars that dominate the population of globular clusters. It is easier to detect helium in hot, horizontal branch stars, but diffusion and preferential element settling can occur making a surface abundance unreliable. However, the near-infrared spectral region contains a unique transition in neutral helium at 1.08 μm. This line has been detected in metal-poor giant stars both in the field and in globular clusters and is optimal for measuring the helium abundance in cool luminous stars. High spectral resolution (>~30,000) is needed because the line is weak, and measurement of the profile can indicate mass outlflow from winds with velocities greater than ~50 km/s.

We have detected the helium line in luminous metal-poor giants with effective temperatures higher than 4500° K. Targets in Omega Cen were chosen from a restricted region of temperature and luminosity among the red giants, avoiding the asymptotic branch objects and horizontal branch stars (Figure 2). The distribution of equivalent widths among this sample of stars could reveal a variation in the strength of the helium line, which is expected to reflect principally abundance differences. The

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Direct Evidence for Helium Variations in Omega Centauri continued

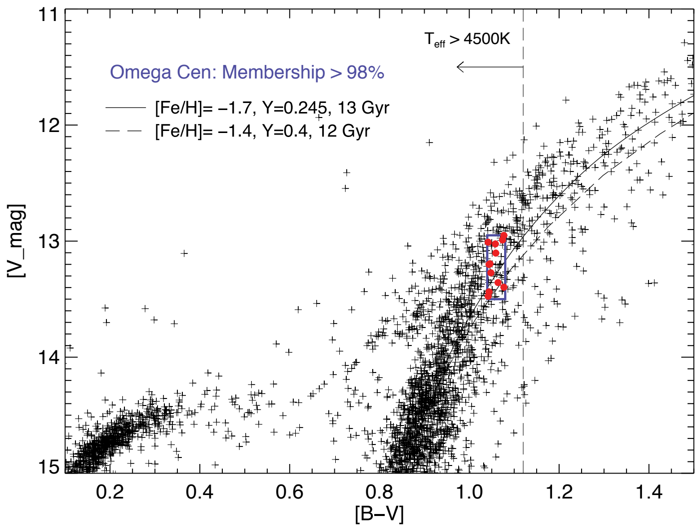

Figure 2: Color magnitude diagram of the Omega Cen stars from van Leeuwen et al. (2000) with better than 98% membership probability. Isochrones from the Dartmouth Stellar Evolution Database. Our targets are marked by red circles. (Dupree, et al. 2011, ApJ, 728, 155; reproduced by permission of the AAS.)

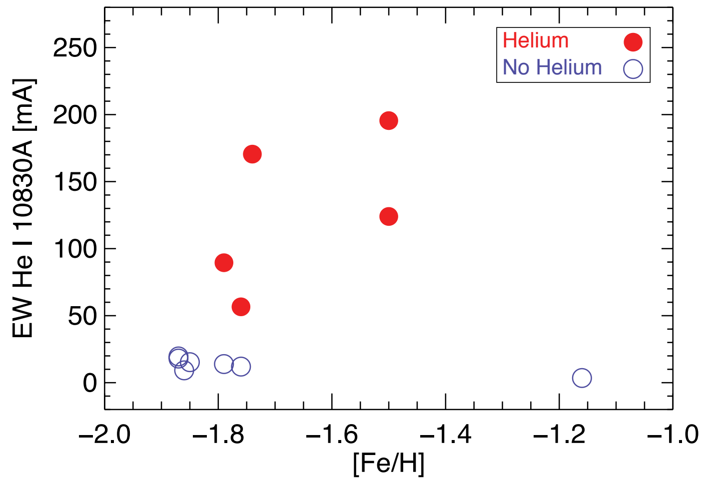

Figure 4: Equivalent width of the He i 1.08 μ line as a function of [Fe/H]. No correlation is apparent. (Dupree, et al. 2011, ApJ, 728, 155; reproduced by permission of the AAS.)

Phoenix spectrograph, temporarily installed on Gemini South, was used for three nights of classical time in March 2010. The spectral resolution was ~50,000. Twelve giants in Omega Cen were measured, and helium absorption was detected in five stars. Figure 3 shows the spectra of two targets, one containing helium (LEID 54084), the other lacking helium (LEID 54064). These two stars are effectively identical in abundance of [Fe/H] and temperature. There is no correlation of the presence of helium with position in the color magnitude diagram, nor with the iron abundance (Figure 4). These results suggest that a true variation in the helium abundance is present in Omega Cen (Dupree, Strader, & Smith 2011). The lack of helium in the most metal-poor [Fe/H] stars and its presence in the stars of intermediate metallicity appears understandable in terms of first-generation pollution. The most [Fe/H] rich target in the sample, without detectable helium, gives additional support to the presence of an old, metal-rich population of subgiants and the lack of a clear age-metallicity relation in Omega Cen (Villanova et al. 2007).

If this variation is the product of a previous generation of stars that underwent high temperature hydrogen burning, then other products, such as the light elements Na and Al, would be expected to appear. Echelle spectra from the Magellan Inamori Kyocera Echelle (MIKE), dual-beam spectrograph on Magellan/Clay, were obtained for our target stars in July 2010. The region of the sodium lines is shown in Figure 5 for the two stars discussed previously. The similar strength of the Fe lines contrasts with the differing strength of Na in these stars, one of which displays helium, the other does not. Our spectra show that the stars with detected helium are preponderantly those with enhanced Al and Na (Figure 6).

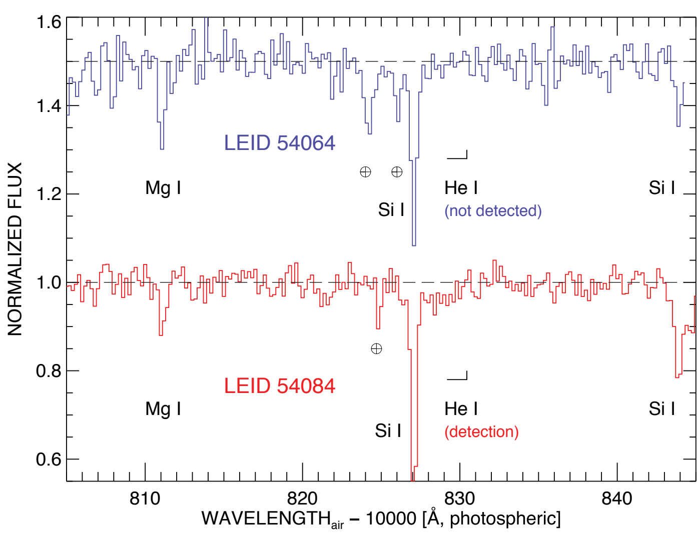

Figure 3: Phoenix spectra of two giant stars of very similar effective temperature and [Fe/H] abundance: LEID 54084 showing helium and LEID 54064 without helium. (Dupree, et al. 2011, ApJ, 728, 155; reproduced by permission of the AAS.)

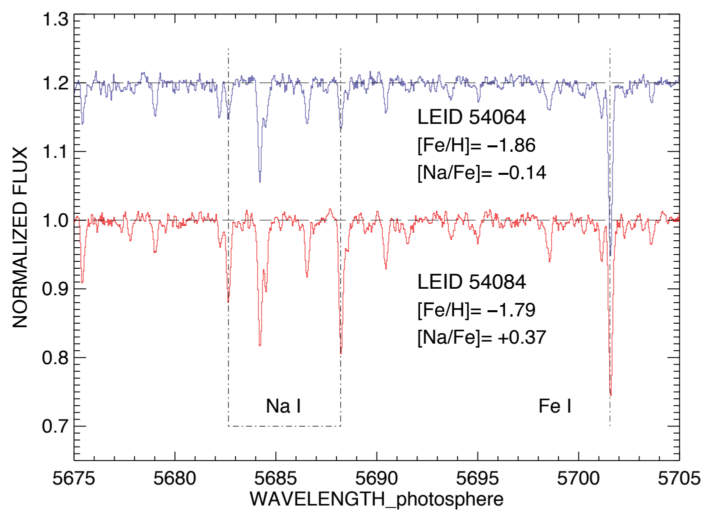

Figure 5. Region of the Na lines in MIKE spectra of the same two stars as shown in Figure 3. Both stars have similar [Fe/H]; LEID 54084 shows helium and LEID 54064 does not. The enhanced value of [Na/Fe] in the giant with helium is apparent from the spectra. (Dupree, et al. 2011, ApJ, 728, 155; reproduced by permission of the AAS.)

continued

Direct Evidence for Helium Variations in Omega Centauri continued

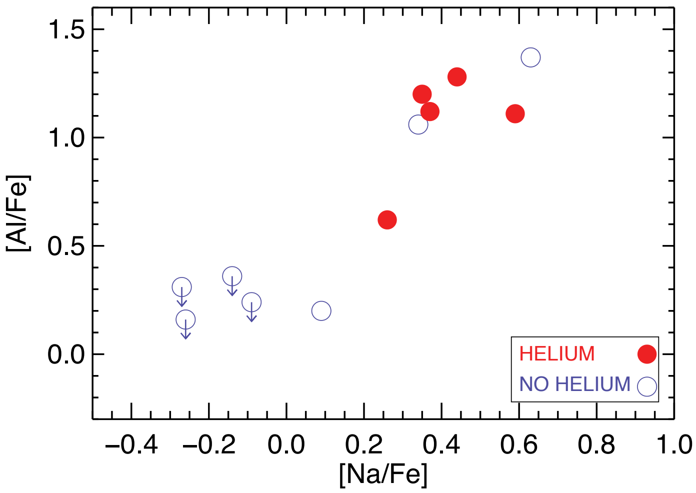

Figure 6: Relation between [Al/Fe] and [Na/Fe]. Stars with detected helium are preponderantly those with enhanced Al and Na. Downward pointing arrows mark upper limits to the [Al/Fe] values. (Dupree, et al. 2011, ApJ, 728, 155; reproduced by permission of the AAS.)

Conclusions

This first direct detection of a helium abundance variation, and its correlation with light element variation, confirms the conjecture that the "blue" main sequence could be helium enhanced and gives strong support to the presence of a second generation of stars in Omega Centauri.

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The Near-Earth Fly-by of Asteroid 2005 YU55

Nicholas Moskovitz (Carnegie Institution of Washington)

Nicholas Moskovitz and a team of collaborators that includes Lucy Lim (NASA Goddard Space Flight Center), Joshua Emery (University of Tennessee Knoxville), Bin Yang (University of Hawai'i), Scott Sheppard (Carnegie Institution of Washington), Mark Willman (University of Hawai'i), and Mikael Granvik (University of Helsinki) carried out a coordinated multi-observatory campaign to obtain visible through mid-infrared (0.4–22 µm) spectra of near-Earth asteroid 2005 YU55 during its close encounter with Earth in early November of 2011. These spectra will result in a detailed understanding of the composition and surface properties of this asteroid. These data will complement other studies of 2005 YU55, including radar observations from the Goldstone and Arecibo observatories, and a photometric light curve campaign that has constrained the rotation period between 16 and 20 hours (Warner et al. 2012).

About once every decade, a large near-Earth object passes inside of the Moon's orbit. On 8 November 2011 at 23:28 UT, the approximately 360-m asteroid 2005 YU55 passed Earth at a distance of 0.0022 AU (~3.3×10^5 km) and reached a brightness of V ~ 11 (Figure 1). This enabled a host of novel investigations of an object ordinarily too faint for extensive multiwavelength observations. The goals of our campaign were to (i) robustly determine the composition of 2005 YU55; (ii) determine whether the reflectance spectra were affected by the range of observed phase angles, i.e., the Sun-asteroid-Earth angle, which varied from 75° down to 16° during our observing run; (iii) constrain the thermo-physical properties of 2005 YU55's surface; and (iv) determine whether 2005 YU55 displays any physical or chemical heterogeneity across its surface.

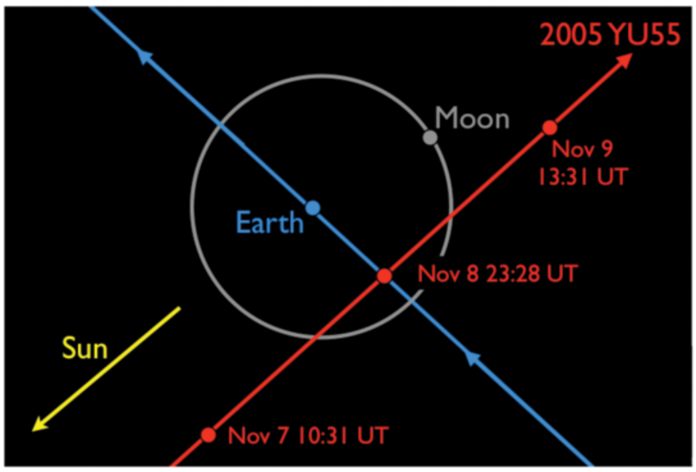

Figure 1: Geometry of asteroid 2005 YU55's close approach to Earth. The orbital directions of Earth (blue) and 2005 YU55 (red) are indicated with arrows. The direction of the Sun and the orbit of the Moon are also shown. The location of 2005 YU55 is indicated at three different times during the encounter. At its closest approach, 2005 YU55 passed within 90% of the Earth-Moon separation at a distance of 0.0022 AU. (Adapted from an image by J. Giorgini, JPL.)

Our campaign was conducted over two nights immediately following closest approach (UT November 9 and 10). Visible spectroscopy was carried out at the Kitt Peak 2.1-m telescope using the GoldCam CCD Spectrograph (GCAM). Near-infrared spectroscopy was performed us-

continued

Near-Earth Fly-by of Asteroid 2005 YU55 continued

ing SpeX at NASA's Infrared Telescope Facility (IRTF) and TripleSpec at the Palomar 200-in Hale Telescope. Michelle at Gemini North was used to obtain mid-infrared photometry and spectroscopy. The use of multiple instruments helped to maximize phase-angle coverage and will allow verification of possible spectral variability. The full range of data will be used to constrain the composition of the asteroid. The data at longer wavelengths (2.0–22 µm) measure thermal emission from the asteroid. Modeling this component can aid searches for variability in thermal properties that could indicate heterogeneous regolith depth or grain size across the surface. Such variability has been detected by spacecraft (Abe et al. 2006), but has been difficult to measure from the ground.

The rapid nonsidereal motion of 2005 YU55 was the most challenging aspect of these observations. At its fastest, the asteroid reached a nonsidereal rate of nearly 9 "/sec. However, because 2005 YU55 was approaching from the sunward direction (Figure 1) it was impossible to test nonsidereal operation of the telescopes on the actual target prior to the encounter. Thus, we found similarly bright, rapidly moving alternatives to serve as test objects, namely the Chandra X-ray Observatory and the Solar Dynamics Observatory. Observations of these satellites were performed several nights before the encounter and proved that we could acquire and maintain guiding on fast-moving targets by applying pointing corrections based on continuous readout of the slit viewing cameras.

Figure 2 shows a time series of spectra from TripleSpec taken on November 9. Asteroid 2005 YU55 has a featureless, red-sloped, near-infrared (NIR) spectrum and shows pronounced thermal emission at wavelengths beyond about 2.1 µm. Based solely on the NIR data, 2005 YU55 is part of the C- or X-complex in the Bus-DeMeo taxonomy (DeMeo et al. 2009) and thus may have a chemical composition related to carbonaceous chondrite meteorites. We will search for a 3-µm absorption band in our data, a feature commonly attributed to the presence of hydrated minerals (Rivkin et al. 2002). Detection of this feature would support the putative connection to carbonaceous chondrites. Initial modeling of the thermal emission from the asteroid indicates an emission peak around 8 µm, which is indicative of a subsolar temperature between 350° and 400° K. Initial spectral modeling indicates variability in slope throughout the observing run, the cause of which is currently unclear. Potential sources for this variability include phase angle, rotation, and observing conditions.

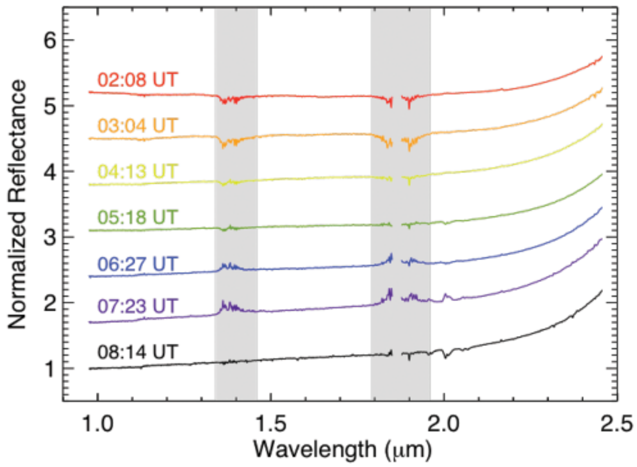

Figure 2: Near-infrared spectra of asteroid 2005 YU55 taken with the TripleSpec instrument at the Palomar 200-in Hale Telescope on 9 November 2011. The spectra have been normalized and offset for clarity. The grey bars represent regions of low atmospheric transmission where telluric correction is poor. The gap in the spectra around 1.85 µm is due to nonoverlapping spectrographic orders. The time stamps for each spectrum represent the midpoint of the observations. These spectra show a featureless, red-sloped reflectance with significant thermal emission longward of ~2.1 µm.

Acknowledgments

We would like to thank the observatory staff who provided invaluable assistance in preparing for and executing these challenging observations. At Kitt Peak: Dianne Harmer and David Summers. At Palomar: Jean Mueller and Kevin Rykoski. At Gemini: Chad Trujillo, Marie Lemoine-Busserolle, Rachel Mason, Tony Matulonis, and Lucas Furhman. At the IRTF: John Rayner.

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Preparing for the Installation of the Dark Energy Camera

Alistair Walker & Tim Abbott

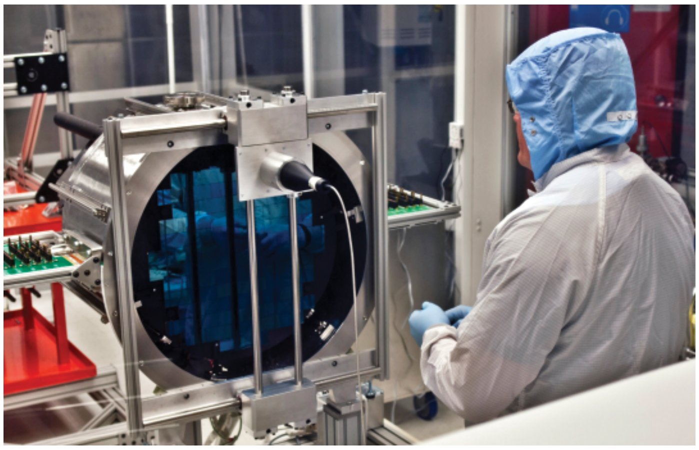


Figure 1: Greg Derylo (Fermilab) and the DECam focal plane array. (Image credit: Tim Abbott/NOAO/AURA/NSF.)

Figure 2: David Brookes of UCL examines and cleans the front surface of the C1 lens. (Image credit: Tim Abbott/NOAO/AURA/NSF.)

The Dark Energy Camera (DECam) is a new, wide-field, facility CCD imager for the CTIO Blanco 4-m telescope that is currently undergoing integration in the Blanco dome. This article is an update to one that appeared in the September 2011 *NOAO Newsletter* on pages 17–18.

Two major shipments have arrived recently. In late November, the imager vessel containing the 74 CCDs (570 megapixels!) was shipped from Fermilab to Cerro Tololo. Following checks that no physical damage had occurred en route and removal of shipping fixtures, the cryostat was closed and pumped, then the focal plane was cooled. A series of tests led by Juan Estrada and the Fermilab team showed that the CCDs had all survived the journey and were performing exactly as they had during testing at Fermilab. Open-Dewar work was carried out in the newly completed, high-quality clean room in the Blanco coudé room. The coudé room has also been significantly remodeled as a climate-controlled, instrument maintenance facility where all other work on the imager is taking place. Figure 1 shows Fermilab' s Greg Derylo in front of the exposed focal plane and using the flatness measuring jig inside the clean room.

Much of the rest of December and January was been devoted to exercising the system, testing and improving software, and training CTIO support staff.

In early December, the new prime-focus optical corrector was shipped from University College London (UCL) to Cerro Tololo, arriving just before Christmas. The five optical elements, the largest almost one meter in diameter (see Figure 2), had been carefully mounted and centered in their cells at UCL during the preceding months; the final steps were to mount the largest lens (C1) into the "cone," and the others (C2–C5) into the "barrel." The cone and barrel join together inside the prime-focus (PF) cage; but, to reduce the size of the shipping crate, the cone and the barrel were packed separately in custom boxes with careful attention to shock and vibration isolation. By late January, the corrector had

Figure 3: CTIO's DECam installation engineer, Freddy Muñoz (left), and telescope operations manager, Gale Brehmer, assist during a rotation test of the DECam cage loaded with dummy weights to emulate the mechanical behavior of the assembly during installation. (Image credit: Tim Abbott/NOAO/AURA/NSF.)

continued

Preparing for the Installation of the Dark Energy Camera continued

been reassembled, tested, and shown still to conform to the alignment specification after its long journey. Work on the corrector optics has taken place inside a custom-built room, designed to control dust, in the ground-floor garage space of the Blanco building.

These two shipments almost complete the arrival of all the DECam components at CTIO, with the only significant remaining shipment being that of the DECam *g* filter, which is due to be delivered by Asahi in March or April 2012.

In the meantime, the CTIO crew has been completing preparatory work, such as upgrading the Telescope Control System and (in collaboration with engineers from NOAO North) designing modifications to the Cassegrain cage of the telescope to compensate for the additional weight of DECam at the top end. The challenge was to fit more than seven tons of counterweight into the existing Cassegrain cage volume, while confirming that the distribution and resulting stresses do not alter the delivered optical quality. The final design relies upon modifications to the current cage: adding lead counterweights with appropriate balance and attention to airflow for Cassegrain instrumentation (see Figure 3).

The focus of activities now turns to the installation of DECam, for which detailed planning has been underway for more than a year.

The Blanco telescope will be taken out of service on February 20, when we will remove the present PF cage and all its contents, and replace them with the new cage and the new corrector. We also will install a complex utilities system (liquid nitrogen hoses, water-glycol hoses, and many cables), carefully align and test these new systems, test and align the *f*/8 mirror, and then install the DECam imager itself. All in all, this is a complex and carefully choreographed process with several hundred individual tasks, involving staff from CTIO, KPNO, and the Dark Energy Survey Collaboration.

All being well, we expect DECam first light to be on August 1 and science verification programs to be in October.

Mock Observing with DECam

Eric Mamajek

On January 23 and 24, Marcelle Soares Santos (Fermilab) hosted mock observing sessions for NOAO and CTIO staff members with the Dark Energy Camera (DECam). Participating in the mock observing sessions were NOAO South scientific staff members Alistair Walker, Tim Abbott, David James, and Eric Mamajek and NOAO North scientific staff Knut Olsen and Abi Saha.

DECam contains a focal plane of 62 2K × 4K Lawrence Berkeley National Laboratory red-sensitive CCDs (plus 12 CCDs for focus and guiding) and will offer NOAO observers wide-field imaging with a 520-megapixel camera in the 0.3- to 1.0-micron bands over a 3-square-degree field of view. Current plans are to have *ugrizY* filters available for the first community observing, and it is hoped that funding can be secured for constructing more filters. Most of the DECam components have already been shipped to Cerro Tololo during the past few months (see "Preparing for the Installation of the Dark Energy Camera" in this *Newsletter* issue) and will be integrated with the Blanco 4-m telescope during a shutdown period starting in February 2012. Soares Santos and other members of the Dark Energy Survey (DES) team have spent considerable time at Cerro Tololo working on and testing DECam and its components in lab spaces, and CTIO staff have been working closely with the DES team to prepare for putting DECam on the Blanco telescope.

Marcelle Soares Santos demonstrates the SISPI software for controlling DECam in the new control room of the Blanco 4-m telescope. (Image credit: Eric Mamajek/NOAO/AURA/NSF.)

The mock observing sessions in late January were an opportunity for the DES team to test the Survey Image System Process Integration (SISPI) system (the hardware and software needed to control DECam and process its data stream) and demonstrate its capabilities in time to identify improvements that can be made before on-sky commissioning begins in mid 2012. The DES team incorporated a fake telescope control system (TCS) to interact with SISPI to make it feel like we were already using DECam on sky. The system operates with several graphical user interfaces (GUIs) that require every bit of the eight computer displays at the new observer console in the Blanco control room. The GUIs include a main observer console for selecting parameters for exposures, editing the observing queue, and monitoring the flow of data from the DECam focal plane to the archives in the US. Also, there are GUIs for monitoring the health of the 62 science and 12 focus and guiding CCDs, a console for monitoring the health of the SISPI components, a variable monitor for plotting variables for troubleshooting or that are simply of interest to the observer, an exposure table summarizing the data already taken, an alarm history, an interlock viewer, an instrument control system status GUI, a telemetry viewer, a script editor (to create an observing queue), an electronic log book, a guider GUI, and an exposure browser. The system appears to be in good health, and we can hardly wait to try it out on sky!

BigBOSS Passes DOE Review with Flying Colors

Michael Levi (Lawrence Berkeley National Laboratory) & Arjun Dey (NOAO)

The Big Baryon Oscillation Spectroscopic Survey (BigBOSS), the project selected in response to NOAO's Large Science Program Call (see *www.noao.edu/kpno/largescience.html*), aims to create a powerful, new spectroscopic capability for the KPNO 4-m Mayall Telescope. The BigBOSS instrument is a 5000-fiber spectrograph with a 3-deg field of view that will undertake a large galaxy redshift survey to constrain various cosmological parameters and be available for community science programs (see *bigboss.lbl.gov/* and Schlegel et al. 2011, arXiv:1106.1706). BigBOSS will be an extremely powerful resource for the broad NOAO community, enabling a wide range of science, as discussed in the September 2011 NOAO Community Workshop (see *www.noao.edu/meetings/bigboss*).

The DOE review panelists from left to right: Dan Green, Wayne Hu, Ian Dell'Antonio, Andy Albrecht, Alan Uomoto, Adam Lyon, Paul O'Connor, Jeffrey Pier (NSF/observer), Kathleen Turner (Chair), Scot Olivier, and Jordan Goodman. Also attending the review from NSF were James Ulvestad and James Whitmore. (Image credit: Kathleen Turner, DOE.)

On 6–7 December 2011, the Department of Energy (DOE) Office of High Energy Physics held an independent peer review of the proposed BigBOSS project at the Lawrence Berkeley National Laboratory (LBNL). The review covered the dark energy science case, the near-term research and development plan, and the plan for the overall project (fabrication and survey). The review was chaired by Kathleen Turner, the DOE Federal Program Manager for the Cosmic Frontier. Nine independent scientists with expertise in the scientific, technical, cost, schedule, and management aspects of the experiment served as review panel members.

The review report, which was submitted in late January to the collaboration and the LBNL director, was extremely favorable. The review report states: "[The] collaboration made a compelling case that the spectroscopic survey would represent the state-of-the art in BAO [baryon acoustic oscillations] measurements … competitive with the BAO components of proposed space-based stage IV missions," (i.e., Euclid and Wide-Field Infrared Survey Telescope-WFIRST). The report also states that, "the team has succeeded in addressing almost all the concerns raised in a non-advocate review held by NOAO, significantly reducing the risk to the project."

The review panel expressed confidence that the proposed research and development (R&D) plan will lead to a mature technical design within 18 months, i.e., by the time of the proposed construction start. The panel identified the continued NSF operations funding for the Mayall telescope as one of the major hurdles facing the project. They also encouraged DOE to move forward quickly and aid the collaboration in securing the international funding for the project. The panel felt confident that the team can proceed quickly as soon as these issues are resolved.

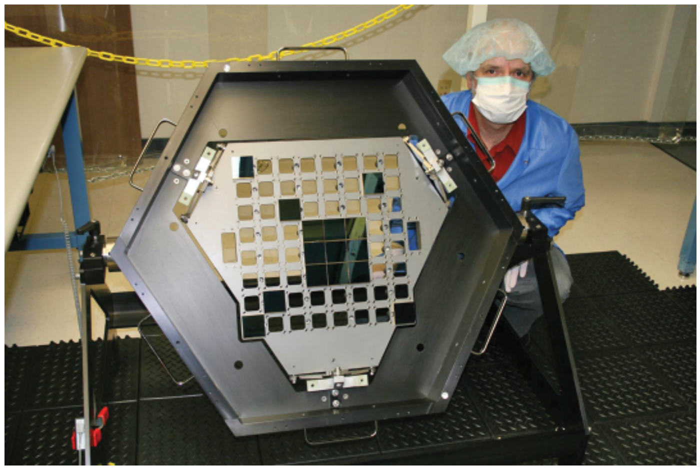
As a result of this review, the project will proceed into a DOE-funded, 18-month R&D phase, during which the collaboration will finalize the design of the instrument, retire risks, and further advance the scientific case and technical plans. NOAO and the BigBOSS collaboration eagerly await the results of the NSF Astronomy Portfolio Review, which will determine the outlook for continued operations of the KPNO Mayall telescope, a critical component of the BigBOSS project.

The WIYN One Degree Imager Comes to the Telescope (Soon)

Todd Boroson

The WIYN One Degree Imager (ODI) has been the planned centerpiece of the WIYN 3.5-m instrument complement for a number of years. This optical imager is distinguished by a large field of view, one degree square; a small pixel scale, 0.11 arcsec per pixel; and a novel type of detector, orthogonal transfer arrays (OTAs). The 64 OTAs that will cover the ODI focal plane are each composed of 64 independent 500 × 500 light-sensing "cells." Within each cell, the accumulated charge can be shifted in either the horizontal or vertical direction at a rate of tens of Hertz in order to follow the motion of an image. Individual cells can be read out at video rates in order to measure guide-star motions. Consequently, ODI will be able to produce a one-degree-square image in which each isokinetic patch has been tip-tilt corrected, yielding image quality as good as 0.3–0.5 arcsec full width half-maximum (FWHM) over the entire field. The entire focal plane will be read out in 20 seconds.

In late 2010, the project to build ODI was nearing completion, but facing a number of critical issues, including difficulties in fabricating the detectors. After a year-long hiatus, during which an NOAO-led team reviewed the issues and pursued the detector problems, the project restarted. The team is now poised to deploy a version of ODI with a partially populated focal plane (known as pODI) at the WIYN telescope in July 2012, with open access planned to begin in the 2013A semester.



Dave Ouellette of the University of Arizona Imaging Technology Laboratory (ITL) holds the pODI focal plate with 14 functional detectors and one nonfunctional detector in the lower left corner. Each detector covers about 8 arcmin on an edge. ITL was contracted to thin and package the detectors and to mount them on the focal plate. The imaging surface is flat to within 20 microns. (Image credit: M. Lesser, ITL.)

While the pODI phase has the great benefit of allowing us to commission the instrument and explore its capabilities, the pODI instrument also will have several limitations compared to the full ODI, which is planned as a future upgrade. The pODI will have 14 OTA detectors configured on the focal plane as shown in the figure. This will allow us to provide a central field of 24 × 24 arcmin with five outlying fields of 8 × 8 arcmin. The most significant remaining problem with the detectors is that their on-chip amplifiers glow during readout; therefore, any OTA that is being used for guide-star monitoring will see this glow, and its use for science data will be compromised. Thus, we plan to support only two modes with pODI: a "static imager" mode, in which the guide signal from one or more guide stars on the outlying detectors is used to move the telescope in the traditional way, and a "coherent guide" mode, in which this averaged guide signal is used to do on-chip shifting of all the detectors coherently. This will remove telescope windshake and very low-level ground-layer seeing effects, but will not achieve the local tip-tilt correction that is the ultimate goal of this instrument.

With the caveats above, we expect the performance characteristics of pODI to be competitive with other optical imagers in terms of sensitivity, read noise, and full well capacity. We have acquired four broadband filters, *g'*, *r'*, *i'*, and *z'*, and we are exploring the purchase of a *u'* filter and a narrowband H-alpha filter.

ODI, and even pODI, will produce data volumes and rates that will tax most users' abilities to easily process or even visualize their data. The pODI instrument will produce almost half a gigabyte per readout. Users will come away from a three-night run with a quarter of a terabyte of data. ODI will scale up these numbers by a factor of 5. Consequently, we will not rely on traditional methods for data management, transport, reduction, or analysis. Simultaneous with the instrument development, a data system called ODI Pipeline, Portal, and Archive (ODI-PPA) is being developed in a collaboration that includes WIYN, NOAO, and Indiana University's Pervasive Technology Institute. This system will give users access to their pipeline-reduced data from pODI as well as tools for analysis that will run at Indiana University or on the Extreme Science and Engineering Discovery Environment (XSEDE), an NSF-supported cluster of supercomputing resources. Archival storage also will be provided, and pODI data will be made publicly available after its proprietary period has expired.

Our current schedule has us installing pODI on the WIYN telescope in July 2012 at the conclusion of summer shutdown. Commissioning activities will proceed through semester 2012B (see accompanying article on WIYN availability, "The Arrival of pODI at the WIYN 3.5-m Telescope: Its Impact on 2012B Scheduling"). We hope to offer pODI for general observing in 2013A.

TORRENT Controllers Begin Observatory Service

David Sprayberry, Peter Moore & Ron George

The TORRENT team, part of the NOAO System Technology Center, has completed development and testing of the TORRENT detector controller. The first TORRENT unit entered scientific service in February 2012, controlling the e2v 4K × 4K CCD on the CHIRON high-resolution spectrograph. CHIRON is deployed on the CTIO 1.5-m telescope and was developed by a team led by Debra Fischer at Yale University with significant support from Andrei Tokovinin, a CTIO astronomer, as well as the CTIO engineering and technical staff.

TORRENT is an evolutionary progression in design from the MONSOON controller architecture that also was developed at NOAO. The design goals of MONSOON included, among other things, the ability to control arbitrarily large focal planes. The MONSOON design includes a number of features that are needed to allow scaling up to very large numbers of pixels and readout channels. These features have proven extremely useful where needed, on large imagers with rapid readout requirements like the NEWFIRM wide-field infrared imager and the Dark Energy Camera, both of which use MONSOON controllers. However, these features also dictate a large physical size and large power consumption for the MONSOON controllers. NOAO also needs a modern, supportable, detector controller that is small and energy efficient to serve on smaller instruments and to replace existing obsolete controllers that are becoming unrepairable because spare parts are no longer available.

Figure 1: Size comparison between a TORRENT controller (right) with its power supply (small black "brick" in foreground) and a MONSOON unit (middle) with its rack-mountable power supply (left). Both controllers pictured support eight video input channels and achieve the same readout speeds, readout noise, and other detector performance characteristics. (Image credit: Mark Hunten/NOAO/AURA/NSF.)

TORRENT is that new controller, designed to support existing and new optical and infrared instrument applications. The CCD version is limited to eight video inputs per unit while still providing the same detector-limited performance achieved with MONSOON. The TORRENT units are significantly smaller, as shown in Figure 1, and incorporate auxiliary functions such as shutter and detector temperature control while consuming less than half of the power used by a MONSOON controller with the equivalent number of video inputs. The TORRENT controllers are lead-free and compliant with the European Union Restriction of Hazardous Substances (RoHS) directive, which limits hazardous substances in electronics. The size and shape of the TORRENT allows it to be mounted directly to the side of the CCD Dewar, as shown in Figure 2, eliminating the need for cabling. The TORRENT controller provides self-calibration and electronic unit interchangeability to facilitate observatory maintenance functions and reduce observing downtime. Like the MONSOON, all signals into and data coming out of the TORRENT travel over a dedicated optical-fiber pair to the control computer. Again like the MONSOON, the control computer is a standard personal computer running the Linux operating system.

Figure 2: A fully assembled TORRENT controller mounted on a CCD Dewar in the NOAO Tucson detector laboratory. The Dewar contains the science grade e2v CCD for KOSMOS. The detector performance is currently being optimized in preparation for delivery of KOSMOS to KPNO in the very near future. The shiny cylinder bolted to the top of the Dewar contains the Fe-55 radiation source used in the optimization process. (Image credit: Ron George/NOAO/AURA/NSF.)

The TORRENT also continues the MONSOON philosophy of fully open source designs. All the design notes, circuit schematics, board layouts, parts lists, firmware, and software source codes, are or will soon

continued

TORRENT continued

be available for free on the NOAO Web site. Any interested person or institution is welcome to download the design information, build their own TORRENT, or modify the design so long as they do so consistently with the terms of the open source license agreement on the Web site. In addition, NOAO may (subject to availability) be willing to make assembled and tested TORRENT units available for the cost of reproduction.

For technical information about the TORRENT controllers, please contact Peter Moore (*pmoore@ctio.noao.edu*) or Ron George (*rgeorge@noao.edu*). For information about the license agreement or other administrative matters, please contact David Sprayberry (*dsprayberry@noao.edu*). NL

KOSMOS and COSMOS Updates

Jay Elias

This article provides an update on the delivery status for the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) and the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS), as well as the policies for applying for KOSMOS time in semester 2012B.

Capabilities

Information on the instrument capabilities can be found in the "KOSMOS and COSMOS Updates" article on page 12 of the September 2011 *NOAO Newsletter* (*www.noao.edu/noao/noaonews/sep11/pdf/104syssci.pdf*). The most current information on the KOSMOS/COSMOS capabilities as well as relevant technical documentation can be found at *www.noao.edu/nstc/kosmos/*.

Schedule and Proposal Policy

In the September 2011 *Newsletter* article, we reported that we were waiting for final delivery of the optics, which had been figured but not coated or assembled at the vendor. Since then, a series of issues with specific coatings and cemented lens assemblies have significantly delayed final delivery of the completed camera and collimator assemblies.

As of the end of January 2012, the collimator assemblies for both instruments have been completed, and they are awaiting acceptance testing, which will take place when the cameras are also completed. The camera assemblies are awaiting re-cementing of two triplets and a doublet (for the combined systems). A firm schedule is not available at this time; it is possible but not certain that KOSMOS will arrive on Kitt Peak in time for its first scheduled run in April.

Given that even the first telescope run will occur after the deadline for proposal submission, and that commissioning will likely be incomplete at the time the Telescope Allocation Committee meets, we are adopting the following policy for requesting KOSMOS (please see the 2012B Call for Proposals for the definitive rules; this is the same policy as was set for 2012A in the September 2011 *Newsletter*):

- Proposers should only write proposals that can be carried out with the R-C Spectrograph or the Multi-Aperture Red Spectrometer (MARS).
- Proposers who would be interested in using KOSMOS if it becomes available should indicate this in their technical section and describe 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 2012B, 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. COSMOS commissioning will take place following DECam commissioning at CTIO, probably beginning during the second half of semester 2012B.

2012B NOAO Call for Proposals Due 29 March 2012

Knut Olsen & Dave Bell

Proposals for NOAO-coordinated observing time for semester 2012B (August 2012–January 2013) are **due by the evening of Thursday, 29 March 2012, 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 and the 200-in (5-m) Hale Telescope at Palomar Observatory.

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 System 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*. The PIT has changed significantly this semester, so please download the new tool and get started early to ensure that you will have sufficient time to complete your proposal.

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*

Update on Blanco 4-m Availability: 2012A Shutdown and DECam Commissioning and Science Verification in 2012B

Chris Smith & Nicole van der Bliek

In the September 2011 *NOAO Newsletter*, we reported that CTIO was planning to begin installation of the Dark Energy Camera (DECam) on the Blanco 4-m telescope. This moment is now upon us. On February 20, the Blanco was taken offline for a period of more than four months.

2012A: Blanco Shutdown & Telescope Recommissioning

During this shutdown, we will replace the prime-focus cage of the telescope, including the ƒ/8 mounting assembly, and install the new imager. We will disassemble the telescope in order to remove and replace the whole top-end cage assembly, the most significant change made in the telescope's almost 40-year history.

Recommissioning the telescope after these fundamental changes will occupy the remainder of 2012A. We will first commission the new ƒ/8 system and the new Telescope Control System (TCS), followed by commissioning of the DECam imager itself. More information on DECam's arrival and the preparations for the shutdown can be found in the article "Preparing for the Installation of DECam" in the System Science Capabilities section of this *Newsletter*.

Given this schedule, we do not expect to be able to carry out significant regular observations in 2012A. From the 2012A proposal cycle, we have scheduled a few nights of observations in early February with the ƒ/8 instruments Hydra and Infrared Side Port Imager (ISPI). In addition, we have selected several highly ranked proposals for possible observations in late 2012A or the very beginning of 2012B if the installation and commissioning run ahead of schedule. Principal investigators will be notified if and when we can schedule these observations. These observations will be carried out in service mode or remotely, to maintain flexibility in the telescope and DECam commissioning schedule while maximizing the opportunities for science.

2012B: DECam Commissioning, Science Verification, DES, & Shared-Risk Opportunities

We plan to begin the commissioning of DECam in August 2012. While the instrument has been thoroughly tested before installation, both on a telescope simulator at Fermilab and on the floor at CTIO, it is a complex system, and we want to get the best performance we can out of the new features such as precise positioning with its hexapod mount and the automated focus system. The commissioning plan includes two phases of DECam tests, with two to three weeks of ƒ/8 observing between them. Finally, we expect science verification to start in October, transitioning into the Dark Energy Survey (DES) and shared-risk observations from mid-October through the end of the semester. In the 2012B Call for Proposals, we will have more details about the expected distribution of science verification, DES, and shared-risk observing time.

Community Access to the Blanco in 2013A and Beyond

DES observations are concentrated in the period of September through January, with some half-night observations in February. Therefore, community access in the A semesters, starting in 2013A, should be largely normal. We are looking forward to offering access to the full complement of instruments (DECam, Hydra, and ISPI) in 2013A, with the addition of the Cerro Tololo Multi-Object Spectrograph (COSMOS) as soon as it can be commissioned (see the "KOSMOS and COSMOS Updates" article elsewhere in this *Newsletter* for more information).

In the B semesters during the five years of DES observations (2012–2017), the community will have access to roughly one week per month in September through January. Although community access is limited in the survey period, 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 only have 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 2012B

Charles Bailyn

Due to financial limitations, we have curtailed some activities at the 1.0-m and 0.9-m telescopes starting in semester 2012A. The 1.0-m and 0.9-m telescopes are only scheduled one at a time, i.e., at any given time, either the 1.0-m or the 0.9-m telescope is in use, but not both.

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. In addition, as of May 2012, we will offer service observing at the 0.9-m telescope only in a campaign mode, so regular monitoring projects will be much more difficult to accommodate.

Proposers are encouraged strongly to consult the SMARTS Web pages prior to proposal submission for the latest information.

Phoenix Returns to Kitt Peak

Ken Hinkle & Dick Joyce

Test and evaluation time for Phoenix, the NOAO high-resolution, 1- to 5-micron, infrared spectrograph, is scheduled for early February 2012 on the Kitt Peak 2.1-m telescope. The purpose of this run is to evaluate Phoenix before offering it on both the 2.1-m and Mayall 4-m telescopes in the 2012B semester. Because the test and evaluation run will take place after the deadline for this issue of the *NOAO Newsletter*, potential Phoenix users should consult the Phoenix and the Call for Proposals Web pages for detailed results. Based on previous results, S/N ~ 100 should be possible in a one-hour integration on K ~ 8.3 point sources at the 2.1-m telescope and on K ~ 9.8 point sources at the 4-m telescope. For S/N ~ 10, the magnitude limits are about 2.5 magnitudes fainter. Limiting magnitudes in the thermal infrared are much brighter with M ~ 6 at the 4-m telescope.

Instruments Offered at KPNO in 2012B

Lori Allen & Patricia M. Knezek

We note a few changes since the previous semester in the instruments offered on Kitt Peak:

- NEWFIRM and Phoenix were welcomed back to the north after stints at CTIO and Gemini South, respectively. As of the end of January 2012, both instruments were on track for 2012B deployment and will be available contingent on successful recommissioning in February.
- KOSMOS is progressing and may be available on a shared-risk basis in 2012B; proposers should plan to use the R-C Spectrograph or Multi-Aperture Red Spectrometer (MARS), but indicate if they are interested in using KOSMOS, should it be available. For more information about KOSMOS, see the article in this *Newsletter* issue titled, "KOSMOS and COSMOS Updates."
- The GoldCam CCD Spectrograph has been pulled from service on the 2.1-m telescope after developing a serious degradation in performance. The cause is under investigation, and we are considering options for upgrading or replacing the detector.

Observers are reminded to check the "Telescopes and Instruments" Web page at *ast.noao.edu/observing/current-telescopes-instruments* for current information before submitting proposals.

WIYN anticipates the delivery of the partially populated focal plane of ODI (called pODI) in July 2012. Engineering verification of pODI is scheduled to take place until mid-September 2012; thus, WIYN will not be available for science observations in August or the first part of September. During the rest of the 2012B semester, a total of ~50 nights, staggered in ~4-night blocks, will be dedicated to pODI commissioning.

With the installation of pODI, all other WIYN instruments will need to share the second Nasmyth port, known as the Hydra port. We will be block scheduling MiniMo+WHIRC, SparsePak+WHIRC, and Hydra. We currently only anticipate offering Hydra once, for approximately four weeks, sometime in the latter three months of 2012B (depending on proposal demands and support availability).

Also, two new filters have been installed in WHIRC. One replaces the original CO filter, and the second, a CN filter, replaces the red-shifted Paschen-beta filter. The WIYN Tip-Tilt Module (WTTM) will be offered in shared-risk mode only. We are currently exploring options to upgrade WTTM and improve its reliability as a tip-tilt imager, but it is unlikely that this work will be completed in 2012B. Please see *www.wiyn.org/observe/status.html* for more details and updates.

The Arrival of pODI at the WIYN 3.5-m and Its Impact on 2012B Scheduling

Patricia M. Knezek

We are all looking forward to the anticipated delivery of the partially populated focal plane of the One Degree Imager (ODI), called pODI, in July 2012! Details about the instrument itself can be found in this *Newsletter* issue in an article written by the ODI principal investigator, Todd Boroson, and titled, "The WIYN One Degree Imager Comes to the Telescope (Soon)." But for all practical purposes for those of us on the ground at WIYN, the fact that the focal plane is partially populated is irrelevant. ODI is coming—and

continued

The Arrival of pODI at the WIYN 3.5-m continued

we need to plan for it. As many of you are aware, the anticipated arrival of pODI has already impacted scheduling in 2012A, as we ready the site for its arrival. I want to describe here the expected impact in 2012B and give everyone a heads-up about 2013A and beyond.

First, engineering verification of pODI is scheduled to take place until mid-September 2012; thus, the WIYN 3.5-m telescope will not be available for science observations in August or the first part of September. In addition, during the rest of the 2012B semester, a total of ~50 nights, mostly staggered in ~4-night blocks, will be dedicated to pODI commissioning and some other needed (non-pODI) testing and engineering activities. Thus, there will be ~80 nights available to the community for science. Our expectation is that, assuming all goes well with the commissioning effort, pODI will be released for shared-risk community use in early 2013A, and we will resume offering most nights of the semester to science.

It is important to point out that pODI (and ODI, once all the detectors are installed) will be permanently mounted on one of the WIYN Nasmyth ports, the port that currently hosts all other instruments but Hydra. The implication is that all the other WIYN instruments need to migrate to the second Nasmyth port and share it. Previously, the second port was dedicated to Hydra. In order to make this possible, we have constructed a cradle that can hold Hydra and allow it to rotate with the telescope when Hydra is not in scientific use. Moving Hydra from active science use to the cradle is a two-day operation (and vice versa). In addition, any time we want to make an instrument change (such as MiniMo to SparsePak), Hydra will have to be removed from the cradle and put off to the side in order to access the port, then returned to the cradle. This is an all-day event. Each move of Hydra incurs some risk. Thus, we will be changing the way that we schedule our instruments. We will be block scheduling MiniMo+WHIRC, SparsePak+WHIRC, (potential) visitor instruments, and Hydra. In 2012B, due to the needs of the pODI commissioning team, we currently only anticipate offering Hydra once, for approximately four weeks, sometime in the latter three months (depending on proposal demands and support availability). The other instruments will be scheduled as best as possible based on proposal pressure, but observers should expect that a minimum block of scheduling will be approximately one week.

For 2013A, we will be working with the WIYN Science Steering Committee to develop block-scheduling policies. But observers should be aware that, in the pODI/ODI era, scheduling will be more constrained.

Please see *www.wiyn.org/observe/status.html* for more details and updates.

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

Knut Olsen, Dave Bell & Verne V. Smith

Semester 2012B runs from 1 August 2012 to 31 January 2013, 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 2012B will be released in early March 2012 (close to the publication date of this *Newsletter* issue), with a US proposal deadline of Thursday, 29 March 2012. As this article is prepared well before the release of the Call for Proposals, the following list of instruments and capabilities are only our expectations of what will be offered in semester 2012B. 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 2012B:

***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, a mid-infrared (7–26 μm) imager and spectrometer that includes an imaging polarimetry mode, should be available.
- GMOS-North: Gemini Multi-Object Spectrograph and imager. Science modes are multi-object spectroscopy (MOS), long-slit spectros-

continued

copy, 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:

- 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: Florida Multi-Object Imaging Near-Infrared Grism Observational Spectrometer version 2. The Gemini near-infrared imager and long-slit and multi-object spectrograph is currently being commissioned. A call for System Verification proposals for its imaging and long-slit modes has been issued. FLAMINGOS-2 may be available with these limited modes in 2012B.
- GeMS: Gemini Multi-Conjugate Adaptive Optics System. While it has achieved first light, it is not expected to be available for 2012B.
- All modes for GMOS-South 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). The PIT has undergone significant changes for 2012B, so proposers should get started early in order to familiarize themselves with the new proposal tool.

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 online 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 2012B:

- **MMT Observatory**
  Up to 12 nights (but only one dark night) of classically scheduled observing time are expected to be available with the 6.5-m telescope of the MMT Observatory. 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 2012B 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 2012B 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 2012B

Spectroscopy	Detector	Resolution	Slit
CTIO BLANCO 4-m [1]			
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	1800, 3600, 7200, 12,600	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, 420–870nm	80,000 (with image slicer)	2.7" fiber

Imaging	Detector	Scale ("/pixel)	Field
CTIO BLANCO 4-m [1]			
DECam Optical Imager	LBL 62-CCD mosaic, 2K×4K	0.27	2.0 degrees diameter
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 2012B, the Blanco 4-m telescope will be available to users for a limited amount of time only. Please see "Late-Breaking News about Blanco" on page 1 and the article by Chris Smith, "Update on Blanco 4-m Availability: 2012A Shutdown and DECam Commissioning and Science Verification in 2012B," 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. The resolutions given are the maximum resolution achievable using the narrowest 0.46" slit. Imaging mode also is available; the instrument has its own set of U, B, V, and R filters, but it is also possible to install any of the SOI 4 × 4 inch 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 2012B, observing time and services at the 0.9- and 1.0-m telescopes continue to be reduced. For more information, please see the article by Charles Bailyn, "Availability of the CTIO 1.0- and 0.9-m Telescopes in 2012B."

[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 2012B*

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 e2v deep depletion 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 EEV CCDs	0.36–1.0µm R~670–4400	0.072	5.5' 5" IFU
NICI	1024×1024 (2 det.) Aladdin III InSb	0.9–5.5µm Narrowband Filters	0.018	18.4"×18.4"
FLAMINGOS-2 (imaging and long-slit modes)	2048×2048 HAWAII-2	0.9–2.4µm	0.18	6.1' diameter circular field

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 2012B

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'	single
FLAMINGOS [3]	HgCdTe (2048×2048, 0.9–2.5μm)	1000–1900	10.3'	single/multi
Phoenix	InSb (512×1024, 1–5μm)	50,000–70,000	30"	single
WIYN 3.5-m				
Hydra + Bench Spectrograph [4]	STA1 CCD	700–22,000	NA	~85 fibers
SparsePak [5]	STA1 CCD	400–13,000	IFU	~82 fibers
2.1-m				
FLAMINGOS [3]	HgCdTe (2048×2048, 0.9–2.5μm)	1000–1900	20.0'	single
Phoenix	InSb (512×1024, 1–5μm)	50,000–70,000	60"	single

Imaging	Detector	Spectral Range	Scale ("/pixel)	Field
Mayall 4-m				
CCD MOSAIC 1.1	8K×8K	3500–9700Å	0.26	35.4'
NEWFIRM [6]	InSb (mosaic, 4, 2048×2048)	1–2.3μm	0.4	28.0'
WIYN 3.5-m				
Mini-Mosaic	4K×4K CCD	3300–9700Å	0.14	9.3'
WHIRC [7]	VIRGO HgCdTe (2048×2048)	0.9–2.5μm	0.10	3.3'
2.1-m				
CCD Imager [8]	T2KB/STA2 CCD	3300–9700Å	0.305	10.4'
FLAMINGOS [3]	HgCdTe (2048×2048)	JHKs	0.61	20.0'
WIYN 0.9-m				
CCD MOSAIC 1.1 [9]	8K×8K	3500–9700Å	0.43	59'

[1] T2KA is the default CCD for the R-C and Echelle Spectrographs. T2KB now serves as T2KA's backup. LB1A may be requested for the R-C Spectrograph if appropriate.

[2] Proposers should only write proposals for the R-C Spectrograph or MARS. But an interest in adapting the proposal to use KOSMOS may be expressed. See the KOSMOS article, "KOSMOS and COSMOS Updates," 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. Anthony Gonzales is currently the PI of the instrument.

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

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

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

[7] WHIRC was built by 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.

[8] T2KB is the default CCD for CFIM. STA2, with MONSOON controller, is available on request. 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 as for T2KB. Potential users should contact KPNO support staff for details.

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

MMT Instruments Available for 2012B

	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	R~1K	60'
Hectochelle (240-fiber MOS, PI)	2 2048×4608	R~34,000	0.38–0.9µm	R~32K	60'
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 2012B

	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

Co-I Access Management and Other New Features in the NOAO Science Archive

Mark Dickinson

Data from NOAO observing programs on KPNO, CTIO, SOAR, and WIYN normally have a proprietary period of 18 months. During that time, the principal investigators (PIs) of those programs can access their raw data (and, for Mosaic and NEWFIRM, their pipeline-reduced data products as well) in the NOAO Science Archive (*portal-nvo.noao.edu*). However, until now, if you were a PI and you wished to let a co-investigator (Co-I) access and retrieve your data from the archive, your only option was to tell your Co-I your username and password—not the most convenient or secure method!

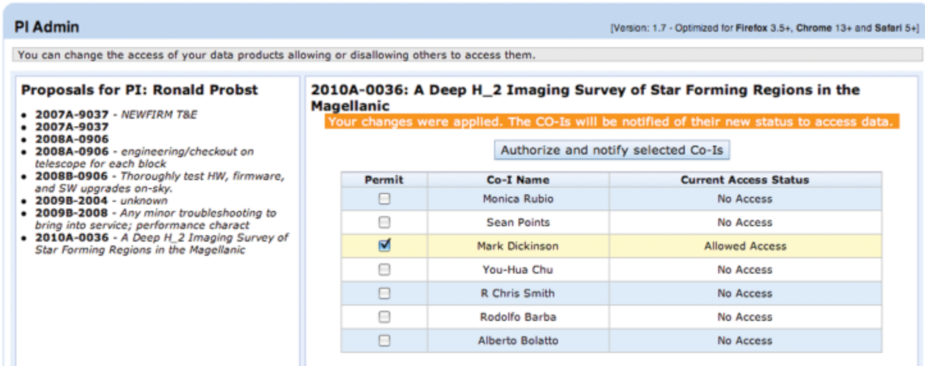


Figure 1: New page in Archive portal for a PI to authorize Co-I access to proprietary data.

By popular demand, the new release of the NOAO Science Archive includes a new "PI Admin" page. If you are registered and signed into the Archive, this page presents you with a list of the NOAO observing programs for which you are PI. Click on a program, and you get a list of your Co-Is with check boxes so you can select which Co-Is to authorize for data access (see Figure 1). The lucky Co-Is will be notified by email, and if they are not registered with the Archive already, they are sent instructions on how to do so. They will then have full access to retrieve proprietary data from this observing program. So, make your Co-Is do some work—give them your data!

Another new feature in the Archive is a filtering tool to help you sift through search results and find the data you want. First, search for data from the Query Form page using any combination of the allowed search parameters (e.g., coordinates, observing date, telescope & instrument, etc.). Often, the search results may have hundreds or even thousands of files, and you may want to narrow that down to a subset. A new box on the Results page, labeled "Filter by," lets you select one of a variety of additional parameters (such as program ID, observation type, processing status, etc.), and further restrict the search results to find just the data that interest you (see Figure 2).

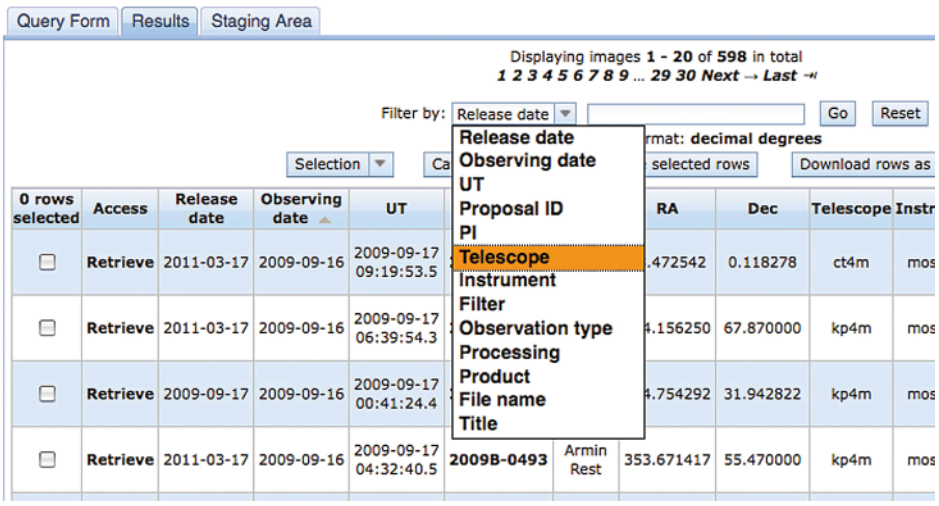


Figure 2: New "Filter by" tool on the Results page to further narrow data retrieved in an Archive search.

You should also try the "Categorize by" feature (which is not new, but is quite useful). With this, you can select one output parameter from the search results (such as "filter" or "PI") and break down the search results into separate, tabbed pages grouped by values of that parameter. For example, you might do a search for Mosaic data, and then use categorization to sort the results into tabs by filter. Or, you might search for pipeline-reduced NEWFIRM data, and then categorize the results into tabs by the processing type (calibrated single images, stacked images, master calibration files, etc.). A little experimentation should be enough to learn how to use these tools to find data that interest you.

Last but not least, the newest release of the Archive portal now works with the Safari and Chrome browsers, as well as Firefox (and other Mozilla-based browsers). Internet Explorer is not supported yet. Search away!

Kicking It Up a Notch

David Silva

It's a big year for NOAO, a year when we commission excellent new instruments and push forward on others, but also a year with significant political and financial challenges.

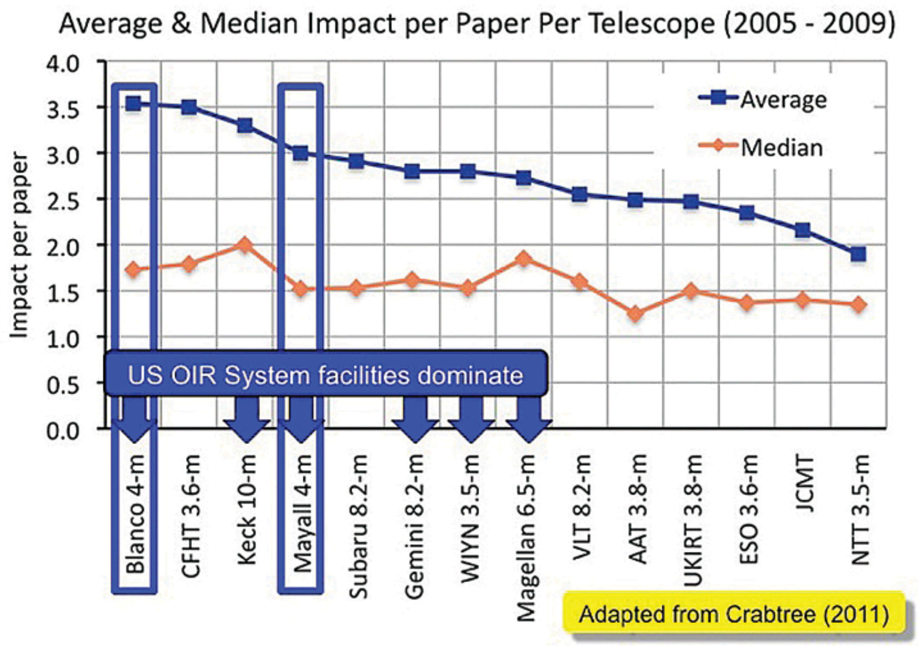
By the end of 2012, NOAO and its partners will finish commissioning more than a few major instruments:

- Dark Energy Camera (DECam) on Blanco: a 2.2-degree-diameter field-of-view optical imager
- Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) on Mayall: an optical, medium-resolution, multi-object spectrgraph
- Partial One Degree Imager (pODI) on WIYN: a 24 × 24-arcminute field-of-view imager with on-board tip-tilt error correction to improve image quality
- SOAR Adaptive Optics Module (SAM) / SAM Imager (SAMI) on SOAR: a ground-layer adaptive-optics system with a high spatial resolution optical imager
- SOAR Integral Field Unit Spectrograph (SIFS) on SOAR: an optical spectrograph with a 1300-element integral field unit

After a move from the south to the north, our NEWFIRM wide-field near-infrared (IR) imager will re-appear on the Mayall. If time and resources permit, we will start commissioning the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS) on Blanco for our second multi-object optical spectrograph. Delivery from Brazil of the SOAR Telescope Echelle Spectrograph (STELES) is also expected. These projects would not have happened without significant supplementary financial investment by NSF and DOE, the Dark Energy Survey (DES) Collaboration, and our WIYN and SOAR partners.

Our data management team is hard at work preparing for these new instruments. In particular, they are deeply involved in the development and deployment of the science modules for image calibration pipelines for DECam and pODI.

Development activity in collaboration with major partners will continue for a cross-dispersed near-IR spectrograph with continuous coverage in the *JHK* bands (TripleSpec for Blanco) and a 3-degree field-of-view, 5000-fiber, multi-object optical spectrograph for the Big Baryon Oscillation Spectroscopic Survey (BigBOSS) on Mayall. In regard to BigBOSS, the DOE-sponsored development team continues to make rapid progress, having passed a major research and development review last December. NOAO remains deeply involved with our Large Synoptic Survey Telescope (LSST) partners, especially in design and development of the LSST itself, the telescope site, and the support facilities in Chile. LSST is on track for a construction start in fiscal year (FY) 2014 if Congress appropriates sufficient funding. By mid 2012, NSF will announce a Giant Segmented Mirror Telescope partnership strategy, and NOAO aspires to be part of that strategy.



As shown by Dennis Crabtree (Crabtree, 2011, in preparation), the average and median impact per paper produced by the NOAO Blanco and Mayall telescopes between 2005 and 2009 were among the highest of all ground-based, general-purpose, optical/infrared (OIR) telescopes in that period. As an ensemble, the US OIR System facilities lead the world in the production of high-impact papers. Here, impact is defined as the number of citations per paper compared to the average (or median) number of citations for all papers published in the *Astronomical Journal* in the same year. (Image adapted from Crabtree, 2011, in preparation.)

As a group, Blanco and Mayall users are already producing some of the highest impact papers published on any ground-based, general purpose telescope, independent of aperture size (see figure). These new capabilities, especially DECam and BigBOSS, should help our users kick it up a notch, especially as NOAO more frequently allocates tens of nights per year to major survey programs. Of course, we expect the DES and BigBOSS key projects to produce their own high-impact results!

At the same time, 2012 is already a year of major financial and political challenges. In February, NOAO learned its annual NSF base funding was reduced from $27.5M in FY 2011 to $25.5M in FY 2012. Funding for FY 2013 is projected to be the same as FY 2012, although actual FY 2013 funding could be lower and will depend on Congressional action and the outcome of the NSF Astronomy Portfolio Review.

While a $2M (7%) reduction relative to FY 2011 is significant, it is not catastrophic. For sure, hard choices will be necessary in the weeks

continued

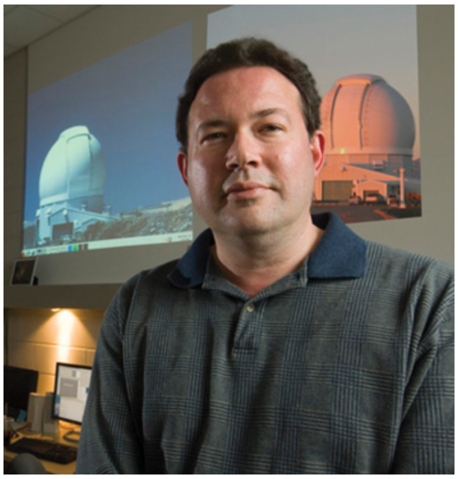
Kicking It Up a Notch continued

ahead to achieve a balanced budget. However, I believe NOAO can meet most (if not) all current, short-term, external obligations, stay on the road to BigBOSS, and keep the Mayall and Blanco operating at current levels that will continue to allow our community to produce high-impact science.

NOAO has a robust, *science-based* strategic vision for itself and the US Optical/Infrared System. This vision is realizable, cost effective, and well aligned with the US astronomical community science goals for this decade. I am extremely grateful for the public support we have received from you, our users, and your advocacy for our program. Through partnership with you and strong US and international astronomy and physics research groups as well as innovative and agile funding strategies, I remain confident that NOAO and the research community we serve can look forward to an exciting decade of forefront experimentation and exploration at the science frontiers.

Message from the Director of KPNO

Timothy C. Beers



As I write this article, I have been present in Tucson as the new director of Kitt Peak National Observatory for three months, beginning in mid-October of 2011. Many of you know our former director, Buell Jannuzi, who stepped down a year ago and Abi Saha, who ably held the reigns as interim director for the past year. NOAO is grateful to both of them for their service and dedication. I would also like to mention the appointment of NOAO Associate Scientist Lori Allen as my new deputy director of KPNO.

This is a particularly important period in the 50-plus-year history of KPNO, and indeed for the entirety of NOAO, as the National Science Foundation and its advisory panels struggle to find the correct balance between the swelling costs of new telescopes and instrumentation for the coming decade, the need to maintain currently productive facilities, the desire to provide support for individual astronomers through the grants program, and the budgetary challenges that our community faces. We have heard from many of you via your comments to the NOAO *Currents* Web page (*ast.noao.edu/node/168/*) highlighting the anticipated budget difficulties going forward, and many of you participated in our System Roadmap survey (*www.noao.edu/currents/201112.html#survey*), for which I would like to express my sincere gratitude. Hopefully, many of you were also present at the NOAO Town Meeting during the recent American Astronomical Society conference in Austin, Texas, where NOAO Director David Silva presented his summary of the current and future plans for NOAO.

I would like to take the opportunity, in this the first *Newsletter* following my arrival in Tucson, to provide a few of my personal perspectives on the importance of NOAO to my own career. I use my history as but one example of similar stories that I believe many others could tell.

I began my career as an extragalactic astronomer, carrying out my very first observations riding prime focus on the Mayall 4-m telescope at KPNO in 1980. These observations contributed to the development of my PhD thesis on substructure in clusters of galaxies, awarded by Harvard University in 1983 under the supervision of Margaret Geller with significant co-supervision by John Huchra. When I began my postdoctoral studies (as a Bantrell Fellow at Caltech), I made the transition to Galactic astronomy, working with George Preston and Steve Shectman of the Carnegie Observatories on what has become known as the HK objective prism survey. This survey was dedicated to the discovery of large numbers of the most metal-poor (and by inference oldest) stars still shining in the Milky Way and required obtaining hundreds of photographic (!) objective-prism plates taken with the Curtis Schmidt telescope at CTIO and the Burrell Schmidt telescope at KPNO. This step alone took a total of almost 15 years (continued during my time as professor of astronomy at Michigan State University) to complete a survey of some 7500 square degrees of sky. During the course of taking the plates, which obviously would not have happened without a US National Observatory, we began a decade-long effort to obtain medium-resolution spectra of the most promising candidates, initially with the Dupont 2.5-m and Hale 5-m telescopes, but later making substantial use of the Mayall 4-m telescope, the KPNO 2.1-m telescope, the Blanco 4-m telescope, and the CTIO 1.5-m telescope, as well as many other telescopes around the world.

This led in turn to the identification of the largest samples of stars known (at the time) with [Fe/H] < -2.5, that is, *below* the metallicity of the lowest abundance globular clusters. This sample provided the input for later high-resolution spectroscopic follow-up of the most interesting of these stars, using the DuPont 2.5-m, the Very Large Telescope, Subaru, Keck, Anglo-Australian Telescope, Magellan, and Hobby-Eberly telescopes, as well as the Hubble Space Telescope. Follow-up observations of these stars continue today. Not to be forgotten is the fact that a successful HK survey led directly to similar, even larger surveys for metal-poor stars, such as the Hamburg/ESO Survey of Christlieb and collaborators, and, in turn, to the huge increase in ancient stars found from the stellar spectra obtained during the course of the Sloan Digital Sky Survey and its extensions. After a quarter century of sustained effort, we now have fundamental information on the nature of the very first generations of stars to have formed in our Galaxy (including stars approaching [Fe/H] ~ -6.0, one-millionth

continued

Message from the Director of KPNO continued

solar!), insight into the origin of the elements in the Universe through observational constraints on the r-process and s-process, and unique information on the formation and evolution of large spiral galaxies like our Milky Way. Other surveys continue this effort at present, such as SkyMapper and the Large Aperture Multi-Object Spectroscopic Telescope Sky Survey (LAMOST); many others are starting in the near future.

My central point is that, without a strong US National Observatory, none of the above would have been possible, or, at the very least, progress would have been delayed by a decade or more. Again, such stories could likely be told by many mid career astronomers in our community about the provenance of their own research work. I took my present job in order to help make it possible for others, now at the early stages of their careers, to use the cost-effective and high-impact science-producing facilities made available through NOAO to begin writing their own stories. The approaches taken will differ, as will the instrumentation used—we are all excited about data that will soon flow from the Dark Energy Survey being conducted with the Blanco 4-m telescope, and hope to continue pushing forward with the Big Baryon Oscillation Spectroscopic Survey (BigBOSS) on the Mayall 4-m telescope in the next few years, as well as the new instrumentation now being made available through the NOAO System—but the outline of discovery for many will, I believe, be remarkably similar to the story I have told. That is most certainly why I am at KPNO and NOAO today.

NSF Director Subra Suresh's Visit to Cerro Tololo and Cerro Pachón

Robert Blum & Nicole van der Bliek

On January 9 and 10, National Science Foundation (NSF) Director Subra Suresh visited NSF optical astronomy facilities in northern Chile. The NSF group included Edward Seidel (head of Directorate for Mathematical and Physical Sciences) and Anne-Marie Schmoltner (program manager in the NSF Office of International Science and Engineering). Other members of the party were Jeff Pier and Gary Schmidt, NSF program officers for NOAO and Gemini respectively. AURA President Bill Smith and CTIO Director Chris Smith hosted the NSF delegation, together with NOAO Deputy Director Bob Blum, CTIO Deputy Director Nicole van der Bliek, Gemini Associate Director Maxime Boccas, SOAR Director Steve Heathcote, and NOAO LSST Telescope & Site Project Manager Victor Krabbendam.

After a briefing in La Serena, the group toured facilities on Cerro Tololo, which included the Blanco 4-m telescope where the Dark Energy Camera is being prepared for its installation later this year (see Figure 1). Brenna Flaugher (Fermilab) gave a description of the construction and testing of the camera.

Figure 1: The NSF delegation hears about the Dark Energy Camera (DECam) inside the Blanco 4-m coudé room. NOAO Deputy Director Robert Blum explains the size of the DECam optics to NSF Director Subra Suresh. Also listening (from left to right), Maxime Boccas (Gemini, associate director for development), Steven Heathcote (SOAR, director), Anne-Marie Schmoltner (NSF, program manager, Office of International Science and Engineering), Gary Schmidt (NSF, Gemini program officer), Alistair Walker (NOAO, DECam instrument scientist), Brenna Flaugher (Fermilab, project manager for DECam), Chris Smith (NOAO, associate director for CTIO), Jeffrey Pier (NSF, NOAO program officer), Edward Seidel (NSF, assistant director, Directorate for Mathematical and Physical Sciences), and William Smith (AURA, president). (Image credit: Victor Krabbendam/NOAO/AURA/NSF.)

The visit continued at Cerro Pachón with a walk on the newly leveled site of the Large Synoptic Survey Telescope (LSST) (see Figure 2), where Victor Krabbendam showed Dr. Suresh the plans for the LSST. The day ended with visits to SOAR and Gemini South. Both SOAR and Gemini were in the middle of an engineering run, commissioning their laser adaptive-optics systems, and the NSF delegation was presented with a nice show of the sodium laser at the Gemini South telescope.

Figure 2: NOAO LSST Telescope & Site Project Manager Victor Krabbendam (second from left) describes the LSST facility as it will look when completed while the group stands on the site at Cerro Pachón. Left to right: NSF Director Subra Suresh, Krabbendam, NOAO Deputy Director Robert Blum, and AURA President William Smith. The Gemini (right) and SOAR (left) telescopes are in the background. (Image credit: Nicole van der Bliek/NOAO/AURA/NSF.)

The next day, the NSF delegation concluded their stay with a visit to a seismological measuring station situated on Cerro Tololo. This station, operated locally in collaboration with the University of Chile, is part of an international network of seismic monitoring facilities coordinated by the NSF-funded Incorporated Research Institutions for Seismology (IRIS) consortium (see Figures 3 and 4).

continued

NSF Director Visits CTIO continued

Figure 3: (from right to left) NSF Director Subra Suresh, David Simpson (president of IRIS) and Sergio Barrientos (Universidad de Chile) discuss the equipment in the IRIS seismic measuring station on Cerro Tololo as Bill Smith (AURA president) and Bob Blum (NOAO deputy director) listen. (Image credit: Nicole van der Bliek/NOAO/AURA/NSF.)

Figure 4: The equipment of the Global Seismic Network in the IRIS seismic measuring station on Cerro Tololo. For more information see: *www.iris.edu/hq/programs/gsn/instrumentation*. (Image credit: Nicole van der Bliek/NOAO/AURA/NSF.)

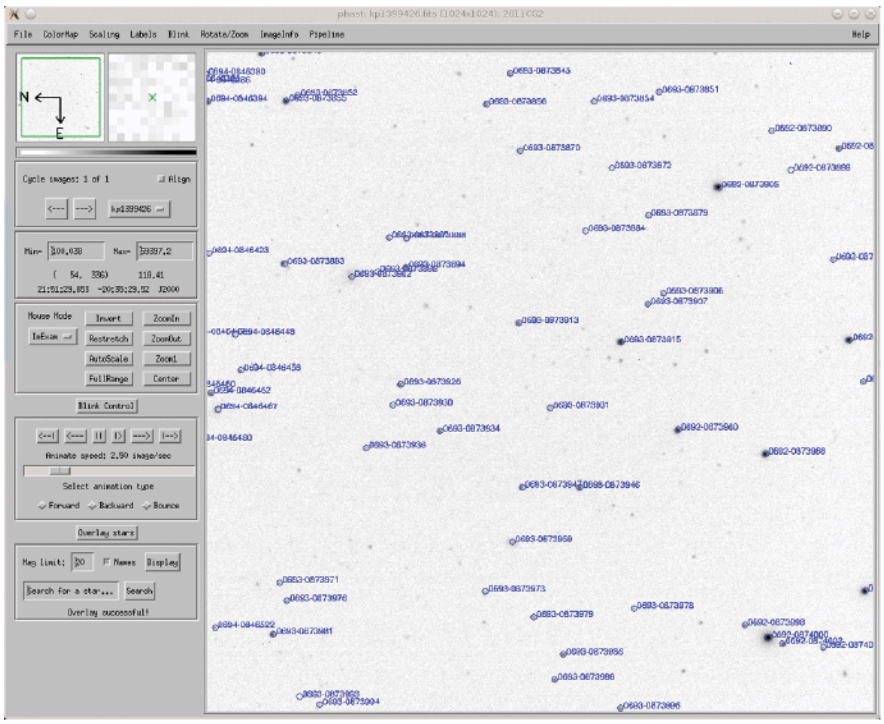
REU Student Makes PhAst Work

Mark Trueblood

The Kitt Peak National Observatory program of Research Experiences for Undergraduates (REU), funded by the NSF and administered by NOAO staff scientist Ken Mighell, invites six bright undergraduate students to work with NOAO scientists for 10–12 weeks during each summer at the NOAO headquarters in Tucson, Arizona. During the summer of 2011, one such student was Morgan Rehnberg of Beloit College (Wisconsin) who was mentored by NOAO staffer Mark Trueblood, his co-investigator Robert Crawford, and Ken Mighell. Crawford serves on Trueblood's research team as the data reduction specialist. The team observes near-Earth objects (NEOs) to refine their orbits and help assess their threat to Earth.

Rehnberg used an existing Interactive Data Language (IDL) photometry tool, ATV, and modified it to analyze several images simultaneously and to blink them to find the target NEOs. He added existing software analysis packages SExtractor (for object detection, image coordinates, and flux) and SCAMP (for World Coordinate System fitting and other astrometry functions) to what became the PhAst (**Ph**otometry/**Ast**rometry) application (see figure). Rehnberg presented a poster about PhAst on 9 January 2012 at the recent 219th American Astronomical Society meeting in Austin, Texas. For more information on Rehnberg's work, see *www.noao.edu/news/2011/pr1107.php*. To download a copy of PhAst, visit *www.noao.edu/staff/mighell/phast/*.

Future work includes adding additional capabilities, such as the ability to read NASA-formatted spacecraft images and use different catalogs for astrometry and photometry, and rewriting the code into classes to enable use of the tool without requiring an IDL license.



PhAst software application developed by KPNO REU student Morgan Rehnberg to help track near-Earth objects.

CTIO Summer Student Program for 2012

Bezia Laderman & Catherine Kaleida

It is summer in the Southern Hemisphere, and the CTIO Summer Students have arrived, eager to learn! During the 10-week CTIO Summer Student Programs, US and Chilean students work and live at the CTIO compound in La Serena. All students carry out research projects with CTIO, SOAR, or Gemini staff; observe a few nights at Cerro Tololo; and attend seminars geared toward the undergraduate level. The students will participate in field trips to various observatories while sampling the social and cultural life in Chile during their time here.

Six US students participate in the CTIO Summer Student Program through the NSF-funded CTIO Research Experiences for Undergraduates (REU) program. The 2012 REU students are Melissa Butner (Austin Peay State University), Kimberly Emig (University of Hawai'i), Christine Gilfrich (St. Mary's College of Maryland), Bezia Laderman (New York University), Samuel Meyer (Harvard College), and Clara Thomann (Macalester College).

Two Chilean students, Mayte Alfaro Cuello (Universidad de La Serena) and Odette Toloza Castillo (Universidad de Valparaíso), participate through Prácticas de Investigación en Astronomía (PIA), funded by CTIO. We wish all students an enjoyable stay in La Serena "y buena suerte en todo."

(Left to right:) Catherine Kaleida, Mayte Alfaro, Odette Toloza, Bezia Laderman, Kimberly Emig, Clara Thomann, Melissa Butner, Samuel Meyer, and Christine Gilfrich. (Image credit: Mario Urrutia/NOAO/AURA/NSF.)

Mentors for the students are an integral part of the program. As such, we would like to thank CTIO staff Tim Abbott, Nicole van der Bliek, David James, Catherine Kaleida, and Eric Mamajek; SOAR staff Tina Armond and Tiago Ribeiro; Gemini staff Percy Gomez and Peter Pessev; and Jackie Faherty from Cerro Calán in Santiago.

Staff Changes at NOAO North and South (16 August 2011–15 February 2012)

New Hires

Alfaro, Mayte	CTIO PIA summer student	NOAO South
Beers, Timothy C.	NOAO Assoc. Director for KPNO	NOAO North
Boberg, Owen	Research Assistant	NOAO South
Brave Bird, Jr., Arvin	General Maintenance Person, Kitt Peak	NOAO North
Butner, Melissa	CTIO REU summer student	NOAO South
Capara, Cameron	Special Projects Assistant, EPO	NOAO North
Dong, Hui	Postdoctoral Research Associate	NOAO North
Emig, Kimberly	CTIO REU summer student	NOAO South
Furlan, Elise	Postdoctoral Research Associate	NOAO North
Gilfrich, Christine	CTIO REU summer student	NOAO South
Hansey, Brent	Craftsperson II, Kitt Peak	NOAO North
Hong, Sungryong	Postdoctoral Research Associate	NOAO North

Staff Changes continued

Kaleida, Catherine	Postdoctoral Research Associate/REU Dir.	NOAO South
Laderman, Bezia	CTIO REU summer student	NOAO South
Lopez, Connie	Cashier, Kitt Peak	NOAO North
Mamajek, Eric	Associate Astronomer	NOAO South
Meyer, Samuel	CTIO REU summer student	NOAO South
Miller, James	Public Program Specialist, Kitt Peak	NOAO North
Norris, Patrick	Testing Engineering	NOAO North
Pforr, Janine	Postdoctoral Research Associate	NOAO North
Phillips, Asa Marie	Business Programmer	NOAO North
Salman, Dean	Public Program Specialist II, Kitt Peak	NOAO North
Salyk, Colette	Goldberg Fellow	NOAO North
Sanchez, David	Technical Buyer	NOAO South
Segundo, R. Vivian	Cashier, Kitt Peak	NOAO North
Siquieros, Johnathan M.	Special Projects Assistant, EPO	NOAO North
Thomann, Clara M.	CTIO REU summer student	NOAO South
Toloza, Odette	CTIO PIA summer student	NOAO South
Villarreal, Antonio	Public Program Specialist, Kitt Peak	NOAO North

Promotions

Allen, Lori	To Deputy Director of KPNO	NOAO North
Avery, Renae	To Controller	NOAO North
Doppman, Greg	To Assistant Scientist	NOAO North
Encina, Eugenio	To Budget & Accounting Manager	NOAO South
Fitzpatrick, Michael	To Principal Software Systems Engineer	NOAO North
Fuentes, Exequiel	To Computer Programmer 2	NOAO South
Schuler, Simon	To Assistant Scientist	NOAO North
Wiest, Orion	To Shipping/Receiving Clerk II	NOAO North

Transfers

Hoblitt, Joshua	From NSO to NOAO SDM	NOAO North

Retirements/Departures

Abraham, Antony	Engineering Manager	NOAO North
Adams, Sally	Administrative Asst. II	NOAO North
Araya, Eduardo	Finance Manager	NOAO South
Baldassare, Vivienne	KPNO REU summer student	NOAO North
Barg, Irene	Operations Manager, SDM	NOAO North
Bays, Kevin	Public Program Specialist, Kitt Peak	NOAO North
Carlson, Jack	Technical Associate I	NOAO North
de Propis, Roberto	Assistant Astronomer	NOAO South
De Young, David	Astronomer/Tenure	NOAO North
Doppmann, Greg	Assistant Scientist	NOAO North
Fersch, Alisa	KPNO REU summer student	NOAO North
Jimenez, Nick	KPNO REU summer student	NOAO North

Staff Changes continued

Kephart, William	General Maintenance II, Kitt Peak	NOAO North
Lewis, Angelina	Accounting Specialist	NOAO North
McCloskey, Frederick	Senior Engineer	NOAO North
Reddy, Naveen	Research Associate (Hubble Fellow)	NOAO North
Rehnberg, Morgan	KPNO REU summer student	NOAO North
Sawyer, David	Manager of Engineering, ETS	NOAO North
Sherry, William	Sr. Associate in Research	NOAO North
Subasavage, Jr., John	Postdoctoral Research Associate	NOAO South
Taylor, Joanna	KPNO REU summer student	NOAO North
Thurn, Walter S.	Craftsperson II, Kitt Peak	NOAO North
Welling, Christine	KPNO REU summer student	NOAO North
Will, George	Observing Associate, Kitt Peak	NOAO North
Zaw, Pye Pye	Special Projects Assistant, EPO	NOAO North

Deaths

De Young, David	Retired Astronomer	NOAO North
Johansen, Ellis	Retired Technical Associate	NOAO North
Meinel, Aiden	Former KPNO Director	NOAO North
Ochoa, Hugo	Education & Outreach Program	NOAO South
Tesch, Deloris	Retired Payroll Supervisor	NOAO North

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