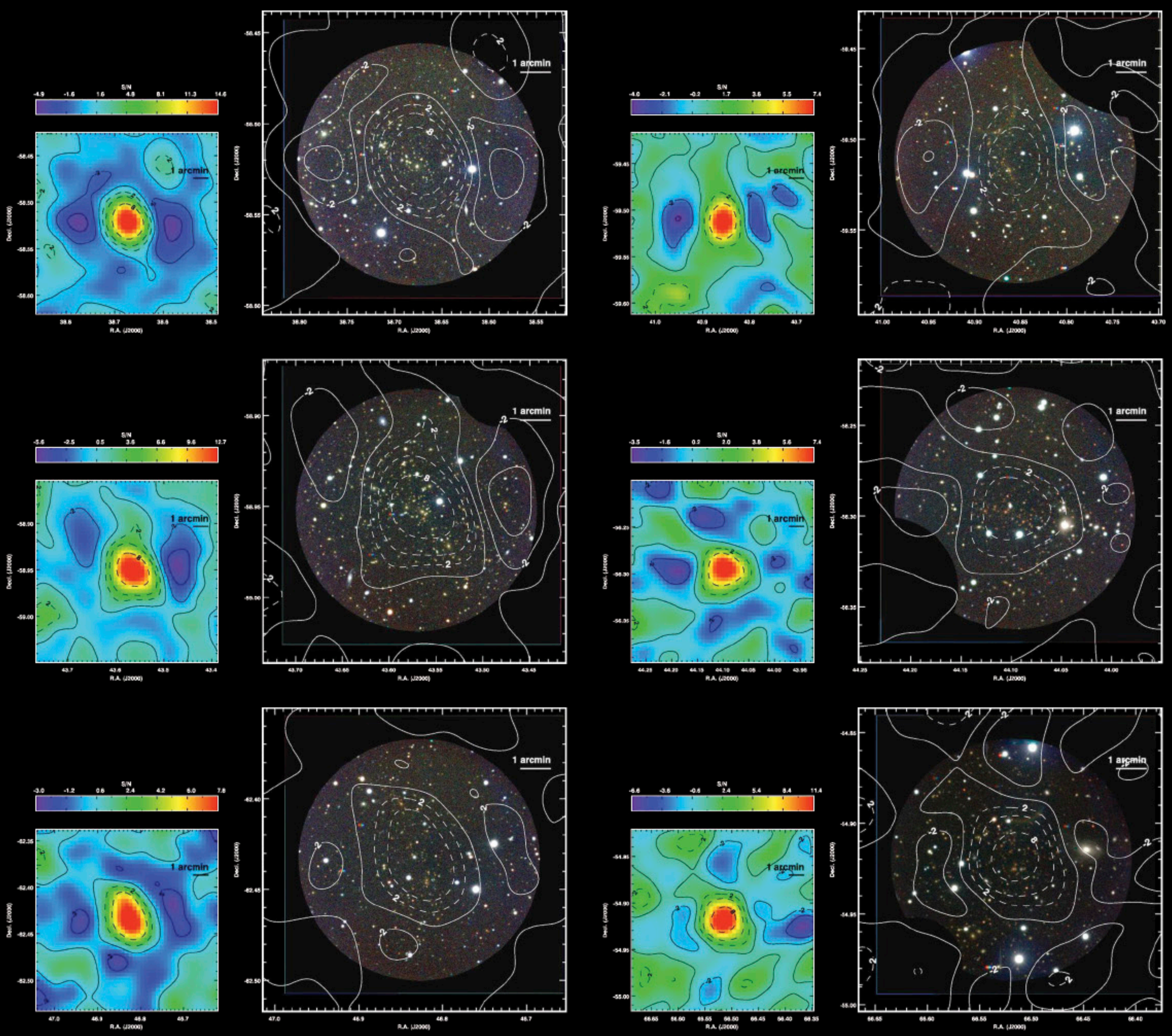
NOAO NEWSLETTER

Issue 108, September 2013



NOAO Newsletter

NATIONAL OPTICAL ASTRONOMY OBSERVATORY

ISSUE 108 — SEPTEMBER 2013

On the Cover

Matt Bayless and collaborators in the NOAO survey of South Pole Telescope (SPT) SZ-selected Galaxy Clusters highlight their program on page 3. The SPT surveys the cosmic microwave background over a large area to find potential galaxy clusters via the Sunyaev-Zel'dovich (SZ) effect, in turn using the distribution of clusters with mass as a dark-energy probe. The NOAO survey uses the Gemini Multi-Object Spectrograph (GMOS) on Gemini-South to measure the velocity dispersions and mass of the clusters. The cover shows typical data for six clusters, with filtered SPT-SZ significance maps (left in each pair) and optical color images from Magellan-II (RGB: g/r/i-bands; right in each pair) centered on SPT-SZ detected galaxy clusters. SZ significance contours are over-plotted on the optical color images. The SZ map is color-coded by significance, and traces the hot gas in each cluster, while the optical images reveal the population of passive elliptical galaxies that are bound within each cluster potential.

Heathcote Appointed Associate Director for NOAO South

NOAO is pleased to announce the appointment of Dr. Stephen Heathcote to the position of Associate Director (AD) for NOAO South for a 5-year term effective 1 February 2014.

Steve received his doctorate from the University of Edinburgh in 1981. He joined the CTIO scientific research staff in 1984 after a postdoctoral position at the Royal Observatory Edinburgh. Over the next 16 years, he served in a number of operational and developmental roles, with a core focus on detector systems.

As Director of the SOuthern Astrophysical Research (SOAR) 4.1-m telescope since 2000, he led the team that commissioned the telescope and then operated it for the last 13 years. During that time, Steve strengthened his skill set in the areas necessary for a successful AD for NOAO South: administrative, technical, and scientific.

Steve's main mission in his new position is to maintain or improve Blanco and SOAR performance (including their instrument suites), in concert with our Dark Energy Survey and SOAR partners, while supporting LSST construction and laying the foundation for vigorous NOAO South engagement in LSST operations.

Welcome, Steve!

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

Publication Notes

This *Newsletter* is presented with active links online at

www.noao.edu/noao/noaonews.html

Tod R. Lauer, Editor

David Silva	NOAO Director's Office
Tod R. Lauer	Science Highlights
Jane Price, Ken Hinkle	NOAO System Science Center
Betty Stobie	Science Data Management
Nicole S. van der Bliek	CTIO
Timothy C. Beers	KPNO
Stephen Pompea	Education & Public Outreach
Dave Bell, Mia Hartman	System Observing
David Sprayberry	NOAO System Technology Center
William Gressler	LSST Project

Production Staff

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

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

Toward a Transformed NOAO

Dave Silva

In recent weeks, the National Science Foundation (NSF) has provided more definitive programmatic and funding guidelines for the NOAO program in 2016 and beyond. These guidelines are consistent overall with the recommendations and priorities established by the NSF Astronomy Portfolio Review panel. At the request of NSF, NOAO has begun a two-year transformation process based on those guidelines. Our goal is to remain a world-leading gateway to front-line research facilities, data sets, and tools that enable scientific leadership for a broad segment of the US astronomical community.

The CTIO Blanco 4-m telescope will remain a world-leading research facility for at least another 15 years, thanks to a new generation of instrumentation: Dark Energy Camera now, the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS), TripleSpec4 soon, and likely a new instrument later motivated by the Large Synoptic Survey Telescope (LSST). If funded, and successfully deployed, the Dark Energy Spectroscopic Instrument (DESI, formerly BigBOSS) at the KPNO Mayall 4-m telescope will be a transformational, wide-field, spectroscopic multi-object facility in the Northern Hemisphere for both federally and non-federally funded survey projects in the years 2018 and beyond. We continue to advocate for community access through peer review to Mayall/DESI. Until DESI is ready for installation, we hope that NSF funding will be provided for some kind of focused, open-access, Mayall science operations model with a limited instrumentation suite that includes Mosaic 1.1, the NEWFIRM wide-field infrared imager, and the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS). Both Blanco and Mayall will have strong synergistic connections to the LSST, Gaia, Euclid, Wide-Field Infrared Survey Telescope (WFIRST), and other surveys, and indeed are critical to the full exploitation of those data sets.

In regards to other facilities on Kitt Peak, NSF has assured current tenants that it intends to remain the Kitt Peak leaseholder, to retain responsibility for the operation and maintenance of the Kitt Peak common "outside the enclosure" physical infrastructure, and to participate in cost-sharing for those operations and maintenance activities. If the Department of Energy (DOE) and NSF reach a mutually satisfactory arrangement to jointly deploy DESI at the Mayall and then operate it into the early 2020s, Mayall/DESI would be the federally funded anchor facility for Kitt Peak, to the mutual benefit of all Kitt Peak tenants. Finally, through NOAO, NSF is investing in an upgrade of the WIYN One Degree Imager (ODI) from its current 3 × 3 (24 × 24 arcmin) configuration to a 6 × 6 (48 × 48 arcmin) configuration, providing WIYN with one of the most powerful imagers in the Northern Hemisphere. NOAO believes that an upgraded ODI will increase interest in WIYN by potential non-NSF-funded partners. Alas, open access for principal investigator (PI)-driven research at the Kitt Peak 2.1-m and WIYN 3.5-m will end in the next 12–18 months, due to reduced funding. In summary, an *enabling* role by Kitt Peak for federal and non-federally supported astronomical research seems assured for many years into the future.

In parallel to the development of transformed facilities in Arizona and Chile, NOAO will continue to be deeply involved in LSST over its entire lifecycle, with the objective of being the focal point for primary research with the LSST data set for the US and Chilean community at large as well as critical, time-domain follow up research. Existing facilities in Chile such as Gemini South, Blanco, and the Southern Astrophysical Research (SOAR) telescope will be central to LSST follow-up research, but facilities on Kitt Peak, such as Mayall and WIYN, also could make significant contributions, especially in the time-domain research, as more than 50% of the LSST footprint on the sky is visible from Arizona.

Enabling community-based scientific leadership through the use of large data sets and large aperture telescopes will occur within an invigorated NOAO System Science and Data Center. Involvement in such Big Data projects as the Dark Energy Survey (DES), DESI, and LSST is motivating the development of deeper expertise in catalogue-based research, machine learning, data mining, etc. Relations with Gemini are improving and serve as a laboratory for establishing how NOAO can best support the US community's use of other large aperture facilities such as Keck, the Large Binocular Telescope (LBT), Magellan, and MMT. Finally, NOAO is participating at NSF's request in a five-year project to develop community-based plans for a potential partnership between NSF and the Thirty Meter Telescope (TMT) Collaboration sometime toward the end of this decade. As suggested by the 2010 decadal survey report, NOAO seeks to have a significant role in such a federal partnership with TMT.

Reaching our goals will require maintaining and/or extending our existing strong partnerships, with the federal agencies (NSF and DOE) as well as leading centers throughout the US (e.g., Fermilab, Lawrence Berkeley National Laboratory, SLAC, Keck, and Gemini) and major international collaborations (such as DES, DESI, and TMT). Our long history of indirect collaboration with NASA will certainly continue as well, given that many of the research programs we support tie directly to key NASA missions such as the Hubble Space Telescope, Spitzer, Chandra, and Kepler.

Unfortunately, our goals will not be achieved without some pain and stress, for NOAO and the community at large. The number of open-access nights for PI-class research will be greatly diminished, especially in the Northern Hemisphere. Not everyone who works at NOAO today will work at NOAO in the future, and many of the people who remain will have new assignments. NOAO management will do what we can to find humane, professional ways to complete its imminent transformation and to keep the community informed of developments in a timely fashion.

An NOAO Survey of South Pole Telescope SZ-Selected Galaxy Clusters

Matthew B. Bayliss & Christopher Stubbs (Harvard University & Harvard-Smithsonian Center for Astrophysics), Jonathan Ruel & the South Pole Telescope Collaboration (Harvard University)

Spectroscopy of the individual galaxies within massive galaxy clusters provides information that is essential for advancing our understanding of cosmology and the astrophysics of galaxy evolution in the most over-dense environments. An NOAO large survey program, using the Gemini Multi-Object Spectrograph (GMOS) on Gemini-South, is currently underway to collect optical spectra of thousands of galaxies within 85 massive galaxy clusters identified by the South Pole Telescope (SPT; Carlstrom et al. 2011).

The goal for the SPT-GMOS spectroscopic survey is to constrain key cosmological parameters by measuring the growth of the largest structures in the Universe over time. Galaxy clusters evolve from the most extreme peaks in the primordial matter distribution, and therefore trace the largest cosmic over-densities. Cosmological studies with galaxy clusters rely on a measurement of the abundance of massive galaxy clusters as a function of mass and redshift, which is sensitive to the dark energy equation of state, as well as the amount of matter in the universe (Ω_m) and the normalization of the fluctuations in the matter distribution (σ_8) (Press & Schechter 1974, Jenkins et al. 2001).

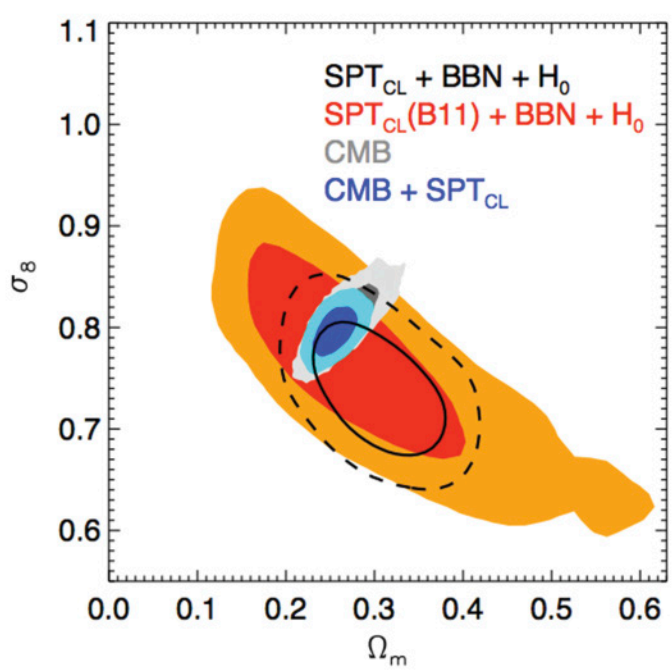


Figure 1: Joint constraints on the matter density (Ω_m) and the normalization of the fluctuations in the matter distribution (σ_8) from SPT measurements of galaxy cluster counts, in combination with (and comparison against) other cosmological measurements. The red/orange contours show 1-σ and 2-σ constraints using 18 SPT clusters with SZ+X-ray data (Benson et al. 2013), and the solid/dashed black contours show constraints using 100 clusters from the first two years of the SPT-SZ survey (Reichardt et al. 2013).

Multi-object spectroscopy of the galaxies that are bound within the deep gravitational potential well of massive clusters provides a measurement of both galaxy cluster redshifts—i.e., the median recession velocity of cluster member galaxies—and the mass of the clusters, using the virial relation between the gravitational mass and the random peculiar velocities of the cluster member galaxies (e.g., Evrard et al. 2008, White et al. 2010). The other element required to extract competitive cosmological constraints from galaxy clusters is a well-selected sample. The SPT identifies galaxy clusters using the Sunyaev Zel'dovich (SZ) effect (Sunyaev & Zel'dovich 1972), resulting in an approximately mass-limited sample of galaxy clusters beyond $z > 0.3$ (Carlstrom et al. 2002). However, the SZ selection does not, on its own, provide information beyond the location of a massive galaxy cluster on the sky; additional follow-up observations at other wavelengths are necessary to precisely characterize the properties of the clusters discovered with the SZ effect.

GMOS observations of SPT-detected galaxy clusters are a crucial part of the process that turns an SPT sample of galaxy clusters into cosmological parameter constraints. Cosmological constraints from the first two years of SPT observations of galaxy clusters have recently been published (Figure 1; Benson et al. 2013, Reichardt et al. 2013). These early constraints use only a small fraction of the final SPT cluster sample, are dominated by systematics in the estimates of individual cluster masses, and do not yet incorporate the mass measurements available from spectroscopic follow-up with GMOS and other facilities. The ultimate cosmological analysis of the SPT galaxy cluster sample will use multiple independent tracers of cluster mass—including velocity dispersions (a majority of which will come from the SPT-GMOS program)—to provide much tighter constraints on key cosmological parameters. SPT-GMOS data are already informing scaling relation comparisons between dynamical mass and SZ- and X-ray-based mass observables (Figure 2 and Figure 3; Ruel et al., in preparation).

A spectroscopic survey of the member galaxies within massive clusters also probes the properties of galaxy populations in dense environments. There is tremendous synergy between the cosmological and galaxy astrophysics science that can be extracted from multi-object spectroscopy of a well-defined sample of galaxy clusters, like that provided by the SPT. Specifically, it becomes possible to classify the spectra of constituent member galaxies and measure the properties of those galaxies in well-understood bins of mass and redshift. The SPT-GMOS data set will allow a measurement of the average spectroscopic properties of the member galaxies in a mass-selected sample of clusters spanning $0.3 < z < 0.8$.

One of the early results from spectroscopic observations of SPT clusters to date is a measurement of the distribution of peculiar velocities for the brightest cluster galaxies (BCGs) relative to their host galaxy clusters. BCGs are expected to reside at the very center of the potential

continued

NOAO Survey of South Pole Telescope SZ-Selected Galaxy Clusters continued

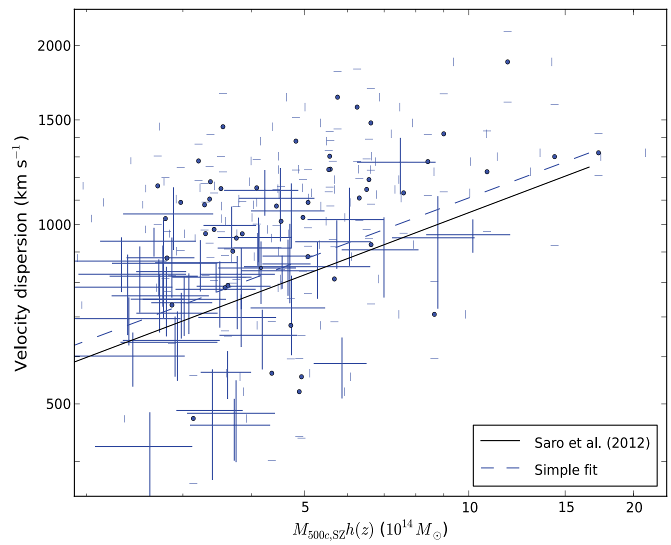


Figure 2: Velocity dispersion—SZ scaling relation for SPT clusters with velocity dispersion measurements as of the end of 2012. The final SPT-GMOS data set will more than double the number of clusters on this plot, contributing a robust constraint on the normalization of the relationship between SZ signal and cluster mass.

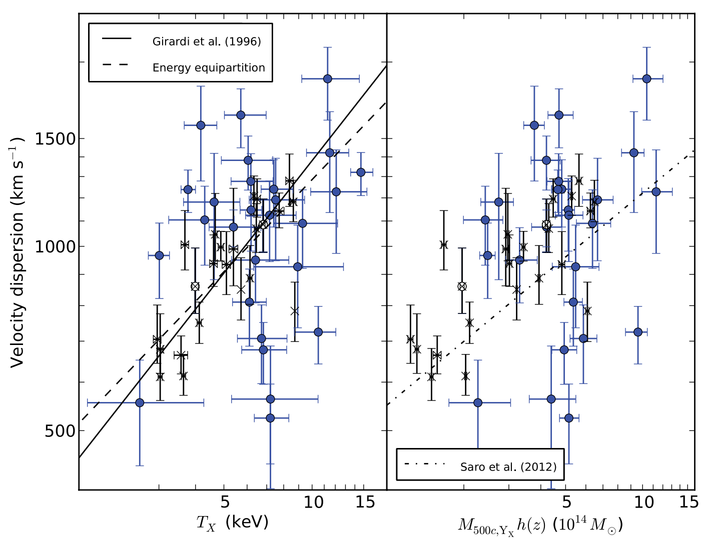


Figure 3: Velocity dispersion—X-ray scaling relations for SPT clusters with velocity dispersion measurements and X-ray observations as of the end of 2012. The best cosmological constraints using SPT clusters will incorporate all available mass observable information to jointly fit scaling relations between, SZ, X-ray, weak lensing, and velocity dispersion measurements of a large (~100) subset of the SPT galaxy cluster sample.

wells of galaxy clusters, but have been observed to be offset from the median cluster recession velocity in low-redshift galaxy clusters (Coziol et al. 2009). A result using observations of SPT clusters through 2011 is consistent with the results from low-redshift clusters (Figure 4), and in future measurements with the full data set, we will be able to better constrain the distribution of BCG peculiar velocities, as well as test for possible evolution in this distribution with cluster mass and redshift.

Additionally, the SPT-GMOS spectroscopic survey data has already begun to yield some unexpected and exciting results. The discovery of a runaway cooling flow in SPT-CLJ2344-4243 (the "Phoenix Cluster"; McDonald et al. 2012) came serendipitously from an examination of the GMOS optical spectrum of the BCG of the Phoenix Cluster (Figure 5). Unlike typical BCG spectra, which are predominantly indicative of passively evolving stellar populations, the BCG of the Phoenix Cluster is undergoing an extreme starburst, forming stars at a rate of ~800 $M_\odot$/yr, in a region extending out >50 kpc from the BCG center. This exciting object defies the conventional picture in which BCGs accrue stellar mass almost exclusively through mergers, and suggests that the galaxies that reside at the centers of massive clusters undergo short-lived episodes of extreme star formation.

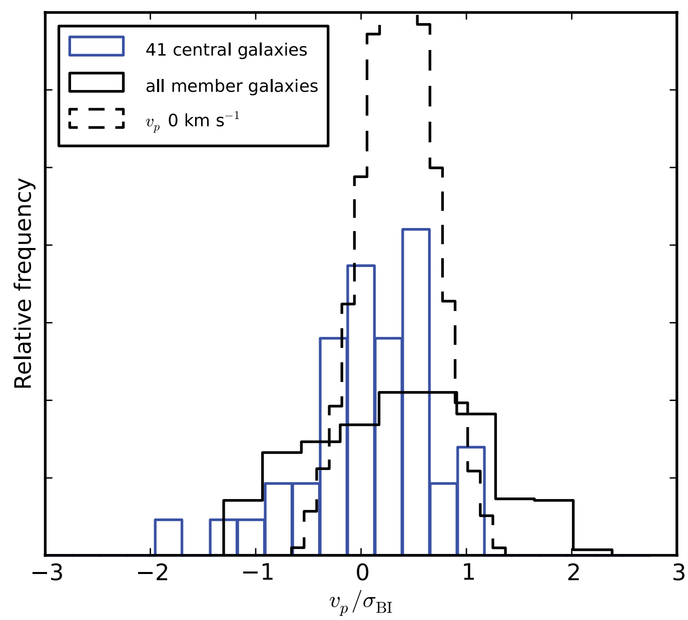


Figure 4: Ratio of galaxy proper velocity to cluster velocity dispersion for SPT clusters, shown as a normalized histogram both for the central galaxies (blue) and all member galaxies (solid black). In the limit where the central galaxy always has a proper velocity of 0 km/s, the distribution would retain a certain width because of the uncertainties in individual velocity measurements, and the expected shape of this zero-velocity distribution is over-plotted as a dashed line for reference. The BCG proper velocities show an excess relative to the zero-velocity distribution, indicating that they are, on average, sloshing around the center of the cluster potentials in which they reside.

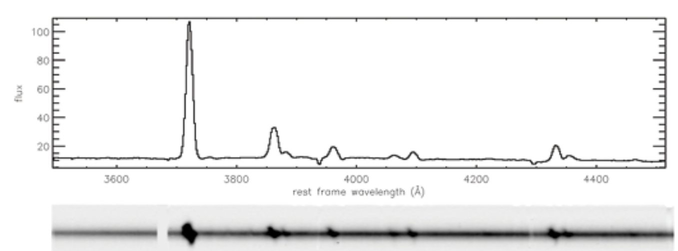


Figure 5: The 2-D and 1-D GMOS spectra of SPT-CLJ2344-4243. The top panel shows the rest-frame extracted 1-D spectrum, which exhibits extremely strong and broad emission features originating from excited Oxygen, Neon, Helium, and Hydrogen. The bottom panel shows the 2-D spectrum over the same wavelength range; the emission line features are clearly spatially extended, indicating that they are nebular features associated with ionized gas throughout the BCG rather than a point-source like AGN.

continued

NOAO Survey of South Pole Telescope SZ-Selected Galaxy Clusters continued

After weather troubles in 2011A, successful GMOS observations of SPT clusters began in the 2011B semester, and have continued since. There are currently 67 galaxy clusters that have either been observed, or are currently in the Gemini queue, and 2014 observations should bring the total to the proposed sample of 85 clusters. As a part of the NOAO survey process, the data and data products that result from the SPT-GMOS survey program will all be released publicly, as they become available. The first year of data are already available (mask catalogs, optical images, reduced 2-D spectra, and extracted 1-D spectra) for download via the Astronomy Dataverse Network (*theastrodata.org*). Higher-level data products (e.g., redshift catalogs, cluster velocity dispersions) will also be released as they are published. Our hope is that the SPT-GMOS program will provide a rich data set that will be scientifically useful for a large part of the astronomical community, in addition to its contributions to constraining the nature of Dark Energy.

Early results from SPT galaxy clusters using GMOS survey data have been published in several recent papers (High et al. 2012, Song et al. 2012, Reichardt et al. 2013, McDonald et al. 2013), and the survey should be completed in 2014, with comprehensive results of the full data set following.

References:

Benson, B., et al. 2013, ApJ, 763, 147
Carlstrom, J.E., Holder, G.P., & Reese, E.D. 2002, ARA&A, 40, 643
Carlstrom, J.E., et al. 2011, PASP, 123, 568
Coziol, R., et al. 2009, AJ, 137, 4795
Evrard, A.E., et al. 2008, ApJ, 672, 122
High, F.W., et al. 2012, ApJ, 756, 68
Jenkins, A., et al. 2001, MNRAS, 321, 372
McDonald, M., et al. 2012, Nature, 488, 349
McDonald, M., et al. 2013, ApJ (submitted), ArXiV; astro-ph/1305.2915
Press, W.H. & Schechter, P. 1974, ApJ, 187, 425
Reichardt, C.L., et al. 2013, ApJ, 763, 127
Song. J., et al. 2012, ApJ, 761, 22
Sunyaev, R.A. & Zel'dovich, Y.B. 1972, Comments on Astrophysics and Space Physics, 4, 173
White, M., Cohn, J.D., and Smit, R. 2010, MNRAS, 408, 1818

DECam NEO: Near-Earth Object Search with the Dark Energy Camera

Lori Allen, David Trilling (Northern Arizona University) & Brian Burt (Northern Arizona University)

A recently completed pilot project demonstrates the promise of the Dark Energy Camera (DECam) and Blanco for finding interesting Solar System objects. Following observing runs of four half-nights in January 2013 and four full nights in April 2013, we submitted more than 100,000 astrometric measurements of ~8700 moving objects to the Minor Planet Center (MPC). Approximately 1% of these have preliminary orbits that are like near-Earth objects (NEOs) (Figure 1). These results are preliminary, and as of mid-July 2013, the MPC had not determined how many of the detected objects are new discoveries, but it looks like we will be able to measure the size distribution of small NEOs (those having diameters <140 m). This is a primary goal of the DECam NEO Survey, which will get underway in 2014A.

Figure 2 shows diameter as a function of geocentric distance for the objects found in our pilot project. Diameter is derived from brightness of the objects, assuming an albedo of 0.2, a reasonable guess that only introduces a small error for any given object and is close to the overall average albedo of NEOs (Mainzer et al. 2011, Trilling et al. 2013). In this pilot project, we found a number of objects of size ~15 m, similar to the one that fell near Chelyabinsk on 15 February 2013. In our full survey, we expect to find 50 or more such objects.

Potentially hazardous asteroids are those asteroids of size 100 m or more, whose minimum orbit intersection distance (MOID) with respect to

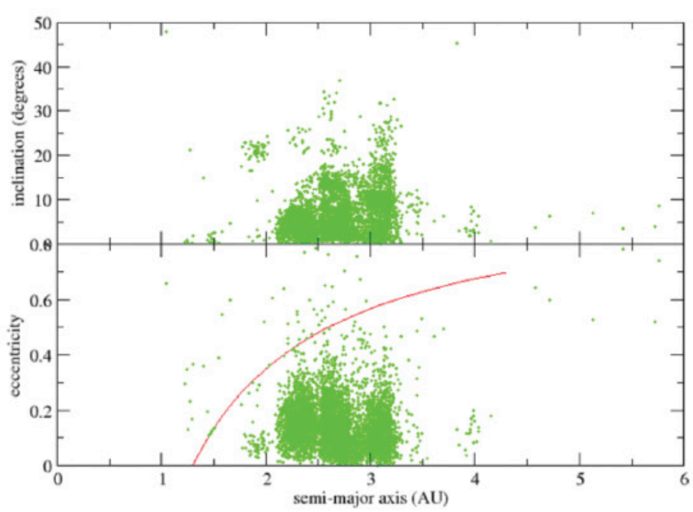


Figure 1: Orbital elements for all moving objects (except a small number of outer Solar System objects) detected on multiple nights in our 2013 pilot observations. The red line in the lower panel shows orbits having perihelion distance q = 1.3 AU; objects to the left of this line are defined as NEOs.

continued

DECam NEO continued

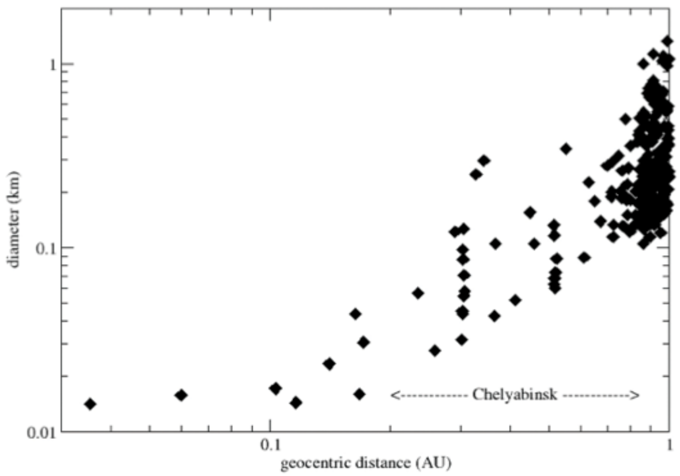


Figure 2: Diameter as a function of geocentric distance for moving objects detected in our 2013 pilot observations. This plot shows all moving objects in our data, not just NEOs, although objects with geocentric distances greater than 1 AU are not shown here. We found a number of objects relatively close to Earth, with a half-dozen Chelyabinsk-sized objects. In our full NOAO survey, we expect to find ~50 Chelyabinsk-sized objects passing close to Earth.

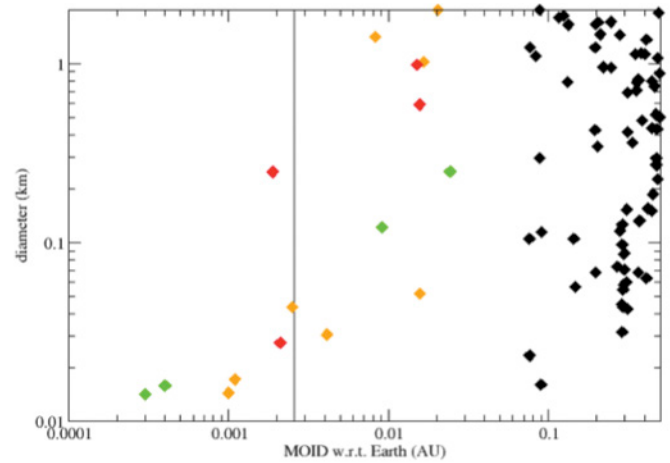


Figure 3: Diameter for objects detected in our 2013 pilot observations with small MOID (minimum orbital intersection distance). Black symbols show objects with MOID > 0.05 AU. Colored symbols show potentially hazardous objects with MOID < 0.05 AU. Green symbols show the brightest objects, with $18 < r < 20$ (where r refers to the measured r magnitude). Orange symbols have $20 < r < 22$. Red symbols have $22 < r < 24$. The vertical line shows the distance of the Moon.

Earth is 0.05 AU or less. Figure 3 shows the diameter of detected NEOs as a function of their MOID. Although these MOID calculations are preliminary and based on short (few nights) arcs, it is clear that we are finding potentially dangerous NEOs that are too faint for most searches.

We use the Moving Object Processing System (MOPS) developed for the Panoramic Survey Telescope & Rapid Response System (Pan-STARRS) and the Large Synoptic Survey Telescope (LSST) to find moving objects over multiple nights. After initial reduction of the images through the DECam Community Pipeline to remove instrumental signatures, a median stack is made for each pointing of the telescope (within a single night, stacks are typically made of four images) and subtracted to produce difference images. Photometry is performed on the difference images using the Astronomical Cataloging Environment (ACE), a photometry package in the Image Reduction and Analysis Facility (IRAF), which was developed at NOAO for source extraction and cataloging (Valdes 2001). The resulting catalogs are fed into MOPS, which we are running on a 96-node cluster at Northern Arizona University.

The basic algorithmic structure of MOPS has been described in several papers (Kubica et al. 2007a, 2007b). In short, MOPS identifies "tracklets" (i.e., moving objects intra-night) then links the tracklets into tracks (inter-night). A tracklet is built using multiple (typically two to four) detections from a single night. The time separation between these detections (~5 min) is enough to allow a precision measurement of the vector velocity, but short enough that the association of detections from the different exposures can be done with reasonable confidence. The results of our April run shown here require at least two detections on a single night to form a tracklet and tracklets on at least three nights to form a track (Figure 4).

The DECam NEO team includes Lori Allen, Frank Valdes, David Herrera, and David James (NOAO); David Trilling, Cesar Fuentes, and Brian Burt (NAU); Steve Larson and Eric Christensen (LPL); Tim Axelrod (LSST); Alissa Earle (Siena College); and Mike Brown (Caltech).

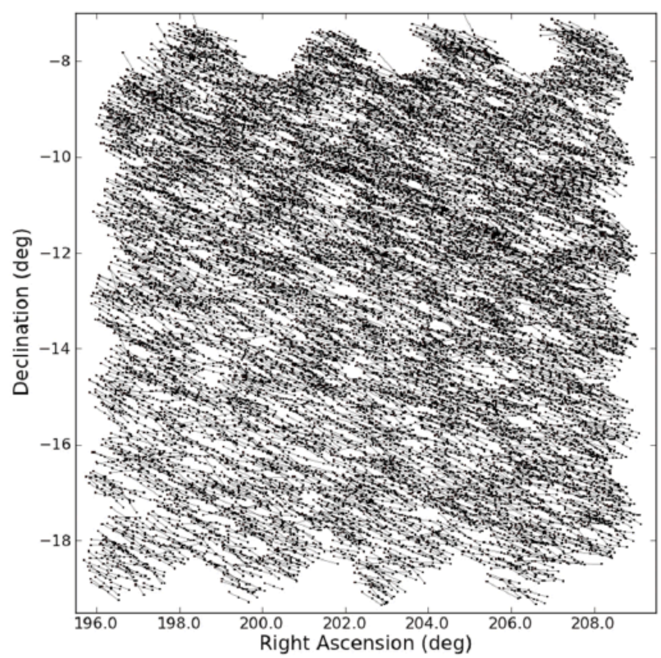


Figure 4: Tracks for all ~6500 moving objects found in our opposition survey (~144 sq deg) in April 2013. The hexagonal DECam field of view is apparent; there are 48 pointings abutted here. Tracks (inter-night linked observations) are shown as lines connecting dots; each dot represents a tracklet (intra-night link). All links and tracks shown here are found by MOPS.

References:

Kubica, J., et al. 2007a, Icarus, 189, 151

Kubica, J., et al. 2007b, ASPC, 376, 395

Mainzer, A., et al. 2011, ApJ, 731, 53

Trilling, D.E., et al. 2013, AJ, "ExploreNEOs VI: Second data release and preliminary size distribution of near Earth objects," submitted

Valdes, F.G. 2001, ADASS X, ASP Conf. Proc., 238, 507

Using the KPNO 4-m to Characterize Kepler's Exoplanet Candidate Host Stars

Mark Everett, David Silva, Steve Howell (NASA Ames) & Paula Szkody (University of Washington)

Mark Everett and Dave Silva (NOAO), Steve Howell (NASA Ames Research Center), and Paula Szkody (U. of Washington) have been using the long-slit Ritchey-Chrétien Spectrograph (RCSpec) on the Mayall 4-m telescope to obtain optical spectra of exoplanet candidate host stars in an effort to obtain fundamental stellar parameters for the stars and understand their attendant planets. The target stars, known as Kepler Objects of Interest (KOIs), were identified from Kepler Mission light curves as likely hosts of transiting exoplanets. Most of the candidate planets are estimated to have sizes in a range between that of Earth and Neptune.

Kepler is the first NASA mission with the primary objective of the discovery and characterization of transiting exoplanets, especially small planets orbiting their stars at distances suitable for life (Borucki et al. 2010). Kepler has obtained nearly continuous light curves of over 150,000 stars within its 115-square-degree field in its four years of operation. The target stars are almost all dwarfs of spectral types F, G, and K and span the magnitude range R = 8–16. A search of these light curves for periodic diminutions consistent with a transiting planet has resulted in over 3000 candidate exoplanets. A critical measurement derived from the transit light curve is the size ratio of the transiting body to that of the star, a quantity based primarily on the depth of the transit signals. To determine the size of the transiting planet, an estimate of the stellar radius is needed. Initial properties, including radius estimates, are available for most KOI stars based on broadband photometric surveys of the Kepler field, but the mission depends on other techniques like ground-based follow-up spectroscopy for more refined values and confirmation of the candidate exoplanets. Relevant stellar properties include the radius, effective temperature, mass, metallicity, and surface gravity.

The spectral follow-up program at the Mayall telescope is part of the Kepler Mission's Follow-up Program (KFOP), which coordinates the observing efforts of various groups using a variety of telescopes, instruments, and techniques. KFOP follows two broadly-defined approaches: (1) making detailed observations of a small number of the highest priority KOIs; and (2) surveying large samples of KOIs for statistical studies of exoplanet properties and occurrence rates, as well as the rate of false positives in the KOI sample (i.e., candidates whose transit-like signals are due to phenomena other than exoplanets).

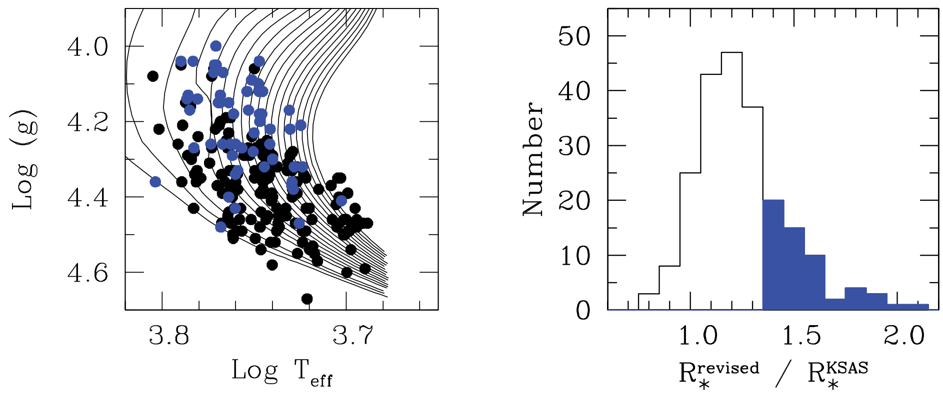


Figure 1: (Left panel) Stellar parameters are used to fit each star to a set of Yale-Yonsei isochrones from Demarque et al. (2004). The blue symbols denote stars with newly-fitted radii that exceed previous photometric estimates by 35% or more. (Right panel) The ratio of the revised to previous stellar radius for a sample of 220 exoplanet candidate host stars is shown. The blue region highlights stars with significantly revised radius estimates.

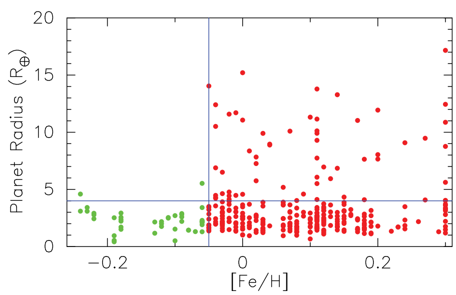


Figure 2: The radii of candidate exoplanets are plotted as a function of their host star metallicity. Blue lines divide the plot into four regions at [Fe/H] = −0.05 dex and planetary radius R = $4R_{\oplus}$. Red and green symbols indicate planets with high or low metallicity, respectively. The size distribution of the planets orbiting the two metallicity samples are indistinguishable among planets smaller than 4 Earth radii. In contrast, larger planets are relatively common among the higher metallicity host stars and significantly under abundant among the low metallicity sample.

The group using RCSpec at the Mayall telescope has surveyed nearly 400 KOI stars to date, obtaining R ~ 3000 spectra in the wavelength region of 364–512 nm. Their KOI sample lies mostly at the faint end of Kepler's targets (R = 14.5–16). These stars are readily accessible only with mid-size or larger telescopes like the Mayall, while other KFOP groups using smaller telescopes concentrated on brighter stars. Because the majority of KOI stars and the majority of the Kepler Mission's high priority exoplanet targets are faint, the program plays a critical role in fulfilling the Kepler Mission's goals.

The first results of the survey are published in Everett et al. (2013). They found fundamental properties for the solar-like stars in the sample by using a region of spectrum surrounding Hβ and fitting the observations to a library of model stellar spectra parameterized by a grid of T_{eff}, log(g), and [Fe/H] values. The best fitting parameters were taken to represent the stellar properties and fit to Yale-Yonsei isochrones (Demarque et al. 2004). The best isochrone fit was used to redetermine the stellar radius. The improvements to stellar radius estimates, when compared to the initial (pre-follow-up) values based on broadband photometry, are in a large part due to spectroscopic log(g) determinations (with new uncertainties of 0.15, down from ~0.4 in cgs units).

A couple of interesting results from Everett et al. (2013) are that a quarter of the KOI stars surveyed required a revised radius that was significantly larger (≥35%) than the initial estimates (see Figure 1). These host stars must be slightly more evolved than originally thought (although still near the Main Sequence). Be-

continued

Using the KPNO 4-m to Characterize Kepler's Exoplanet Candidate Host Stars continued

cause the sizes of planets orbiting these stars had been previously estimated by modeling the transit light curves with an assumed stellar radius, the new, larger stellar radii imply larger planet radii. The planets orbiting these stars must be larger (by 35% or more) than previously believed. Larger stellar radii estimates may point to systematic errors in the photometrically determined stellar properties or selection biases present in the sample of faint KOIs selected on the basis of estimated planet size. Host star metallicity also seems to play an important role in the occurrence rate of large planets. As shown in Figure 2, planets larger than $4R_{\oplus}$ (the size of Uranus) are found primarily around host stars with relatively high metallicity $[Fe/H] \geq -0.05$. This result is comparable to conclusions reached by Buchhave et al. (2012) in a smaller sample of brighter KOIs. These results bolster ideas that host star metallicity plays a role in the presence of large planets or the migration of large planets into short-period orbits where the geometric requirements for transits are more favorable.

The spectra and data from this study are available on the Kepler Community Follow-Up Observing Program website (*https://cfop.ipac.caltech.edu/*). Future plans of the group are to survey more KOIs, which will continue to be discovered from the Kepler light curves as more data are processed, extend the spectral-fitting study to other spectral types, and further investigate the results found in the initial study.

References:

Borucki, W.J., et al. 2010, Science, 327, 977

Buchhave, L.A., et al. 2012, Nature, 486, 375

Demarque, P., Woo, J.-H., Kim, Y.-C., & Yi, S.K. 2004, ApJS, 155, 667

Everett, M.E., Howell, S.B., Silva, D.R., & Szkody, P. 2013, ApJ, 771, 107

The Big Picture View of a Mini Starburst

Sarah Willis (Iowa State University & Harvard-Smithsonian CfA)

Sarah Willis (Iowa State University & Harvard-Smithsonian CfA) has used the NEWFIRM wide-field infrared imager to study the massive Galactic star-forming region NGC 6334, working with collaborators Lori Allen (NOAO), Massimo Marengo (Iowa State University), Giovanni Fazio and Howard Smith (Harvard-Smithsonian CfA), and Sean Carey (Jet Propulsion Laboratory/Infrared Processing and Analysis Center). NGC 6334, or the Cat's Paw Nebula, is a highly active, massive star-forming region located in the southern sky at a distance of ~1.6 kpc. The team used the NEWFIRM camera on the CTIO 4-m Blanco telescope to obtain a deep, wide-field view of NGC 6334. NEWFIRM's 28-arcmin field of view was well-suited for obtaining images in the deep J, H, and K_S bands of the 0.9×1.2 deg^2 star-forming complex to characterize the low-mass stars forming in the region. Studying the mechanisms of star formation in NGC 6334 may provide a bridge to better understanding of the high star formation rates and efficiency seen on large scales in starburst galaxies.

Almost 300,000 point sources were detected at the H and K_S bands by NEWFIRM and 3.6 and 4.5 μm by Spitzer and its Infrared Array Camera (IRAC). The team used the color-selection criteria presented by Gutermuth et al. (2009) to identify young stellar objects (YSOs) forming in NGC 6334 that were detected at all four IRAC bands. From that sample, they were able to extend the color-selection criteria to the near-infrared to enable the detection of over 1100 additional YSOs in areas where the IRAC observations were plagued by bright or saturated 8-mm emission. Combined, the NEWFIRM and IRAC observations found over 2000 young stellar objects (YSOs) displaying excess emission above normal photospheric levels at infrared wavelengths.

Figure 1: The combined Spitzer IRAC/NEWFIRM view of NGC 6334, showing NEWFIRM in blue and green and IRAC in red.

continued

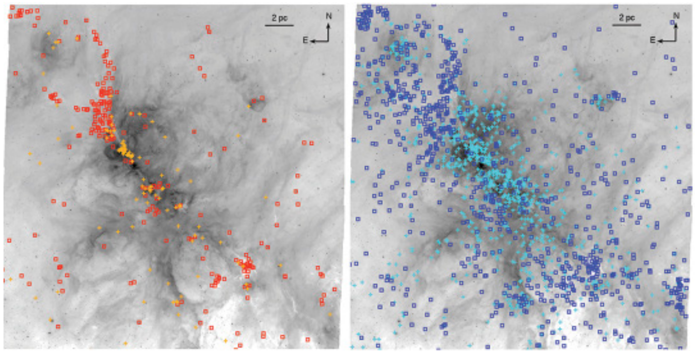


Figure 2: The location of Class I (first panel) and Class II (second panel) YSO candidates marked on the IRAC 8.0 µm map. The IRAC-selected candidates are plotted as squares and the candidates added using the near-infrared/warm Spitzer criteria are shown as plusses. Many YSOs in the bright nebulous regions of NGC 6334 that saturated at long IRAC observations are recovered by the near-infrared criteria.

The sensitivity of this study was sufficient to detect young stars down to approximately 0.5 $M_{\odot}$ in areas with low levels of background emission. By comparing to model YSO SEDs (Robitaille et al. 2006), the team was able to determine the YSO mass above which the census was complete (between 0.5 and 1.5 $M_{\odot}$, dependent on YSO class). They used a standard Kroupa initial mass function to infer the total stellar mass content of NGC 6334 as M_{YSO} = 9800 $M_{\odot}$. Using the disk half-life of 2 Myr for Class II YSOs (Evans et al. 2009) indicates that NGC 6334 is forming stars at a rate of 4900 $M_{\odot}$ Myr^{-1}. Over the observed 600 square parsecs, this corresponds to a star formation rate surface density of $8.2^{+6.3}_{-4.2} M_{\odot}\ Myr^{-1}\,pc^{-2}$.

Using the IRAC-NEWFIRM point source catalog, the team was able to map the extinction through the cloud. The resulting extinction map saturated around A_V = 30, which may be an order of magnitude smaller than the true extinction toward the dense infrared dark clouds and filaments. Summing over the extinction map yields a lower limit of $1.6 \times 10^5\ M_{\odot}$ for the observed portion of the GMC, or a mass surface density $\Sigma_{gas} \approx 250\ M_{\odot}\ pc^{-2}$. By determining the star-formation rate surface density and the gas mass surface density, NGC 6334 can be compared to nearby, low-mass star-forming regions as well as the Kennicutt-Schmidt relation for other galaxies.

The derived Σ_{gas} and Σ_{SFR} place NGC 6334 above and to the right of the low-mass star-forming regions in Figure 3. The rate and efficiency of star formation in this region are also significantly higher than those seen in other giant molecular clouds of the same overall size and mass, such as Orion. This may be due to the high fraction of dense gas in NGC 6334; over half of the observed mass is condensed into clumps and ridges where $A_V > 8$. NGC 6334 bridges between the "normal" low-mass star-forming regions nearby and the Galactic "mini-starburst" regions such as W43, providing a local opportunity to study resolved extreme star-forming activity.

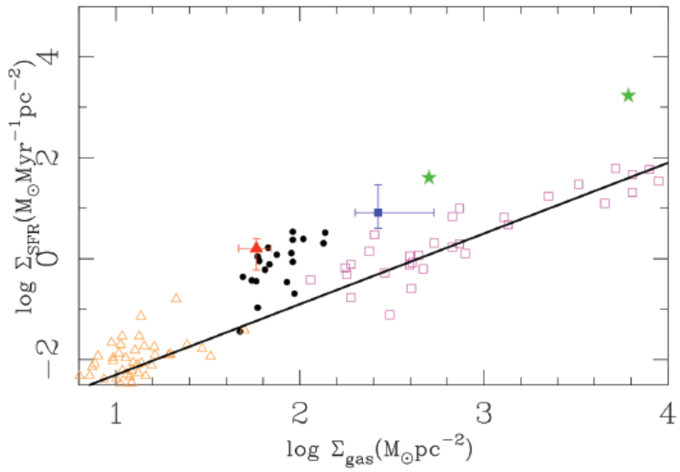


Figure 3: The Kennicutt-Schmidt relation comparing the observed star-formation rate surface density and gas mass surface density. NGC 6334 is the blue box and the error bars correspond to the uncertainty in the mass estimates of the YSO population and the molecular cloud. Orion is shown as a red-filled triangle with corresponding errors bars at the star-formation rate surface density derived with our method. Low-mass star-forming regions from Spitzer's c2d and GBS programs are plotted as filled black circles. W43 and G035.39, two Galactic massive star-forming regions identified as prototypical "mini-starbursts" (Motte 2012) are plotted as green stars. The open triangles show a sample of normal spiral galaxies and the open boxes show starburst galaxies. The line marks the Kennicutt-Schmidt relation with α = 1.4. NGC 6334 bridges between the nearby, low-mass star-forming regions and some of the most extreme star-forming environments we find in our galaxy.

References:

Evans II, N.J., et al. 2009 ApJS 181, 321 Gutermuth, R.A., et al. 2009, ApJ 184, 18

Motte, F., et al. 2012, SF2A-2012: Proceedings of the Annual Meeting of the French Society of Astronomy and Astrophysics, 45

Robitaille, T.P., et al. 2006, ApJS, 167, 256

Willis, S., et al. 2013, ApJ, submitted NL

A SMARTS Way to Keep an Eye on Blazars

By Erin Wells Bonning (Quest University Canada)

The Yale SMARTS (Small & Moderate Aperture Research Telescope System) blazar group has been using the 1.3-m and 1.5-m telescopes at CTIO to carry out an unprecedented optical and infrared (IR) photometric and spectroscopic campaign on nearly 75 gamma-ray bright relativistic jets visible in the southern sky. Operating since the launch of the Fermi Gamma-ray Space Telescope in 2008, the Yale SMARTS campaign provides low-energy coverage of flaring or otherwise interesting sources. The near-infrared (NIR) coverage

continued

A SMARTS Way to Keep an Eye on Blazars continued

of ANDICAM is particularly valuable as this region of the spectrum samples the peak of the synchrotron emission from the most luminous blazars (and is comparatively rare in the world of ground-based blazar monitoring programs). Concurrent with the photometric monitoring program, Yale graduate student Jedidah Isler has been carrying out spectroscopic observations with the RCSPEC instrument on the 1.5-m telescope. Tracking the response of spectral lines to changes in the jet continuum over long time frames constrains the jet/disk connection in blazars.

The most recent results from the Yale blazar team include the description of an "orphan" optical flare of PKS 0208-512 with no gamma-ray counterpart (Chatterjee et al. 2013) and a time resolved analysis of the broad line region (BLR) in 3C 454.3 (Isler et al. 2013, submitted), where evidence is seen that two gamma-ray flares were likely emitted at small radii (within the BLR) on account of the coincident increase of BLR luminosity and beamed gamma-ray luminosity. The long time-frame, multi-wavelength, and joint photometric and spectroscopic observations with the SMARTS telescopes have been crucial for describing these transient and sometimes ephemeral events, which together help to determine the structure and energy content of the jet.

The team's first data paper (Bonning et al. 2012) looked at an original set of 12 historically bright sources over the course of several years. Findings included: correlated variability in flat-spectrum radio quasars consistent with external Compton scattering models, increasing variability amplitude toward the IR due to the presence of a slowly varying accretion disk, and several examples of anomalous behavior including hysteresis tracks in color-magnitude space, achromatic flares, and distinct states associated with gamma-ray luminosity. Analysis of the full sample of more recent observations is ongoing. Additionally, SMARTS data made publicly available (see *www.astro.yale.edu/smarts/glast/home.php*) as part of this campaign have been incorporated into numerous papers by external authors on individual sources. NL

Imaging the Main Belt Comet P/2010 A2 with pODI

Jayadev Rajagopal, Susan Ridgway & David Jewitt (University of California, Los Angeles)

We started a program in semester 2013A to obtain deep images of Main Belt Comets (MBCs) to demonstrate the high-quality, wide-field imaging capability of the newly commissioned partially populated One Degree Imager (pODI) on the WIYN 3.5-m telescope. MBCs (also called active asteroids) are asteroids that show transient, comet-like morphologies resulting from significant mass loss, blurring the distinction between asteroids and comets. One of the objects that we imaged, P/2010 A2,

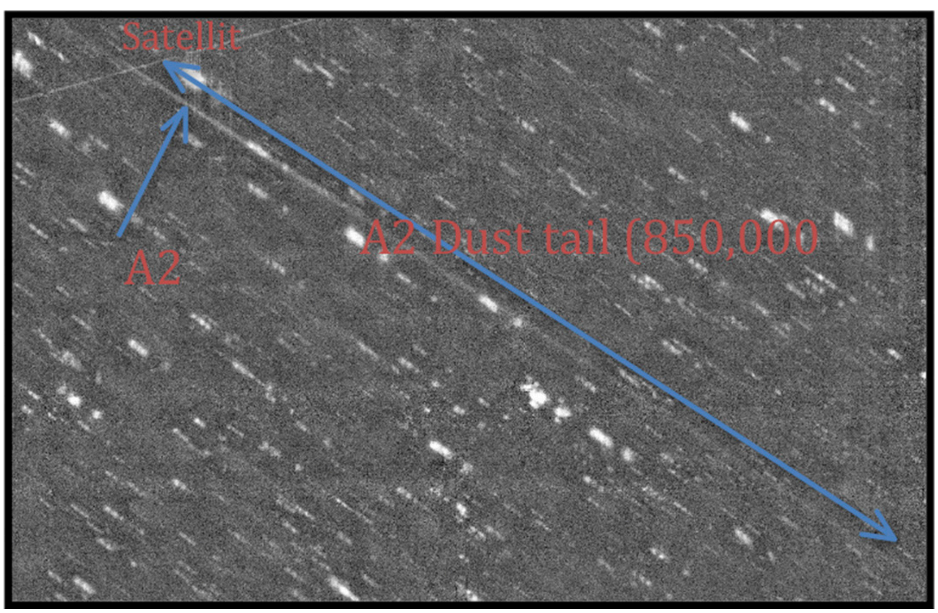


Figure 1: WIYN pODI image of active asteroid P/2010 A2. R-band image, ~1-hour exposure, taken in November 2012 when the object was at a distance from Earth of about 1.28 AU. Forty-three months after the disruptive event (orbital period is 42 months), the tail is seen as a long line (15 arcmin top left to bottom right), stretching for almost a million kilometers. By now mostly centimeter-sized (effective mean radius ~2 cm, Jewitt et al. 2012) particles remain in the dust debris, slowly sweeping out in a sheet (seen edge-on) in the ecliptic, driven by radiation pressure, ejection momentum, and solar gravity. The longevity and length make this a highly unusual tail, the full extent of which has been captured for the first time with the wide field (25 arcmin) of the pODI camera.

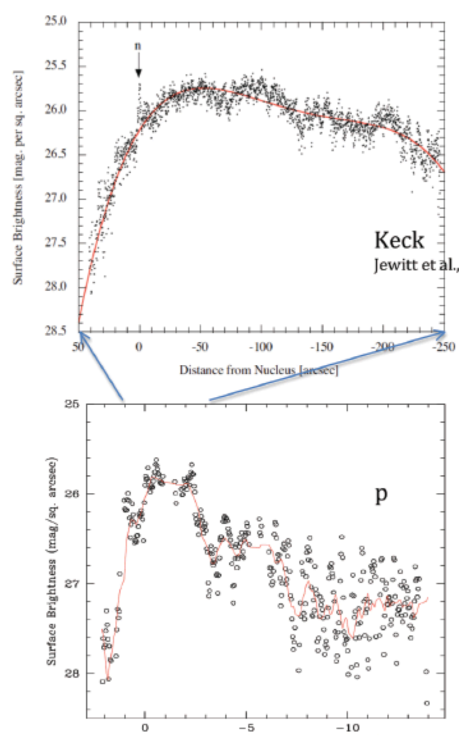


Figure 2: Profile (R band) of the P/2010 A2 debris tail from pODI and Keck images.

continued

was seen to have an extended dust tail, highlighting the usefulness of pODI for studying such objects.

P/2010 A2 was discovered in 2010 using the US Air Force telescope, Lincoln Near Earth Asteroid Research (LINEAR). Follow-up imaging with the Hubble Space Telescope (HST) showed an X-shaped structure with a broad tail (Jewitt et al. 2010, Nature). The evolution of the morphology indicated that the disruption of the nucleus (~100 m in diameter) occurred in February–March 2009. Likely causes are rotational "bursting" or a collision with a smaller object.

A recent image from the Keck telescope (Jewitt et. al. 2012) showed the debris tail extending beyond the 4-arcmin field of view (FOV). This prompted us to target A2 with the 25 arcmin-wide pODI FOV. The resulting R-band image (Figure 1, ~1-hour stack, with individual exposures of 3 minutes) was surprising. The tail is seen as a long line, extending beyond even the pODI FOV.

The shape and extent of the tail are controlled by the ratio (β) of radiation pressure to gravitational acceleration and the ejection velocity. Hence, the profile yields particle size distribution and mass. The pODI image samples the profile (Figure 2) out to much larger distances from the nucleus (>15'). The red curves are smooth overlays to help guide the eye.

A major question is understanding how much active asteroids contribute to the zodiacal dust production rate. Imaging a much wider extent of the tail will enable us to pin down the total mass of the debris. The mass estimate derived by extrapolating the profile derived from the Keck 4-arcmin FOV is uncertain by a factor of 2 or more.

The current estimate is that asteroids with known mass loss contribute only a few percent of the Solar System zodiacal dust production rate (10^3 to 10^5 kg/s). The small number of known active asteroids makes this a tentative number. Our program, which will continue in 2013B, seeks to image a few other active asteroids, as well as other asteroids in those fields, to pursue the problem of dust formation and its implications for exo-solar debris disks.

First Science Results with SAM in Laser Guide Star Mode

Andrea Kunder, Luciano Fraga & Andrei Tokovinin

Fraga, Kunder, and Tokovinin (2013, AJ, 145, 165) present deep, optical observations of the globular cluster NGC 6496 using the SOAR Adaptive Module (SAM) at the Southern Astrophysical Research (SOAR) 4.1-m telescope during commissioning of the SAM Laser Guide Star (LGS) mode.

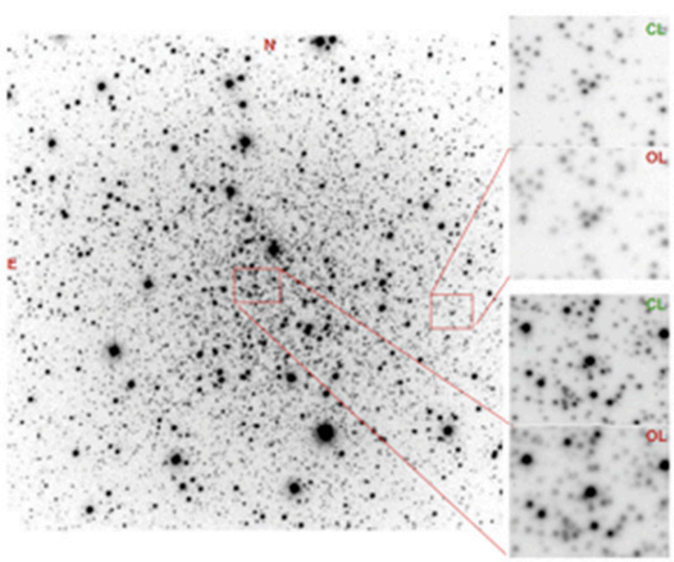


Figure 1: Full-frame I-band image of NGC 6496. The panel on the left shows fragments of 15″ × 12″ size comparing closed-loop (upper) and open-loop (lower) images taken with the same exposure time, 120 s, and displayed at the same intensity scale: at the center and at the edge of the 186″ field.

NGC 6496 lies in the direction of the Galactic bulge and is heavily obscured by the Galactic plane. This has made it difficult to determine its basic properties, and a lack of consensus on this cluster's extinction, distance, metallicity, age, and its classification as a disk or halo cluster made this cluster an intriguing target to observe. Further, because it is a relatively low-density cluster, ground-based studies of its core can penetrate to the cluster center, enabling photometric studies with little stellar incompleteness.

The authors used the capabilities of SAM to peer deep into this crowded cluster, obtaining firm results on its properties. Figure 1 shows the improvement in the image quality that was obtained using the LGS mode of SAM, leading to a precise color magnitude diagram (Figure 2), which reaches three magnitudes below the main sequence turn-off in the BVRI pass bands.

The authors used the location of the red clump, as well as theoretical isochrones, to measure a reddening to the cluster of E(V-I) = 0.28 ±0.02 mag, a distance of 10.0 ±0.1 kpc, an age of 10.5 Gyr ±0.5 Gyr, a metallicity of [Fe/H] = –0.65 ±0.05 dex, and a classification of a disk cluster.

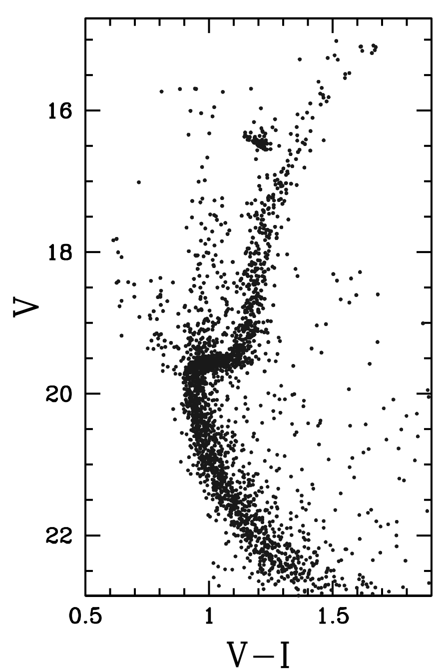


Figure 2: (V–I, V) Color Magnitude Diagram of NGC 6469.

DESI (Formerly BigBOSS) Status Update

Timothy C. Beers & David Sprayberry

NOAO astronomers and KPNO management and technical personnel continue to contribute considerable effort to planning for the Dark Energy Spectroscopic Instrument (DESI), formerly known as the Big Baryon Oscillation Spectroscopic Survey (BigBOSS) project. DESI is a 5000-fiber optical spectrograph with a 3-degree field of view and resolving power of R = 5000 that will measure baryon acoustic oscillations and redshift space distortions in the distribution of galaxies and hydrogen gas over redshifts $0.2 < z < 3.5$. We anticipate that it also will be available for community science programs (see *bigboss.lbl.gov*, *desi.lbl.gov*, and Schlegel et al. 2011, arXiv:1106.1706).

NOAO personnel attended a DESI collaboration meeting at the Lawrence Berkeley National Laboratory (LBNL) in early March 2013, to discuss use of the Mayall telescope for the experiment and to participate in discussions of alternative survey strategies for DESI.

In May 2013, the Department of Energy (DOE) announced the selection of the Mayall 4-m telescope as the preferred site for execution of DESI. Following the site selection, NOAO was granted representation on the DESI Interim Steering Committee. The responsibility of this committee is to advise the DESI director on matters related to the DESI collaboration in advance of the formation of more formal structures and principles of operation.

Most of the personnel from NOAO who are engaged in DESI work attended a DESI collaboration meeting at LBNL in July 2013, to kick off activities related to preparation for the DESI Critical Decision-1 (CD-1) review, which is anticipated to take place in January 2014. Co-chairs of the DESI Community Science Advisory Committee, Constance Rockosi (University of California, Santa Cruz) and Joan Najita (NOAO, ex officio), along with the other members of the committee have completed development of a white paper that outlines plans for a number of representative community science projects that could be carried out with DESI, either during the DESI survey or after its completion. See the white paper at *ast.noao.edu/sites/default/files/bigboss-csc-report.pdf*.

NOAO continues to be heavily involved in collaborative engineering work with LBNL staff to define the interfaces between DESI and the Mayall telescope and infrastructure. Efforts are underway to measure in detail the thermal and vibrational characteristics of the telescope and dome floor spaces where various DESI subsystems will be installed. Considerable work also has been devoted to designing and testing prototypes of the cable management systems that convey the fibers from prime focus to the stationary spectrographs at the dome floor level. Finally, preliminary planning continues for the future work needed to prepare the Mayall and install DESI.

Look for further updates on progress with DESI, post CD-1 review, in the next issue of the *NOAO Newsletter*.

KOSMOS and COSMOS Updates

Jay Elias & David Sprayberry

The Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) and the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS) are nearly identical spectrographs being developed simultaneously for use in the Northern and Southern Hemispheres, on the Mayall and Blanco telescopes, respectively. The development is by a partnership between NOAO and The Ohio State University (OSU) and is funded through the NSF's Renewing Small Telescopes for Astronomical Research (ReSTAR) Program.

We have modified the spectrograph camera design as a result of problems experienced by a third party optics vendor, which delayed delivery. Details of the delivery schedule are discussed below; these are essentially the same as described in the March 2013 *Newsletter*.

Commissioning time for KOSMOS is scheduled in early October 2013, with a second run in December. We plan to make KOSMOS available on the Mayall in semester 2014A. Because it will not have been commissioned by the time proposals are due, prospective users should propose for the R-C Spectrograph and indicate their interest in using KOSMOS instead, following the rules described below. We expect COSMOS commissioning to begin on the Blanco telescope during semester 2014A; we do not expect it to be offered for science use in semester 2014A.

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 expected KOSMOS/COSMOS capabilities as well as relevant technical documentation can be found at *www.noao.edu/nstc/kosmos/*.

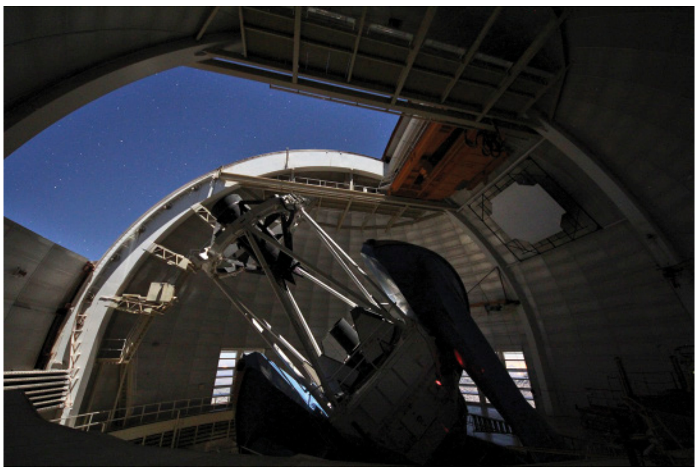
Status

The collimator assemblies for both instruments were completed by the end of July 2012, but there were continuing problems with the glued triplets and doublets in the camera assemblies. We have concluded that the cemented interfaces will not work over the required temperature

continued

KOSMOS and COSMOS Updates continued

range. OSU has negotiated with the vendor to deliver the collimator assemblies and the camera lenses. OSU designed a camera barrel that will use fluid coupling between the triplet and doublet elements instead, and acceptance testing of those assemblies will take place when the cameras are also completed. A prototype fluid-coupled lens cell has been built and extensively tested; the final design was independently reviewed and approved in January 2013. Similar designs have been implemented in, among others, the Baryon Oscillation Spectroscopic Survey (BOSS) spectrograph on the Sloan Digital Sky Survey Telescope at Apache Point (Smee et al. 2012, AJ, submitted: astro-ph: arXiv 1208.2233) and the Goodman spectrograph on SOAR (Clemens, Crain and Anderson 2004, Proc. SPIE, 5492, 331).



Interior of Mayall 4-meter telescope on Kitt Peak, future site of KOSMOS.
(Image credit: P. Marenfeld/NOAO/AURA/NSF)

The optics have all been delivered to OSU, inspected, and accepted. Mechanical fabrication of the camera barrels and cell components has been completed in the Tucson instrument shop. Integration with the optics and subsequent integration of the camera and collimator assemblies into the instruments took place in Tucson as well, for both instruments, beginning in early August 2013.

We expect KOSMOS to be "telescope ready" by the end of September, which means that KOSMOS commissioning at the Mayall should begin as scheduled on October 7. The CCD Dewars for COSMOS are still under construction in the instrument shop, and we expect completion by the end of 2013. This would allow COSMOS commissioning to be carried out at CTIO during semester 2014A.

Because the two instruments are nearly identical mechanically, COSMOS integration has been proceeding largely in parallel with KOSMOS; performance of the two should be nearly identical as well. COSMOS commissioning will take place following recommissioning of the repaired $f/8$ secondary mirror, probably during semester 2014A, due to time pressure from the Dark Energy Survey during the B semesters.

Policy for proposing to use KOSMOS in 2014A

We are adopting the following policy for requesting KOSMOS, because the first telescope run will occur after the deadline for proposal submission, and commissioning will be incomplete when the Telescope Allocation Committee meets. (Please see the 2014A Call for Proposals for the definitive rules; this is the same policy as was set for 2013B in the March 2013 *Newsletter*). Again, COSMOS will not be available for proposals in 2014A.

Interior of Blanco 4-meter telescope on Cerro Tololo, future site of KOSMOS.
(Image credit: Reidar Hahn/Fermilab)

- Proposers should only write proposals that can be carried out with the R-C Spectrograph.
- 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 found at *www.noao.edu/nstc/kosmos/* for the same amount of observing time.
- If KOSMOS is ready for shared-risk use during 2014A, we will contact scheduled observers to 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).
- Although we are in the process of commissioning a red-sensitive Lawrence Berkeley National Laboratory (LBNL) CCD for each instrument, proposers should assume only the availability of the e2v CCD; successful proposers who might benefit from the LBNL device will be contacted when it becomes available. NL

2014A NOAO Call for Proposals Due 26 September 2013

Verne Smith & Dave Bell

Proposals for NOAO-coordinated observing time for semester 2014A (February–July 2014) are **due by the evening of Thursday, 26 September 2013, 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), community-access time with the Keck 10-m telescopes and the CHARA interferometer, as well as time available on the Subaru 8.2-m telescope and the 4-m Anglo-Australian Telescope through exchange programs.

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. 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** are encouraged to use Gemini's tool, which runs on Solaris, Red-Hat Linux, Windows, and Mac platforms and can be downloaded from *www.gemini.edu/sciops/observing-gemini/proposal-submission/phase-i-tool-pit*.

Note that proposals for Gemini time may also be submitted using the standard NOAO form, and proposals that request time on Gemini plus other NOAO facilities must do so using the standard NOAO form. PIT-submitted proposals use a PDF attachment for the proposal text sections that closely mimic the standard NOAO form—be sure to use the correct PDF template. To ensure a smooth import of your proposal, follow the guidelines at *www.noao.edu/noaoprop/help/pit.html*.

Proposal Preparation and Submission Help

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***
Gemini-related questions about operations or instruments	***gemini-help@noao.edu***
	www.noao.edu/ngsc/noaosupport.html
CTIO-specific questions related to an observing run	***ctio@noao.edu***
KPNO-specific questions related to an observing run	***kpno@noao.edu***
Keck-specific questions related to an observing run	***keck@noao.edu***

System-Wide Observing Opportunities for Semester 2014A: Gemini, Keck, CHARA, Subaru, and AAT

Letizia Stanghellini, Dave Bell & Verne V. Smith

Semester 2014A runs from 1 February to 31 July 2014. 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. Observing opportunities on telescopes other than those of KPNO, CTIO, WIYN, and SOAR are summarized below.

The Gemini Telescopes

The US user community is allocated about 75 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.

NOAO encourages US investigators to propose for classical programs, which can be as short as one night, on the Gemini telescopes in an effort to increase interactions between US users and the Gemini staff and to increase observing directly with the telescopes and instruments. We also encourage queue observers to visit Gemini to see the operation first-hand. NOAO will cover the travel costs for thesis student observers to observe at or visit Gemini.

US Gemini observing proposals are submitted to and evaluated by the NOAO Time Allocation Committee (TAC). The formal Gemini "Call for Proposals" for 2014A will be released in early September 2013 (close to the publication date of this *Newsletter* issue), with a US proposal deadline of Thursday, 26 September 2013. As this article is prepared well before the release of the Gemini Call for Proposals, the following lists of instruments and capabilities are only our expectations of what will be offered in semester 2014A. Please watch the Gemini Science Operations web page (*www.gemini.edu/sciops*) 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 2014A:

***Gemini North*:**

- NIFS: Near-infrared Integral Field Spectrometer.
- NIRI: Near Infrared Imager.
- GMOS-North: Gemini Multi-Object Spectrograph and imager. Science modes are multi-object spectroscopy (MOS), long-slit spectroscopy, integral field unit (IFU) spectroscopy and imaging. Nod-and-Shuffle mode is also available. GMOS-North currently features red-sensitive e2v CCDs. Gemini does not expect to replace them with higher efficiency Hamamatsu CCDs in 2014A.
- 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.
- ALTAIR adaptive optics (AO) system in natural guide star (NGS) mode, as well as in laser guide star (LGS) mode, with sky coverage limited by the need for natural AO or tip/tilt guide stars. A mode that uses LGS along with fast guiding from the peripheral wavefront sensor yields improved image quality with 100% sky coverage. ALTAIR can be used with NIRI imaging, NIFS IFU spectroscopy, NIFS IFU spectral coronagraphy, and GNIRS.
- All of the available instruments and modes are offered for both queue and classical observing, except for LGS, which is available as queue only. Classical runs are offered to programs that are one night or longer and consist of integer nights.
- Details on the use of the LGS system can be found at *www.gemini.edu/sciops/instruments/altair*, 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.

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. At this time, the instrument is offered with EEV CCDs; a plan is set but not scheduled to replace these with the Hamamatsu CCDs. If the replacement occurs during 2014A, the time available on GMOS-South might be reduced.
- GeMS+GSAOI: Gemini Multi-Conjugate Adaptive Optics System with the Gemini South Adaptive Optics Imager.
- FLAMINGOS-2: Florida Multi-Object Imaging Near-Infrared Grism Observational Spectrometer version 2. FLAMINGOS-2 is expected to be available in imaging and long-slit modes for regular proposals in 2014A. The multi-object spectroscopy mode is expected to be commissioned in 2014A.
- GPI: Gemini Planet Imager. GPI could be offered on a shared-risk basis in 2014A pending successful acceptance and commissioning in late 2013.
- GMOS-South and FLAMINGOS-2 are offered for both queue and classical observing. As with Gemini North, classical runs are 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.*

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). We encourage proposers for US-only time to consider using the PIT, as it includes additional tools for target optimization and verification and produces proposals that can be smoothly migrated into Phase II. The NOAO Web-based form continues to be available and should be used for proposals that wish to request other NOAO resources besides Gemini.

continued

System-Wide Observing Opportunites for Semester 2014A continued

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 using 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*.

Subaru Access through Gemini Exchange Program

We expect classical observing time to be available on Subaru through an exchange program with Gemini, but at this time we do not have a specific commitment on the time or instrument that will be available. Observers interested in the Subaru time exchange should check the status of these capabilities closer to the deadline.

TSIP Open-Access Time on Keck

As a result of awards made through the National Science Foundation Telescope System Instrumentation Program (TSIP), telescope time is available to the general astronomical community at the Keck Telescopes. A total of 7 nights of classically scheduled observing time will be available with the 10-m telescopes at the W.M. Keck Observatory on Mauna Kea. All facility instruments are available. For the latest details, see *www.noao.edu/gateway/keck/*.

AAT Access through CTIO Exchange Program

In 2012B, CTIO and the Australian Astronomical Observatory (AAO) started a program to exchange time between the CTIO 4-m telescope and the 4-m Anglo-Australian Telescope (AAT). This program is expected to continue through 2014A, with up to 10 classically scheduled nights on the AAT available to the NOAO community. All AAT instruments are available to this program. NOAO users may also apply directly for AAT time through the AAO's open call. For additional information, see *www.noao.edu/gateway/aat/*.

Access to the CHARA Optical Interferometer Array

About 50 hours will be available during calendar year 2014. All proposals are due at the 2014A deadline of 26 September 2013, even for observations that would nominally fall in 2014B. For information on available beam combiners and links to observation planning tools, see *www.noao.edu/gateway/chara/*.

Summary of Instruments Available

Lists of instruments that we expect to be available in 2014A can be found following this article. As always, investigators are encouraged to check the NOAO website for any last-minute changes before starting a proposal.

If you have any questions about proposing for US observing time, feel free to contact Letizia Stanghellini (*lstanghellini@noao.edu*), Dave Bell (*dbell@noao.edu*), or Verne Smith (*vsmith@noao.edu*). NL

Telescopes and Instruments Offered at KPNO in 2014A

Lori Allen

The instruments available on the Mayall 4-m telescope in the 2014A semester will be the Ritchey-Chrétien Spectrograph (R-C Spec), Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS), Echelle, Phoenix, Mosaic, and the NEWFIRM wide-field infrared imager. Pending the successful commissioning of KOSMOS in October, some R-C Spec programs may be migrated to that instrument. Proposals to use KOSMOS or R-C Spec should indicate clearly whether either instrument can be used. Phoenix will not be offered beyond 2014A.

The instrument complement at the 4-m telescope will be further restricted in coming semesters. By the end of 2015A, it will likely consist of only three instruments: Mosaic, NEWFIRM, and KOSMOS.

Semester 2014A will be the last semester of open access for the KPNO 2.1-m telescope, which will have the optical imager as its sole instrument in 2014A. Visitor instruments at the 2.1-m telescope will still be considered for 2014A, but only in situations where the proposal can identify a critical observation to be performed, or as a path-finder for future independent operation of the telescope. In all cases, the proposer must be prepared to demonstrate technical readiness of the instrument prior to final approval; KPNO staff will be able to provide only very limited support for installation. See Timothy Beers' article, "KPNO Director's News," in this issue for more information.

The Half Degree Imager at the WIYN 0.9-m telescope is scheduled for commissioning in 2013B. It will take the place of Mosaic, which will remain at the Mayall 4-m telescope.

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 Instrument Availability for 2014A

Eric Hooper (WIYN)

To get the latest updates and for links to the most current information, we strongly recommend that you visit the WIYN status web page, *www.wiyn.org/Observe/wiynstatus.html*, prior to proposing.

WIYN 3.5-m

Commissioning of the partially populated One Degree Imager (pODI) in static mode is essentially complete, and commissioning of the coherent guiding mode is underway. We should have several months of normal operations under our belt before the 2014A semester starts, but currently we cannot guarantee that all aspects of the instrument, including pipeline processing, will be fully tested and optimized. Therefore, (1) observers should be prepared to confirm the measurements they make (surprising results, especially), (2) some functions may not have been implemented yet, and (3) some aspects may be inefficient. Information about proposing for pODI as well as its capabilities and performance can be found at *www.wiyn.org/ODI/Observe/wiynodiobserve.html*.

It is anticipated that pODI will be available for only the first part of the 2014A semester, after which it is expected to be removed for an upgrade to a larger 48 arcmin × 48 arcmin imager. As of mid-July, pODI was scheduled to be removed in late March to early April 2014. This may change, so please check the WIYN status web page (*www.wiyn.org/Observe/wiynstatus.html*) as needed.

The status of the other instruments follows:

- MiniMo will not be available in 2014A.
- All other WIYN instruments now share the second Nasmyth port, known as the Hydra port. Thus, SparsePak+WHIRC, WHIRC+Visitor Instruments, and Hydra will be block scheduled. The switch between Hydra and the Instrument Adapter System (IAS) that supports the WIYN High-Resolution Infrared Camera (WHIRC), SparsePak, and visitor instruments takes two to five days to complete. We currently are discussing the best timing for the switch. Therefore, there will be a minimum of two months between changes of Hydra to other instruments on the Hydra port. Check the WIYN status web page (*www.wiyn.org/Observe/wiynstatus.html*) for updates.
- The repair work on the mechanical elements of the WIYN Tip-Tilt Module (WTTM) has been completed. It is believed that degraded coatings on the WTTM mirrors contributed to an observed decrease in the sensitivity of WHIRC (see *www.noao.edu/kpno/manuals/whirc/hotnews.html* for the latest measurements). Work on these coatings is underway, and hopefully will reach completion this fall. If the schedule holds, the newly coated mirrors will be in place and ready to use in WTTM for the 2014A observing semester.

Remote observing at WIYN is now available to all qualified observers (see the remote observing policies in the link below). Those wishing to observe remotely with ODI must do so from a pre-approved (and tested) workstation. Please see *www.wiyn.org/Observe/wiynremote.html* for more information.

WIYN 0.9-m

WIYN is anticipating the delivery and commissioning of the Half Degree Imager (HDI) camera on the WIYN 0.9-m telescope during fall 2013. Through the NSF Program for Research and Education with Small Telescopes (PREST), the 0.9-m Consortium will be offering nights to the community through proposals to NOAO. In semester 2014A, these nights will be offered as shared risk, and the total number of nights available is currently under negotiation. Because of this and the schedule uncertainty as of mid-July, we strongly recommend that you visit the WIYN status web page (*www.wiyn.org/Observe/wiynstatus.html*) to get the latest updates and links to current information prior to proposing. If HDI is unavailable for part of 2014A, we anticipate continuing to offer the S2KB imager (*www.noao.edu/0.9m/observe/s2kb.html)* during that time.

The SMARTS Consortium Continues

Victoria Misenti (Yale), Todd Henry (Georgia State University) & Nicole van der Bliek

The Small and Moderate Aperture Research Telescope System (SMARTS) Consortium has been operating the 1.5-m, 1.3-m, 1.0-m, and 0.9-m telescopes on Cerro Tololo since 2003. SMARTS has been renewed and, under the current agreement, SMARTS 3, is expected to continue operations through observing semester 2016A. For 2014A, the 1.5-m and 1.3-m telescopes will be operated in full service observing mode. Please contact Victoria Misenti at Yale (*victoria.misenti@yale.edu*) for information on the 1.5-m and 1.3-m telescopes. The 0.9-m telescope is operated in classical user mode. Please contact Todd Henry at Georgia State University (*thenry@chara.gsu.edu*) for information on the 0.9-m telescope. The 1.0-m is closed currently.

If you are interested in science programs that require large or small amounts of observing time, new partners are welcome. For information about membership, see the SMARTS website at: *www.astro.yale.edu/smarts/about.htm*. For detailed, up-to-date information on the telescopes, instruments, and available operations modes, please consult the SMARTS web pages at *www.astro.yale.edu/smarts*.

For an example of science carried out with the SMARTS telescopes, see "A SMARTS Way to Keep an Eye on Blazars" in the Science Highlights section of this issue. The article describes the work on blazars by the Yale group using the SMARTS telescopes.

CTIO Instruments Available for 2014A

Spectroscopy	Detector	Resolution	Slit
CTIO BLANCO 4-m			
Hydra + Fiber Spectrograph [1]	SITe 2K×4K CCD, 3300–11,000Å	700–18,000, 45,000	138 fibers, 2" aperture
SOAR 4.1-m			
OSIRIS IR Imaging Spectrograph [2]	HgCdTe 1K×1K, JHK windows	1200, 1200, 3000	3.2', 0.5', 1.2'
Goodman Spectrograph [3]	Fairchild 4K×4K CCD, 3100–8500Å	1800, 2800, 4300, 5900, 10,100	3.5'
CTIO/SMARTS 1.5-m [4]			
CHIRON	e2v CCD 4K×4K, 420–870nm	80,000 (with image slicer)	2.7" fiber

Imaging	Detector	Scale ("/pixel)	Field
CTIO BLANCO 4-m			
DECam Optical Imager	LBL 62-CCD mosaic, 2K×4K	0.27	2.0 degrees diameter
ISPI IR Imager [1]	HgCdTe (2K×2K 1.0–2.4μm)	0.3	10.25'
SOAR 4.1-m			
SOAR Optical Imager (SOI) [5]	e2v 4K×4K Mosaic	0.08 (1×1 binning)	5.25'
OSIRIS IR Imaging Spectrograph [5]	HgCdTe 1K×1K	0.33 (*f*/3 camera), 0.14 (*f*/7 camera)	3.2' (*f*/3 camera), 1.3' (*f*/7 camera)
Spartan IR Imager [5,6]	HgCdTe (mosaic 4-2K×2K)	0.0661, 0.0400	5.04', 3.05'
Goodman Spectrograph [3,5]	Fairchild 4K×4K CCD	0.15	7.2' diameter
SOAR Adaptive Module (SAM) [7]	4K×4K CCD (e2v)	0.045	~3'×3'
CTIO/SMARTS 1.3-m [8]			
ANDICAM Optical/IR Camera	Fairchild 2K×2K CCD	0.17	5.8'
	HgCdTe 1K×1K IR	0.11	2.0'
CTIO/SMARTS 0.9-m [9]			
Direct Imaging	SITe 2K×2K CCD	0.4	13.6'

[1] Pending Blanco *f*/8 secondary mirror repairs and recommisioning, Hydra and ISPI may be available in 2014A. For more information and the latest update, see the Call for Proposals for 2014A.

[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 resolutions achievable with the 400, 600, 930, 1200, and 2100 l/mm gratings using the narrowest (0.46") slit and measured at 5500Å. Imaging mode is also available. The instrument has its own set of U, B, V, and Rc filters, but it is also possible to install any of SOI 4×4 inch square filters.

[4] Service observing only.

[5] Remote observing is possible with this instrument. Please see *www.soartelescope.org/observing/remote-observing-at-soarfor* details.

[6] 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 NIR imaging observations.

[7] The SOAR Adaptive Module (SAM) will be available in shared-risk mode during the 2014A semester.

[8] Service observing only. Proposers who need the optical only will be considered for the 0.9-m unless they request otherwise. Note that data from both ANDICAM imagers is binned 2×2.

[9] Classical only.

Gemini Instruments Available for 2014A *

GEMINI NORTH	Detector	Spectral Range	Scale ("/pixel)	Field
NIRI	1024×1024 Aladdin Array	1–5µm Broad and narrow filters	0.022, 0.050, 0.116	22.5", 51", 119"
NIRI + Altair	1024×1024 Aladdin Array	1–2.5µm + L Band Broad and narrow filters	0.022, 0.050	22.5", 51"
GMOS-N	3×2048×4608 e2v deep depletion CCDs	0.36–1.0µm R~670–4400	0.072	5.5' 5" IFU
NIFS	2048×2048 HAWAII-2RG	1–2.5µm R~5000	0.04×0.10	3"×3"
NIFS + Altair	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
FLAMINGOS-2	2048×2048 HAWAII-2	0.9–2.4µm R~1200, 3000	0.18	6.1' (circular)
GSAOI + GeMS	4×2048×2048 HAWAII-2RG	0.9–2.4µm Broad and narrow filters	0.02	85"×85"
GPI	2048×2048 HAWAII-2RG	0.9–2.4µm R~40–90	0.0141"/lenslet	2.8"×2.8"

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'
HSC (Subaru)	104×2048×4096 CCDs	0.4–1.0µm	0.17	90' diameter
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)
FMOS (Subaru)	2048×2048 HAWAII-w	0.9–1.8µm R~250–7500	0.216	30' diameter
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", 21", 54" square

* 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 2014A

Spectroscopy	Detector	Resolution	Slit Length	Multi-object
Mayall 4-m				
R-C CCD Spectrograph [1]	T2KA/LB1A CCD	300–5000	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
Phoenix [3]	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

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				
pODI [7]	12K×12K central + 4 (4K×4K) distributed	3600–9500Å	0.11	24'×24' central
WHIRC [8]	VIRGO HgCdTe (2048×2048)	0.9–2.5µm	0.10	3.3'
2.1-m				
CCD Imager [9]	STA CCD	3300–9700Å	0.305	10.2' (RA) × 6.6' (DEC)
WIYN 0.9-m				
Half-Degree Imager [10]	8K×8K	3500–9700Å	0.43	59'

[1] PIs can propose for RCSP in 2014A, but projects will be moved to KOSMOS, where possible, upon its successful commissioning in 2014A. T2KA is default the CCD for RCSP and ECH. T2KB now serves as T2KA's backup. LB1A may be requested for RCSP if appropriate.

[2] PIs should write proposals using the capabilities offered by RCSP. If the science requirements can be met by the initial capabilities of KOSMOS, PIs should specifically indicate an interest in adapting the proposal for KOSMOS when writing the Technical Description section. See page 16 of the March 2012 NOAO Newsletter for more details.

[3] See *www.noao.edu/kpno/phoenix* before preparing the proposal.

[4] One-degree field with two fiber bundles of ~85 fibers each. "Blue" (3") and "Red" (2") fibers. See "WIYN Instrument Availability for 2014A" in this *NOAO Newsletter* for information about block scheduling of this instrument.

[5] Integral Field Unit, 80"×80" field, 5" fibers, graduated spacing. See "WIYN Instrument Availability for 2014A" in this *NOAO Newsletter* for information about block scheduling of this instrument.

[6] Permanently installed filters include *J*, *H*, *Ks*. See *www.noao.edu/ets/newfirm* for further information, filter availability, and the policy on filter changes.

[7] Due to the scheduled upgrade to pODI, proposals will be accepted for February and March only.

[8] WHIRC was built by Dr. Margaret Meixner (STScI) and collaborators. Potential users requiring WTTM are advised to contact KPNO support staff for details on its current status before proposing and *www.wiyn.org/observe/status.html* for any updates.

[9] An STA CCD with Monsoon controller will become the default CCD for the 2.1-m; T2KB may be available as a backup. Lab performance will be made available as soon as possible. Meanwhile, contact KPNO Support for further information.

[10] Availability of HDI is anticipated beginning in 2014A, pending successful commissioning.

Keck Instruments Available for 2014A

	Detector	Resolution	Spectral Range	Scale ("/pixel)	Field
Keck-I					
HIRESb/r (optical echelle)	3x MM-LL 2K×4K	R~30K–80K	0.35–1.0μm	0.19	70" slit
LRIS (img/lslit/mslit)	Tek 2K×4K, 2x e2v 2K×4K	R~300–5000	0.31–1.0μm	0.22	6'×8'
OSIRIS (near-IR AO img/spec)	2048×2048 HAWAII2	R~3900	0.9–2.5μm	0.02–0.1	0.32"–6.4"
MOSFIRE (near-IR img/mos)	2048×2048 HgCdTe	R~4000	0.97–2.4μm	0.18	6.1', 46 slits
Keck-II					
DEIMOS (img/lslit/mslit)	8192×8192 mosaic	R~1200–10,000	0.41–1.1μm	0.12	16.7'×5'
ESI (img/low-disp/optical echelle/IFU)	MIT-LL 2048×4096	R~1000–6000	0.39–1.1μm	0.15	2'×8', 4.0"×5.7" (IFU)
NIRSPEC (near-IR echelle)	1024×1024 InSb	R~2000, 25,000	1–5μm	0.14, 0.19	42", 12" & 24" slit lengths
NIRSPAO (NIRSPEC w/AO)	1024×1024 InSb	R~2000, 25,000	1–5μm	0.014, 0.018	3.96", 1.13" & 2.26"
NIRC2 (near-IR AO img)	1024×1024 InSb	R~5000	1–5μm	0.01–0.04	10"–40"

AAT Instruments Available for 2014A

	Detector	Resolution	Spectral Range	Scale ("/pixel)	Field
AAOmega + 2dF (392-fiber MOS)	2x e2v 2024×4096	R~1300–8000	0.37–0.95μm	R~1.3K–8K	120'
AAOmega + KOALA (1000-element IFU)	2x e2v 2024×4096	R~1500–10,000	0.4–0.95μm	0.7" or 1.25"	24"×18" or 43"×32"
HERMES + 2dF (392-fiber MOS)	4x e2v 4096×4112	R~28K, 45K	0.47–0.79μm	R~28K or 45K	120'
IRIS2 (near-IR img/spec/mos)	1024×1024 HgCdTe	R~2400	0.9–2.5μm	0.45	7.7'×7.7'
UCLES (cross-dispersed echelle)	2K×4K EEV2 or MITLL3	R~45K–100K	0.38–1.1μm	0.16, 0.18	
UCLES + CYCLOPS2 (16-element IFU)	2K×4K EEV2 or MITLL3	R~70K	0.45–0.74μm	0.6"/fiber	2.45"
UHRF (ultra-high resolution echelle)	2K×4K EEV2	R~300K, 600K, 940K	0.3–1.1μm	0.03, 0.05, 0.10	

CHARA Instruments Available for 2014

	Beam Combiner	Resolution	Spectral Range	Beams
The CHARA Array consists of six 1-meter-aperture telescopes with baselines from 30 to 330 meters.	Classic, Climb	Broadband	H or K	2 or 3
	MIRC	40	H or K	6
	VEGA	6000/30,000	45nm in 480–850nm	2 or 3
	PAVO	30	630–900nm	2

Community Access Time Available in 2014 with CHARA

Steve Ridgway

NOAO and Georgia State University are announcing a fifth opportunity for observations with the Center for High Angular Resolution Astronomy (CHARA) optical interferometer array at Mt. Wilson Observatory. About 50 hours will be available during calendar year 2014. Observations will be carried out by CHARA staff.

Requests should be submitted using the standard NOAO proposal form by selecting "CHARA" in the telescope list and entering "nights requested" as a decimal assuming 10 hours/night (e.g., 1.6 nights = 16 hours). Proposals must be submitted by the standard 2014A deadline of 26 September 2013. This one-time call covers all of calendar year 2014, as opposed to the six-month period of February–July 2014 for other resources in the 2014A proposal cycle. For more information, see *www.noao.edu/gateway/chara/*.

DECam Update

Alistair Walker

DECam has completed its first full semester as a community instrument, and, on the whole, things have gone very well. The instrument has consistently produced high quality data, and the acquisition software (SISPI) and other software tools available during observing have proven to be capable and reliable. Data transfer back to NOAO-Tucson and into the NOAO Science Archive has been trouble-free, and the community pipeline for data reduction has been rapidly gaining in functionality (see "DECam Community Pipeline" in this *Newsletter*).

Prior to the 2013A semester, the Blanco 4-m telescope tracking and guiding were big issues, seriously affecting the delivered image quality, particularly to the north of zenith. Some improvements were made during December and January by reducing friction and stiction of the DECam cable wraps and by reinstating use of the damper motor for the RA drive. However, the big breakthrough came at the very start of 2013A when the oil wipers on the RA axis horseshoe bearing were found to be in contact with the bearing surface. After proper adjustment of the primary oil wipers and removal of the secondary wipers, the rms tracking jitter fell to 0.04 arcsec, and the unstable tracking that was a feature of the first few months of DECam use vanished. Further improvements were made at the end of February with the re-tuning of the Declination servo. With adjustments to the tracking model, the track rate error was reduced to less than 0.5 arcsec/min over the sky, usually less than half that, and the telescope tracking ceased to be an issue. This also had a substantial effect on the quality of the guiding, both in reducing image shifts in the unguided 20 seconds at the start of each exposure and by the guider and telescope control system having a much easier time providing and applying position corrections. We learned that even with four 2048 × 2048 guide CCDs, guide stars sometimes were not found in the u band, but almost always a simple increase of the exposure time from the nominal 0.6 s to 1.2 s solved that problem. Another guiding issue arose as the semester progressed and the galactic center was targeted by science programs. The guider had difficulty automatically selecting guide stars in very crowded fields; a quick fix was to reduce the guider exposure time to 0.3 or 0.2 s. A more robust solution to this problem will require changes to the automatic guide star selection process; this is on the to-do list.

Pointing accuracy has affected some programs. DECam is much heavier than Mosaic II. With almost three times its mass added to the Cassegrain focus for the telescope, DECam is now ~10 tons heavier than Mosaic. The Serrurier truss structure is unequally loaded, thus more flexure is to be expected and is observed between the primary mirror and the focal plane. In a perfect world the telescope would behave elastically, and any displacement and tilts of the focal plane would be removed by adjusting the DECam hexapod from entries in a look-up table (LUT) that depend on sky position. While we do indeed have a hexapod LUT, we find that the active optics system calculates and applies substantial tweaks to the LUT-derived values and that these tweaks change with time for a given sky location. We are devoting effort to understanding the opto-mechanical behavior of the telescope and DECam, but in the meantime, the rms pointing accuracy is not as good as we would like, being typically ~20 arcsec rather than ~5 arcsec. Stay tuned, and contact us if the pointing accuracy is a significant issue for a scheduled or proposed program.

The observing statistics show that almost no time was lost in the first three months of the semester due to instrument problems. The weather was extremely good, too. Then, on May 12, we had two DECam failures a few hours apart. First, the pump that provides cooling for the electronics crates in the prime focus cage failed. Swapping in a replacement was well underway when the second failure occurred: the liquid nitrogen (LN_2) cooling pump failed. That pump is immersed in a 200-liter liquid nitrogen tank, and to replace it meant warming up the whole system, requiring almost a week of work from warm up to cool down. It took a total of two weeks to get everything to work properly after these failures. We have been working for the last several months to harden telescope and instrument systems by providing hot back-up options and, in some cases, by improving maintenance procedures. During a 10-day shutdown in July, we made improvements to several aspects of the camera that will help us ensure better long-term reliability. The short lifetime of the LN_2 pump is a serious concern, and CTIO and Fermilab are looking at the options.

Finally, a word about image quality: The best images produced by DECam in the z and Y bands are 0.6 arcsec, just over two pixels full width

continued

DECam Update continued

half-maximum. We are active on two fronts to make sure the image quality delivered at the focal plane is dominated by the atmosphere, not by the optical performance of the telescope and DECam or by seeing effects created inside the dome and telescope. For the former, we are investigating actively controlling the figure of the primary mirror as a function of sky position to correct for small amounts of astigmatism. This will require a higher-resolution transducer for all 33 mirror supports, which is a project that we expect to carry out in 2014. For the latter, we plan to install two large air handling units in the Blanco dome at telescope level, to better control the dome temperature during the daytime. In combination with the primary mirror cooling system, this will help to increase the number of nighttime hours that the primary mirror is slightly cooler than the dome air temperature and will help to reduce temperature stratification in the dome in low-wind conditions.

DECam Community Pipeline

Frank Valdes

The DECam Community Pipeline (CP) has been performing basic instrumental calibration and stacking on community data from the inception of science verification (SV) through the current observing semester (2013A). There have been continual improvements during this period as a result of our increasing knowledge of the camera's characteristics. The early SV processing that used early versions of the CP was deemed not suitable for release and awaits a reprocessing campaign, although a few reprocessed data sets have been made available. Data from the end of 2012B through 2013A have been released through the NOAO Science Archive, although they also will be part of a reprocessing campaign.

The Dark Energy Survey Project team has made considerable progress on understanding the various instrumental characteristics and developing techniques to address them. Some that have been applied recently are better identification and handling of crosstalk, saturation, and bad pixels. The most important characteristics that remain to be addressed are non-linearities at low and high light levels, and a reflection pattern seen as a large ring. A new version of the CP that includes steps for handling these features was delivered in mid-July. If testing is successful, this version will be used in the 2013B semester and in a planned reprocessing of all community data.

The goal for the CP is to process data for PIs within a week of the end of an observing run. This goal has not been achievable yet due to the continuing evolution of the pipeline. Currently, the CP is running several weeks behind this goal.

NOAO Science Archive News

There will be a new, simpler login process for the NOAO Science Archive, starting early in semester 2013B. Watch for a news announcement in the NOAO Portal. The new login is intended to simplify the process for accessing proprietary data. Registered users of the archive will receive an email from *sdmhelp@noao.edu* with more details, including a new User ID and password. Current users also will be able to log on with their older ID and password (based on the VO Single Sign-on) by choosing an alternative login method.

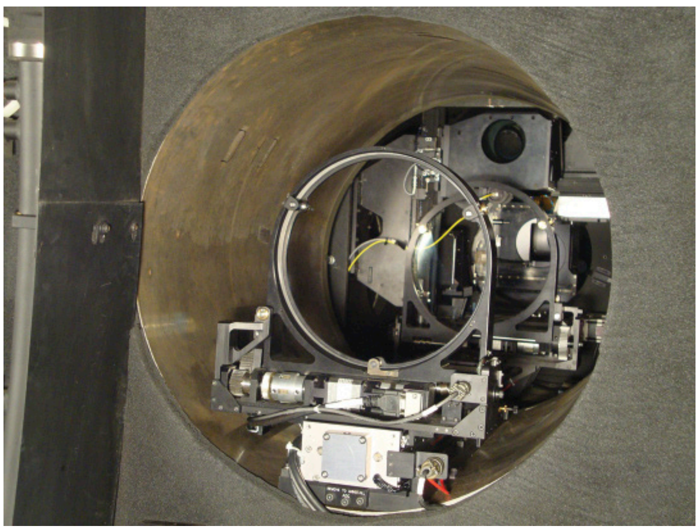
The default access policy will change, starting in 2014A, so that users will be allowed to download data on any proposal on which they are co-investigators (co-Is). This replaces the current policy where, by default, co-Is do not have data access. Principal investigators (PIs) will still be able to control which co-Is have access; it is only the default value that will be different. If you have any questions, please email *sdmhelp@noao.edu*.

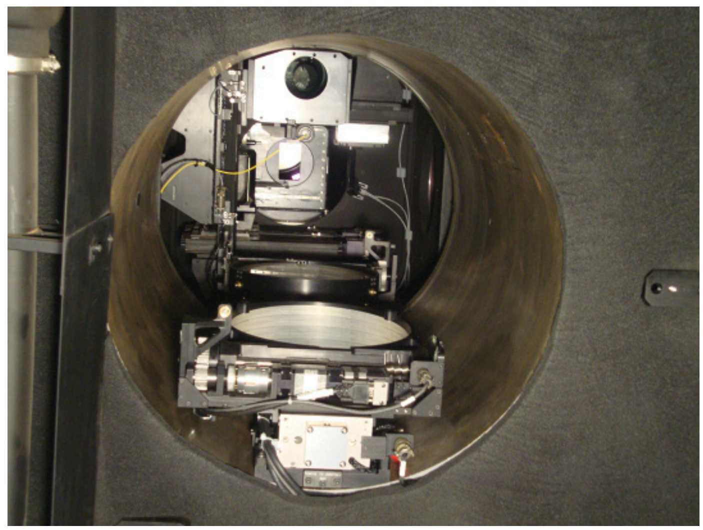
New Atmospheric Dispersion Corrector for SOAR

Steve Heathcote

Installation and testing of the facility Atmospheric Dispersion Corrector (ADC) for the optical Nasmyth port of the SOAR 4.1-m telescope was recently completed successfully. This new device allows spectra to be obtained with the Goodman spectrograph at larger zenith distances without suffering the loss of image quality and the resulting wavelength-dependent slit losses caused by atmospheric differential refraction. This is important for spectroscopy of extended objects and particularly for multi-slit spectroscopy where it is generally not possible to keep the slit aligned along the parallactic angle.

The SOAR ADC, designed and built in a collaborative effort between the University of North Carolina at Chapel Hill and CTIO, is permanently installed in the elevation axis of the telescope ahead of the cluster of optical instruments mounted at the Nasmyth focus. The ADC consists of a pair of 30-cm-diameter sol-gel coated fused silica prisms in a trombone-like arrangement. The forward prism can be moved parallel to the elevation axis, on a linear stage, in order to "dial in" the amount of atmospheric dispersion to be compensated, while a fixed prism corrects the resulting focal plane tilt. Both prisms can be folded "flat" out of the beam to allow work without the ADC when using the SOAR Adaptive-optics Module (SAM), which has a built-in ADC, or when even the small loss of light due to the two additional prisms is unacceptable.



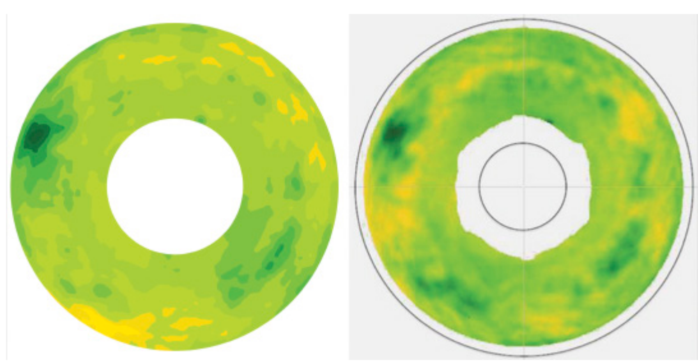


The new SOAR ADC is seen here viewed along the elevation axis toward the Nasmyth instrumentation package. At left, both prisms are deployed for use, while at right, they are folded out of the beam.

Progress with the Blanco *ƒ*/8 Secondary

Tim Abbott

We last reported on the return of the *ƒ*/8 secondary to the Blanco 4-m telescope in the March 2013 *Newsletter*. Since then, the Cer-Vit plug has been epoxied into the prepared hole in the center of the mirror, and the mirror re-aluminized on Kitt Peak. Repeat optical testing showed the mirror to have much less astigmatism than it did before the repair, and the mirror is essentially the same as measured after the refiguring of 1993 (Figure 1). This very satisfactory result meant that no refiguring was required. The repaired mirror was shipped back to Cerro Tololo, arriving there in April.



Interferograms from 1993 (left) and today. The inner circle in the right-hand figure corresponds roughly to the plug diameter, while the outer circle is the full diameter of the mirror. The clear aperture is approximately the size of the actual surface map, for on-axis observations. Note the good match between the features in both maps; the overall figure is well under 0.1 wave rms in both cases.

A new cart was built at CTIO to handle the mirror while it is not on the telescope, with special attention paid to accident prevention. The cell with the dummy mirror (a steel blank) was installed on the cart, and a new tip/tilt servo system was installed. The mirror's radial support, a mercury-filled rubber tube, was also replaced. Laboratory tests were successfully completed and the cell was taken to the telescope.

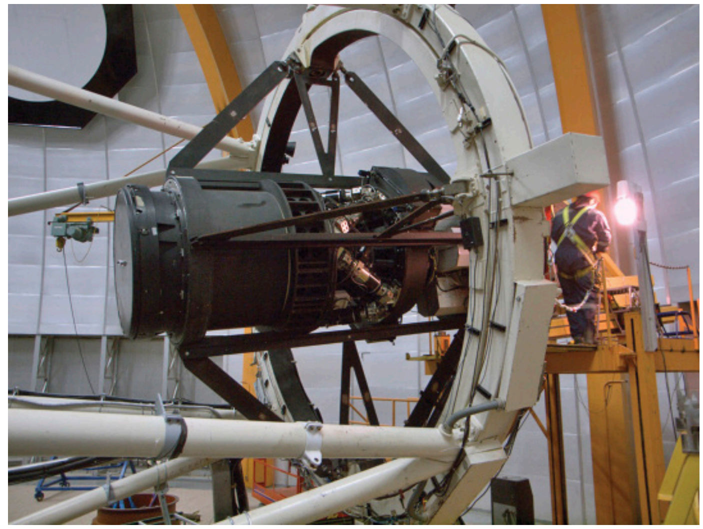
continued

Progress with the Blanco ƒ/8 Secondary continued

The Blanco 4-m telescope was shut down for just over two weeks beginning on June 24. During this period, we successfully exercised all of the subsystems required to perform a top-end change from DECam to the ƒ/8 and back again, three times. The first achievement was a successful "partial flip" in which the inner top ring is rotated ~120° in the outer ring in order to present the front of the prime focus cage (the optical corrector end of DECvam) to the ƒ/8 handler (a mechanism built at Argonne National Laboratory). A full flip of 180° is no longer possible without severing the LN_2 feed lines to DECam, and the new handling system was designed accordingly. Given that this was the first such operation of the top ring flip mechanism since before DECam was installed, we were careful to ensure that nothing moved unexpectedly and that proper alignment was maintained after the cage was rotated back to its operating position. Everything proceeded smoothly, and no misalignment was observed.

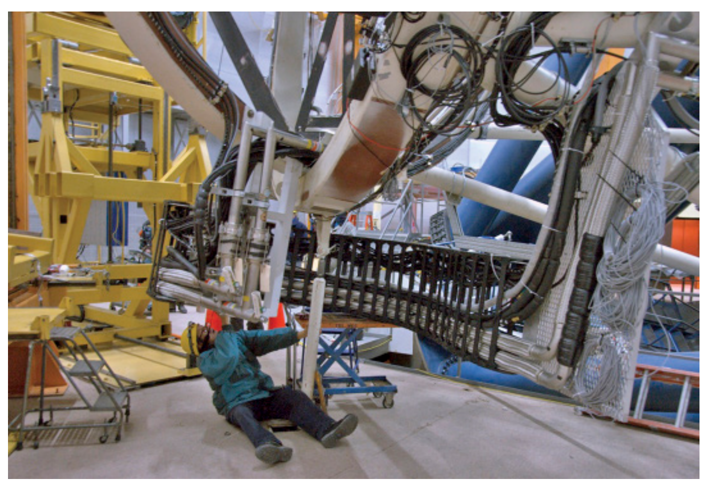
Victor Pinto tightens the bolts attaching the ƒ/8 cell to the prime focus cage. The "red" counterweight is in front of him.

Next, we removed the "red" counterweight that balances the prime focus cage while the ƒ/8 secondary is not present and acts as a first stray light baffle for DECam. This counterweight was shipped down to La Serena and lightened by ~80 kg and painted black (it continues to be known as the "red" counterweight and now weighs 876 kg). Meanwhile, the ƒ/8 cell with the dummy mirror was placed onto the ƒ/8 handler and then mounted onto the prime focus cage. After rebalancing the telescope, the misalignment of the dummy mirror with respect to the Cassegrain cage was measured at the zenith. The ƒ/8 cell was removed from the telescope, and its position on its adapter ring adjusted to take up that misalignment. When the cell had been reinstalled on the telescope, we found that we had overshot the adjustment slightly, but the entire procedure was effective and suitable for use with the mirror itself. The "red" counterweight was returned to the telescope, which was then made available for DECam observations.



The ƒ/8 cell mounted on the prime focus cage.

Performing these procedures for the first time was not without its difficulties. We are still learning how to use the ƒ/8 handler, and the details of mounting large, heavy components on the telescope at such a novel position are complex and time-consuming. The final removal of the ƒ/8 cell and reinstallation of the "red" counterweight took one, long, working day which is the maximum allowable for a top-end change in order to avoid cutting into observing time. We have two more shutdowns scheduled (August and October) during which we will perform the top-end change with the re-aluminized ƒ/8 secondary mirror in its cell and commission the entire system. The first science observations are expected in October. Between these shutdowns, we will modify the handling mechanisms and refine our procedures to streamline top-end changes. We are encouraged at this point, having proved that everything works in practice and that DECam can live in harmony with other instruments on the telescope.



Rossano Rivera inspects the flip mechanism from below. If the "red" counterweight and ƒ/8 cell are removed, the telescope is severely out of balance. So, it is held down by the large pin held in Rossano's left hand. The complex array of connections to DECam is evident in the picture. NL

KPNO Director's News

Timothy C. Beers

The future of Kitt Peak is being molded today. We continue to work on planning the course of the coming decade. Despite the recommendations of the NSF Portfolio Review Committee (*www.nsf.gov/mps/ast/portfolioreview/reports/ast_portfolio_review_report.pdf*), which called for termination of NSF funding for the Mayall 4-m, KPNO 2.1-m, and the NOAO portion of WIYN telescopes, there are several exciting prospects on the horizon. The much-anticipated announcement from the Department of Energy (DOE) of their "preferred site" for execution of the proposed Dark Energy Spectroscopic Instrument (DESI, formerly known as "BigBOSS") was received in May—the Mayall 4-m telescope was selected to host this powerful new spectroscopic facility (see "DESI (Formerly BigBOSS) Status Update" in the System Science Capabilities section).

The NSF and DOE are presently in the process of working out details of their cooperative agreement for implementation of the DESI experiment on the Mayall; a formal memorandum of understanding is expected to be crafted in the near future. As part of this agreement, it is our hope and expectation that a significant community science component will be executed during the course of DESI, with the possibility that such programs can be expanded in the future with this instrument, pending identification of funding, after the main experiment is completed. We have already benefited from the contribution of a number of representative science cases developed by the DESI Community Science Committee (co-chaired by Connie Rockosi, University of California at Santa Cruz and Joan Najita, NOAO, ex officio) as part of their white paper (*ast.noao.edu/sites/default/files/bigboss-csc-report.pdf*). The topics include galaxy evolution, the diffuse medium in galaxies, galactic structure, time domain science, stellar activity, and planetary sciences. I urge all members of our community to peruse this document to see examples of the compelling science that is possible to carry out with DESI on the Mayall. Additional ideas and suggestions for science topics from the community are welcome. As the development of DESI continues, we expect to refine these into a set of programs that will provide a plethora of exciting data to the community.

KPNO and NOAO management are discussing how best to make use of open-access time that will be available on the Mayall 4-m telescope between now and the shutdown of the facility for installation of DESI (presently envisioned to occur as early as 2017, or soon thereafter). Among other alternatives, serious consideration is being given to the possibility of increasing the time made available for large survey efforts to 50% or more (depending on the quality and scope of proposals received) of the allocated time on the Mayall. The purpose is to encourage the development of legacy data sets that will remain useful for exploration by a wide swath of the community in the years to come. We expect that this change of mission could begin as early as 2015A; details will be provided in the March 2014 issue of the *NOAO Newsletter*.

NOAO has committed resources to carry out an upgrade of the One Degree Imager (ODI) for the WIYN telescope that will result in a quadrupling of the on-sky coverage from the current 24'× 24' field of view to 48' × 48'. The result will be a powerful tool for wide-field imaging surveys, taking advantage of the excellent image quality that already has been demonstrated by the partially populated ODI (pODI), which is now in routine operation at WIYN. The WIYN consortium continues to seek new partners to replace the 40% of time presently allocated to NOAO. We expect that the advent of an upgraded ODI will make time on this excellent facility even more desirable to potential partners. If all goes well, one can look forward to a "new" ODI as early as 2014B, with shared-risk observations beginning in 2015A.

The future of the KPNO 2.1-m telescope remains very much in doubt. Due to the necessity of concentrating the efforts of our staff on preparing for DESI and the ramping up of personnel to support the Mayall during the transition to DESI, it will not be practical for KPNO to operate the 2.1-m telescope beyond 2014. Thus, in the absence of additional funding (which is not currently anticipated), we are working on the assumption that 2014A will be the last semester of open access for the KPNO 2.1-m. Access to the Coudé Feed would be terminated on a similar time scale. The 2014B semester will be used to develop and initiate execution of a close-out plan for the KPNO 2.1-m. An announcement of opportunity for potential new operators of the KPNO 2.1-m will be circulated in the near future.

The NSF remains committed to maintaining Kitt Peak as an active astronomical site and has advised the Kitt Peak tenants that the NSF will continue its role as primary lease holder and will provide financial support for basic mountain infrastructure.

The CTIO 50th Anniversary Conference

Andrea Kunder & Nicole van der Bliek

The CTIO 50th anniversary conference participants. (Image credit: Tim Abbott/NOAO/AURA/NSF.)

CTIO hosted the scientific conference "Fifty Years of Wide-Field Studies in the Southern Hemisphere: Resolved Stellar Populations in the Galactic Bulge and the Magellanic Clouds" in La Serena, on 6–9 May 2013 in honor of the observatory's 50th anniversary. The conference was well attended with more than 75 participants, about one third of the group being graduate and undergraduate students. The participants came from all over the world, with the majority from the US and about a third from South America, making it truly an inter-American conference for celebrating the anniversary of an inter-American observatory.

Many speakers were astronomers who had participated in the observatory during the past 50 years, and their presentations highlighted the history of CTIO. The topics of these historic talks ranged from Victor Blanco and Jürgen Stock to highlights of instrumentation, science, and operations. Almost all of the scientific presentations included a connection of the research with the history of CTIO. As a courtesy to Instituto Nacional de Capacitación Profesional (INACAP), the institute where the conference was held, public talks in Spanish were held at the end of the conference days. This was a festive conference with a fine mix of history, science, and group activities. "I went to three conferences this year, and this [the CTIO 50th anniversary conference] was the most educational and most fun of the three," said postdoc David Nataf of ANU.

Presentations from the conference are available at: *www.ctio.noao.edu/noao/conference/Presentations*.

Seeing Things in a Different Light: Dark Skies and Energy Education Comes to Yuma

Constance E. Walker

What do you get when you mix light pollution, energy conservation, and all of the sixth graders of a mid-size Arizona city? You get a new education program designed and delivered by NOAO for Yuma, Arizona!

The NOAO Dark Skies and Energy Education program made its debut in Yuma in January 2013, sponsored by a grant from the Arizona Public Service Company Foundation. The goal of the project was to inspire students to be responsible stewards in helping their community safeguard one of its greatest natural resources, a dark night sky. The program was designed to help Yuma science teachers address energy and lighting issues in their community.

NOAO's Education and Public Outreach (EPO) department, led by Dr. Connie Walker, trained fifteen sixth-grade teachers in two professional development workshops. The first workshop focused on why shielded lights should be used to stop upward light, examined different kinds of bulbs for energy efficiency, and performed an outdoor lighting audit of the teachers' schools. Building on the activities from the first workshop, the second workshop a month later concentrated on helping the teachers develop classroom projects. Two months later, the projects were presented as the culminating event at an end-of-the-semester Family Science Night (see Figures 1 through 4).

continued

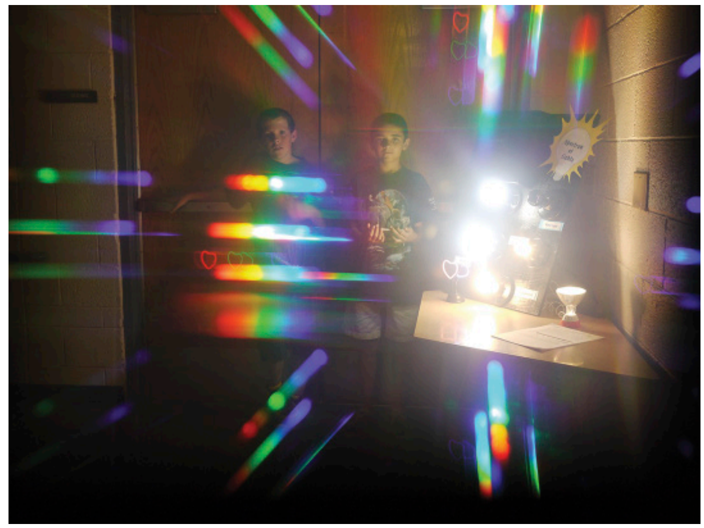
Seeing Things in a Different Light continued

Because Yuma is a four-hour drive from the NOAO Headquarters in Tucson, teachers, students, and NOAO staff used the FaceTime video-chat program to maintain high levels of communication between the events. To accomplish this, each teacher in the program received an iPad as part of their teaching kit in addition to a $450-set of teaching supplies related to dark skies education, which included complete instructional guides and classroom supplies for all six activities.

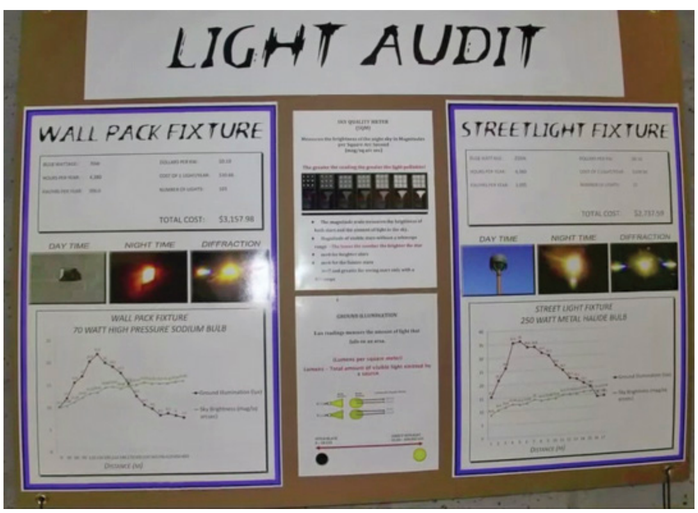
Reports from the program's independent evaluator showed that the students enjoyed learning from the three foundational activities as well as the three other activities. The three additional activities had children building star-brightness "readers," creating glow-in-the-dark tracings to visualize constellations, and performing role-playing skits about hatching sea turtles confused by on-shore lights. The final presentations and projects by the Yuma students were outstanding in their creativity, level of effort, and scientific accuracy.

The NOAO EPO staff have been invited back to continue the program this fall. The teachers and students want to spend a year on this program rather than just a semester. They feel the project has made a difference in their community—teachers, students, and families now view light pollution and energy waste in a different light.

Students from Castle Dome Middle School explain good and bad lighting through examples of efficient and inefficient bulbs and fixtures.



Students from Castle Dome Middle School demonstrate the variety in spectra from different types of lights due to how the spectra are generated.



Students from Castle Dome Middle School present their results from a lighting audit done in and around their school.

A student (right) from Ron Watson Middle School explains how properly shielding a light minimizes glare, sky glow, and light trespass, three main types of light pollution that affect the quality of our lives.

Why So Few Native American Astronomers? One Student's Perspective

Calvin John Ortega, Jr. (Pima Community College)

My name is Calvin John Ortega, Jr. I am a member of the Tohono O'odham Nation, a federally recognized Native American tribe from Southern Arizona. I spent a majority of my childhood living on the reservation, which is located 60 miles west of Tucson, Arizona, and just a scant 50 miles away from the US/Mexico border. I received my secondary education primarily from schools located on the reservation, graduating from Baboquivari High School in 2010. The fall after I graduated, I enrolled in classes at Pima Community College, where I am currently pursuing a degree in Physics.

Because of my involvement with NOAO's Research Experiences for Undergraduates (REU) program during the summer of 2012, I was able to attend the American Astronomical Society's 221st meeting in Long Beach, California, in early January 2013. While at the conference, I was able to attend a session that was of paramount interest to me. The session was entitled, "The First Nation Astronomers and Educators." It was a discussion panel to examine why there are so few Native American and indigenous people entering graduate studies in the field of astronomy. Dr. Jarita Holbrook of University of California Los Angeles (UCLA) was the moderator, with panelists Dr. Paul Coleman, a Native Hawai'ian, professor at the Institute for Astronomy at the University of Hawai'i; Carmen Martinez-Yaden, a member of the Tohono O'odham Nation and undergraduate director of Project Native of the Tohono O'odham Community College and the University of Arizona; and Charee Peters, a member of the Yankton Sioux tribe, graduate student enrolled in the Fisk-Vanderbilt Master's to PhD Bridge program.

The panel had a large turnout and a very engaged but subdued pace. The mood was refreshing compared to the rest of the sessions, which were all high impact. The panelists shared their experiences, concerns, and recommendations about the plight of indigenous peoples at the student, professional, and administrative level. The audience was keen to hear the panelists' opinions and stories, and had genuine interest in the issue at hand, especially myself. Several of the issues that affect the ability of indigenous peoples to succeed that were brought up included the social, cultural, and academic environments to which indigenous people are exposed. The issues that were brought up in this panel are important to note not only for minorities in the science, technology, engineering, and mathematics (STEM) fields but for anyone who wants to see diversity in science and math. Recognizing and discussing these issues will set the stage so that changes can be made. Perhaps we can find solutions to these problems and others faced by minorities in general.

One of the issues that I feel should receive a fair amount of focus is preparation among Native Americans. I feel that proper preparation is the key to success, not only in astronomy and science, but in any aspect of life. I also feel that Native Americans have substantially more hindrances in their pursuit of technical and scientific degrees. Academic preparation among Natives who wish to pursue the sciences in college is precarious. Many of the young men and women who are working toward science degrees are the first in their entire family's history to venture into a scientific profession, with some being the first to pursue any college degree. The home front is the first guild of preparation for all students, and not knowing how or what needs to be done to properly prepare their children to venture into a profession they have zero knowledge about is a huge barrier.

I remember vividly during my first year of college, when I was working on homework for a college algebra course late at night, my mother stood in awe at what most likely appeared to her as gibberish. She took particular interest in Pascal's Triangle, which she had never seen in her life, or if she did, it surely did not make much of an impression. My mother has been there to help and advise me at the most critical points in my life, but how exactly could I expect her to help me with my course work? The first math class I took, which was a few semesters behind the typical four-year college's academic track was beyond her experience. If Pascal's Triangle was beyond her, how could I expect to ask her for help with my differential equations homework at three in the morning? In mathematics, I've noticed that this is a common trend among my tribal peers. Many of the students from tribal schools enter with a slight academic deficiency, and this alone could make students shy away from science programs.

Having the lack of guidance from guardians is not the only hindrance for indigenous students; often, education from schools is insufficient as well. I recall the turmoil I experienced during my high school years. My high school went through more principals and administrative staff than the number of math and science courses that were offered. This inconsistency was not limited to the administrative staff, as instructor positions were just as brief. It is very difficult to absorb a new subject when your teachers are changing faster than you are covering the material. Add to this the fact that a lot of the rotating staff was appointed by the State of Arizona, as my high school was one of the lower achieving schools, a trend which seems to be common among reservation schools. This means that many of the staff coming into the school system had no familiarity with Native American culture or with any of the local customs and problems. Qualified as they may be to teach, it does not help if teachers are not able to establish a connection with the students. This leads both students and teachers to become frustrated and can result in students not attaining the background knowledge expected of

continued

Why So Few Native American Astronomers? continued

them in higher education. I knew I wanted to venture into a science field since my sophomore year of high school, but still had to take remedial classes the entirety of my first year of college.

Now, this is not to say that the only type of preparation indigenous peoples lack is academic. College students, science majors in particular, have to develop a certain amount of social dexterity in order to navigate their careers successfully. Native Americans have a different set of social and cultural values regarding interaction and communication that might affect how they respond to their surroundings. Many students, myself included, elect to attend school off the reservation to expand the science options that reservation colleges can't provide. However, many who do opt to leave the reservation for metropolitan settings face leaving for an extended period of time for the first time and find that there is a world's difference from life on the reservation. The pace and flow of events can be vastly overwhelming, and the culture and social requirements can catch even the most thoroughly prepared student off guard. This culture shock is inhibiting, and not being able to adapt to "city life" can harm a student's success.

Cultural identity also can lead to issues developing skills expected of scientists. As a scientist, you are apt to run into problems that are outside of your understanding or ability, sometimes multiple times in a single day. If you do not have the skill set to reach out, discuss, or ask for help, you will face problems. For example: you may be stuck for days on something that is easily answered by a peer or advisor; you will not have the mindset to correct your professor when he/she has clearly written something wrong on the board or to stand up for your scientific beliefs; and you will not be able to reach out to your fellow students and learn important teamwork skills. Most young Native Americans are taught that they must honor the word of their elders and not talk back or question what is said. That doesn't quite translate to the scientific environment, where questioning and debate is (hopefully) encouraged. These social skills are essential to a scientist, even more so than advanced mathematics at times. Having to assimilate into an entirely different culture in order to obtain these skills is yet another hurdle that claims many would-be Native American scientists.

Calvin Ortega, an NOAO EPO student worker and former KPNO REU student, presents a hands-on activity about asteroid discovery at the Arizona-Sonora Desert Museum's Family Astronomy Night (15 June 2013).

One of the panelists at the AAS session mentioned that her experience in trying to draw more students to the sciences at the graduate level was a labor-intensive process and involved a lot of community and relationship building, which can be very time consuming. To draw someone who comes from an environment where family and culture are primary priorities and expect that person to succeed in a scientific environment is asking a lot. However, a very observant audience member noted that the connectedness and community so readily found in indigenous cultures is something that is desperately needed in the astronomy community, and would be warmly welcomed. It is an advantage for indigenous people and people in the STEM fields, including astronomy, to work together to find solutions to these and other problems that First Nations peoples face.

While I attended the AAS, I met a majority of the Native Americans involved in astronomy, if not the entire community. These fellow Native Americans and the First Nation panel helped me realize that I had many questions and ideas. But only so much conversation could be squeezed out of such a limited time. I am beginning to analyze my home, my state of education, and my background from an outside point of view. The session was a great success and fulfilled its purpose of informing the public of the nature of Native Americans and indigenous peoples in astronomy, and more importantly, it got people discussing and offering solutions that could be implemented. Many more conversations are needed before some sort of a course of action can be developed, but one is sure to benefit from a conversation on a nice April morning, and a nice June morning, and a nice January morning.... NL

The American Experience

Chloe Partridge (University of Glamorgan)

The Bachelor of Science (BSc) Observational Astronomy students of the University of Glamorgan, in Wales, visited Kitt Peak in February 2013 (Figure 1). We and our lecturers, Prof. Paul Roche, Professor of Astronomy Education at the University of Glamorgan and Prof. Sarah Roberts, were visiting some of Arizona's famous astronomical and geological sites to tie together the end of our three-year degree course. Thus, we made the journey to the top of the Quinlan Mountains.

The tour of Kitt Peak was fantastic—I will never forget arriving. The top of the mountain was covered in a beautiful layer of snow with luscious green vegetation protruding over the top as the sunlight danced off the surrounding telescopes; the white exteriors of which were set majestically against the clear blue sky, leaving us in awe of their size (Figure 2). That was before we even stepped out of the car!

On arrival, we were greeted by a lovely couple, John Glaspey and Katy Garmany (Figure 3),

continued

The American Experience continued

who have been involved heavily with Kitt Peak over the years—John especially, as he used to be the manager of the entire mountain, so he knew more or less everything that there was to know about the telescopes. They were extremely informative and friendly, leading us around the observatory and all its telescopes.

Our first great experience of the day was visiting the McMath[-Pierce] telescope (Figure 4 and Figure 5), a solar telescope that extends 150 meters in length down the side of the mountain, which we were allowed to walk inside (Figure 6), very exciting stuff for astronomers. It was amazing to see inside where all the real science is done. The telescope is used mainly for research on the magnetic field of the Sun and its sunspots' structure and spectra. We got to observe some live images of the Sun as well (Figure 7). Unfortunately, the telescope's operations will be shut down in the near future, meaning its research capabilities will be lost.

Figure 1: University of Glamorgan, BSc Observational Astronomy students at the WIYN telescope on Kitt Peak. From left, rear: Chantal Babooram, Craig Keddilty, Louisa Connolly, Sam Whitaker, Emma Wride, Sarah Roberts, Paul Roche, and Phil Wallace. From left, front: Chloe Partridge, Antos Kasprzyk, and Josh Webb.

We then visited the 2.1-m and WIYN 3.5-m telescopes. It was nice to see and experience a group of students setting up in the WIYN for a night of observing. As fellow astronomers, we were all gutted [disappointed] we couldn't stay and start preparing with them for a night of collecting data.

One of the highlights of the day was exploring the 4-m Mayall telescope (Figure 8). The size of the telescope was BIG (astronomical length); you had to take a lift to get to the top. We were really lucky in that we got to stand inside and experience the dome as it moved around us—very disorienting.

Figure 2: Kitt Peak entrance. The beautiful setting on the mountain made for some great contrasting photos.

Figure 5: The McMath-Pierce telescope head on. Impressive!

Figure 3: Left to right: Katy Garmany, Chloe Partridge, and John Glaspey by the giant concrete donut—a replica of the 4-m Mayall mirror.

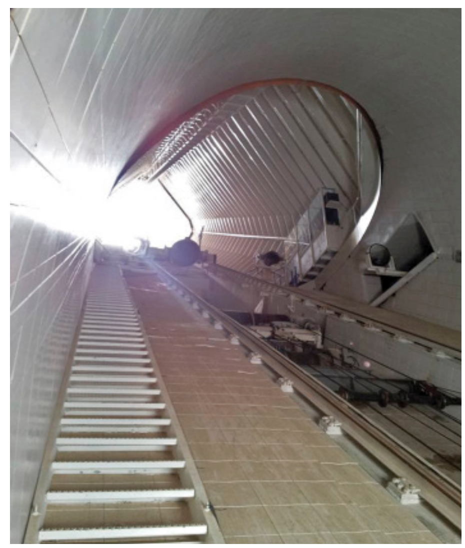


Figure 6: Inside the McMath-Pierce telescope!

Figure 4: Louisa Connolly (left) and Chloe Partridge in front of the McMath-Pierce telescope: an example of the great contrasting photos.

Figure 7: Solar observing at the McMath-Pierce telescope.

continued

The American Experience continued

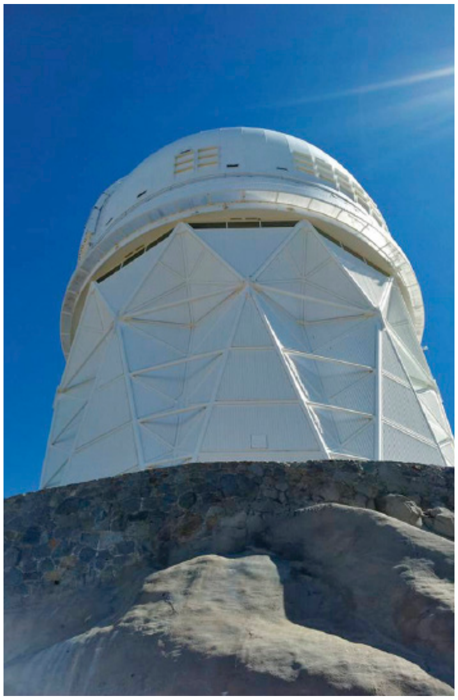


Figure 8: The 4-m Mayall telescope.

Structures like the 4-m Mayall leave you mesmerized by their sheer size; the time and effort that went into making such a structure is unimaginable. Standing inside it (Figure 9) reminds you of the marvel of science and the sparks that first stirred your passion for astronomy.

The day was not complete without a trip to the visitor center though, to collect some much needed memorabilia: a lanyard, so I could pretend I worked at such a cool place.

Kitt Peak is a wonderful site, and it offers great opportunities and use of its facilities to astronomers and research students. I think everyone by the end of the trip either wanted to live on the top of the mountain or wished they could have such a facility available to them back home.

The site itself is incredible, the work that went into building it and the work that goes into maintaining it, by itself is unbelievable, but the fact that this site is the heart of astronomical research and discoveries is, I think, amazing! I am so glad I got to see this piece of history, and

Figure 9: Inside one of astronomy's giants, the Kitt Peak Mayall 4-m telescope!

more so to meet John and Katy—your hospitality and knowledge of the site is something none of the BSc Observational Astronomy students will forget, so, thank you. Prof. Paul Roche added, "The trip was a huge success, both for the staff and students, and we owe it all to the fantastic people we worked with out in Arizona—we cannot thank Katy and John enough for the day we spent with them at KPNO!"

Until we meet again, Kitt Peak!

CTIO's Arturo Gomez: Celebrating 43 Years of Astronomical Service

Robert Chris Smith

Arturo Gomez, a leader of the observer support team on Cerro Tololo, recently retired after providing 43 years of support to the observatory. Arturo was one of the key "go-to" staff for visiting astronomers to CTIO's telescopes for more than four decades. He joined the Tololo staff in 1969, working on an observing project on the University of Michigan Curtis Schmidt telescope, and soon moved into the role of supporting visiting astronomers coming to use recently opened facilities (inaugurated in 1967) to explore the wonders of the Southern Hemisphere skies. But Arturo's role went well beyond supporting the occasional observer. He served as professor to many young astronomers, providing not just an introduction to the telescope but a more general introduction to observing and optimizing the scientific output of an observing run. Arturo also served as repairman, always available (at any hour!) to fix problems with the telescopes or instruments during the night. Perhaps most impressive is that he maintained these roles of support, professor, and repairman over the evolution of astronomical data collection from photographic plates and single-channel photometers to large format CCDs, up to and including participation in Dark Energy Camera support.

Over the years, Arturo's impact grew beyond Tololo's astronomical community. He became an informal spokesperson in Chile not only for Tololo, but more broadly for astronomy in general. The Chilean national

Arturo Gomez, leader of the CTIO telescope support team. (Image credit: CTIO/NOAO/AURA/NSF.)

press frequently called upon Arturo to provide information about the latest comet, planet conjunction, and even occasionally about UFOs. Arturo's simple, yet accurate, descriptions of astronomical phenomena have provided an introduction to the wonders of the Universe to generations

CTIO's Arturo Gomez continued

of Chileans, young and old. Complementing his talent for clear explanations, he became a highly skilled astrophotographer, setting up stunning shots of the southern skies and the observatory at night.

Arturo, together with Oscar Saa (another Tololo legend), put together CTIO's 50th anniversary exhibition last year. They collected historical photos and old instruments that illustrated the evolution of the observatory from its beginnings to the current era.

Arturo has commuted from Santiago to Cerro Tololo on a weekly basis for the past four decades, traveling (by his estimate) more than one trip to the Moon and back, and spending more than 20 years of his life on the mountaintop! His telescope introductions and support will be missed by many of our visiting astronomers, but we wish him well in this new phase of life, with a well-deserved break from the weekly commute!

Todd Boroson: An Appreciation

David Silva

After more than 24 years, Dr. Todd Boroson left NOAO at the end of July to become the Director of Las Cumbres Observatory Global Telescope Network (LCOGTN). It is hard to overstate Todd's broad contributions and their immense impact on NOAO and the US community at large during his NOAO years. His modesty, good humor, energy, and thoughtful advice will be missed by his many friends and colleagues at NOAO, including myself.

Todd was the man of all seasons, making broad intellectual and technical contributions in telescope, instrument, detector, and data system development as well as new modes of observatory operations (especially queue observing). Some of his titles were Head of CCD Development, Project Scientist for CCD Mosaic Imager, Head of TAC, Head of Telescope System Instrumentation Program (TSIP) implementation, US Gemini Project Scientist, IRAF Project Scientist, Head of Data Products Program, Principal Investigator for WIYN One Degree Imager (ODI) and ODI Pipeline, Portal, and Archive System, and NOAO/TMT Liaison. His broad interests and contributions are reflected in the many workshops he led or helped to organize in these areas.

In addition, Todd also served the gamut of senior management roles within NOAO, including Associate Director for US Gemini Project Office, NOAO Deputy Director, and NOAO Director (interim). The current flow of new instrumentation to the Mayall and Blanco, including the Dark Energy Camera, as well as the deep involvement of NOAO in LSST, is a result, in large part, of Todd's leadership in those management roles.

Todd is also a widely recognized leader outside of NOAO, having served on many external review panels and national-level committees, including the optical/infrared (O/IR) panels of the last two decadal surveys, the main decadal survey panel in 2000, the Committee of Astronomy and Astrophysics (1997–2000), and the American Astronomical Society Council (2003–2006). Todd is one of the small number of leaders who developed the US O/IR System concept, working tirelessly over the last decade to seek common ground within a seemingly disparate community for the good of all. As in other areas, Todd's hallmark is bringing people together for discussion and consensus building.

On top of these many contributions and commitments to NOAO and the US community, Todd also has remained an active scientist, with a steady stream of refereed scientific publications. The core theme of his research during his time at NOAO was the characterization of supermassive black holes in the context of their host galaxies. Recently, he has emerged as a leader in the detection and characterization of binary supermassive black holes.

But this is not a final good-bye. As LCOGTN Director, Todd will be responsible for bringing into regular operation an innovative, time-domain exploration tool, which will illuminate many of the operational and scientific challenges faced by LSST. So, as we have in numerous other areas in the past, NOAO will benefit from Todd's time-domain experience as we push forward into the era of LSST. Bon voyage, Todd, and clear skies—on all six LCOGTN sites!

Scientific Staff Changes at CTIO

Nicole van der Bliek & Chris Smith

Alfredo Zenteno, Kathy Vivas, and César Briceño will be joining the CTIO scientific staff by the end of 2013 as postdoctoral fellow, assistant astronomer, and associate scientist, respectively. While we are welcoming these three new staff members, we are also sad to see two others, Andrea Kunder and Dan Phillips, moving on to other positions.

Alfredo is currently finishing his PhD in Astronomy in Munich (Ludwig-Maximilians University) and will start in November as a CTIO postdoctoral fellow. Alfredo is originally from Santiago, where he studied physics at the Pontifícia Universidad Católica de Chile, receiving a bachelor degree, Licenciatura en Física, in 2001. Alfredo then worked at CTIO as a research assistant for four years, getting involved in a variety of projects that included studies of the Magellanic Clouds and participating in cosmological studies using supernovae. He did graduate studies at the University of Illinois, where he obtained a Master's of Science in Astronomy in 2009 before moving to Munich for his PhD. Alfredo is interested in cosmology and galaxy formation. He has studied supernovae and galaxy clusters as cosmological probes. For his thesis, he studied the properties of the galaxy population in massive galaxy clusters selected by the Sunyaev-Zel'dovich effect. In particular, Alfredo is interested in characterizing the evolution of the galaxy spatial distribution, galaxy luminosity, and halo occupation distribution. We are happy to welcome Alfredo back to CTIO!

Kathy Vivas, originally from Venezuela, obtained her PhD in 2002 from Yale University. Her scientific interest is focused on observational studies on the formation and structure of the Milky Way. Kathy has been deeply involved in the QUEST survey for RR Lyrae stars to map the distribution of stars in the halo and recognize stellar streams, which may be interpreted as debris of destroyed dwarf galaxies. Kathy also uses variable stars to study the stellar populations in the Milky Way and its satellites. For the past 10 years, Kathy has worked as a staff astronomer at the Centro de Investigaciones de Astronomía (CIDA) in Venezuela, and she has experience in large, multi-epoch, photometric surveys, spectroscopy, and data mining. Kathy is very excited about getting involved with DECam for her own science, and we are looking forward to her contributions in DECam support as well!

César Briceño was born in Caracas, Venezuela, and grew up in Mérida. He obtained his PhD in 1998 at Universidad Central de Venezuela; his doctoral thesis work was done at CfA, as a Smithsonian Predoctoral Fellow, from 1995 to 1998. From 1998 to 2000, César was a postdoc at Yale University, working on the QUEST survey, and in 2000, he returned to Venezuela to take a position as staff astronomer at CIDA. César was also adjunct director at CIDA from 2004 to 2011, and chair of the Scientific Department from May to November 2013. César's main line of research is observational studies of star formation in our Galaxy. Among his noteworthy accomplishments are his contribution to understanding the nature of the numerous populations of X-ray-active young disk stars that were revealed by the ROSAT All Sky Survey, and the large-scale mapping of the off-cloud population in the Orion OB association, which has led to the discovery of the 25 Orionis cluster, the most populated group of ~10-Myr-old stars within 500 pc. César has extensive experience in large-scale surveys, X-ray, optical and infrared photometry, and spectroscopy. He is the first author of a review chapter on OB associations in the *Protostars & Planets V* book, and a review chapter on Orion's off-cloud young populations in the two-volume *Handbook of Star Forming Regions*, a comprehensive compilation of our knowledge of star-forming regions in the Milky Way. César will strengthen the CTIO scientific staff taking on the position of associate scientist, primarily in support of the SOAR Telescope.

Kathy and César will be moving to La Serena at the end of the year, together with their two daughters, Sofía (age 9 yrs) and Julia (age 6 yrs).

Andrea Kunder and Dan Phillips arrived at CTIO together in 2009 and are now headed to Germany where Andrea will take up a postdoctoral position at the Astrophysical Institute Potsdam in Germany. Andrea came to CTIO as a postdoctoral fellow, while Dan moved into a general maintenance and project oversight position. Over the past four years, Andrea and Dan have made outstanding contributions to the observatory, including Andrea's leadership in the documentation for community use of DECam and Dan's management of the CTIO maintenance group as well as his oversight of the blasting and preparation of the LSST site. Andrea also co-chaired the organization of CTIO's 50th anniversary symposium, all while maintaining a vigorous program of scientific research. We will certainly miss their contributions, but we wish Andrea, Dan, and their daughter, Lizzie, all the best in their new adventure in Germany.

Kitt Peak Mourns the Passing of Two Retired Employees

John Dunlop & Pat Knezek (NSF)

We are saddened that Facilities Supervisor John Scott and Special Services Coordinator Dawn Clemons passed away on 23 December 2012 and 30 January 2013, respectively. Both were deeply committed to supporting observatory operations and the cadre of visiting astronomers.

John Scott retired from KPNO in 2003 after 17 years of dedicated service and supervision over the mountain support crew. He had a mechanical background and was instrumental in supporting many repairs and upgrades to the various telescopes. John did all the planning and clearing of the number 1 36-inch telescope site to prepare it for the WIYN construction, and provided oversight of the contractor's building efforts. He pioneered the new road into the future Calypso site and worked closely with Arizona Department of Transportation (ADOT) staff when the new bridge was constructed on the road up to Kitt Peak, State Route 386; his efforts were later recognized with an award from ADOT. John worked closely with the KPNO Engineering group on various repairs to all telescopes and essential repairs to the NSO/Kitt Peak Vacuum Telescope cylinders. His mechanical expertise was critical to the supervision and repair of the Mayall 4-m telescope's shutter gearbox after its failure in 1995 and the installation of the Mayall's dome ventilation system in 1997; he also developed the installation jigs for the louver system efforts. To top off a stellar career in supporting critical telescope repair projects, he traveled to CTIO in 2003 to assist with the Blanco shutter repair after its failure. After his retirement from KPNO, he continued to remain involved in the construction industry. He is survived by his wife of 52 years, two sons, and numerous grandchildren.

Dawn Clemons joined Kitt Peak in 1991 as a food services cook and proceeded to expand her efforts in supporting the mountain and many visiting observers. She became the lead custodian and subsequently, the primary water plant operator. Dawn was a tireless worker dedicated to Kitt Peak, and she went the extra mile in supporting the observatory, tenants, staff, and visiting observers. She made sure that telescopes were cleaned after shutdown activities and provided critical support to the fire fighters during their response to the 2007 Alambre and 2009 San Juan fires on the mountain. Dawn was very adept at rattlesnake removal and was always one of the first to arrive and last to leave for every Kitt Peak Family and Tohono O'odham night. During her off-duty time, Dawn operated her own business, which provided cleaning services to the MDM Observatory, among others. She dearly loved her job and the people with whom she worked over the years. We all miss her greatly. Her legacy is continuing with her daughter, Tanya, who now serves as a cook in the dining hall. Dawn is survived by her husband of 28 years, three children, two step-children, and numerous grandchildren.

NOAO Staff Changes at NOAO North and South

(16 February 2013–15 August 2013)

New Hires

Antone, Arnold J.	General Maintenance (KPNO)	North
Auza, Nicole	Library Administrative Specialist 8	South
Behmard, Aida	KPNO Summer REU	North
Blancato, Kirsten	KPNO Summer REU	North
Chmielewski, Jeanine	KPNO Summer REU	North
Garcia, Leander	General Maintenance (KPNO)	North
Hunt, Sharon	Librarian (part time)	North
Jeraldo, Alex	Commissary Man 4	South
Jose, Kenneth	General Maintenance (KPNO)	North
Kutsop, Nicholas	KPNO Summer REU	North
Levy, Rebecca	Special Project Assistant	North
Liu, Wilson	ODI Data Analyst (WIYN)	North
McGraw, Allison	Public Program Specialist I	North
Morgado, Dixon	Receptionist/Visitor Center Guide (part-time)	South
Narayan, Gautham	Postdoctoral Research Associate	North
Nydegger, Rachel	KPNO Summer REU	North
Pinto, Luz	Administrative Assistant	South

continued

NOAO Staff Changes continued

Ponce, Sergio	Driver 2 (part-time)	South
Small, Lindsey	Special Project Assistant I	North
Smullen, Rachel	KPNO Summer REU	North
Soto, Christian	Observing Associate	North
Stupak, Robert (Bob)	Technical Associate - Electronics	North
Torres, Simón	Assistant Observer 3 (SMARTS)	South
Valladares, Geraldo	Assistant Observer 1 (SMARTS)	South
Watson, Zachary	Special Project Assistant	North
Winfield, David	Craftsperson II-HVAC&R	North

Promotions

Alvarez, Alberto	To Observer Support	South
Bird, Nanette	To Administrative Manager	North
Guvenen, Blythe	To AOP/NOP Program Coordinator	North
Jeraldo, Juan	To Commissary Man 4	South
Jeraldo, Nelson	To Commissary Man 2	South
Layana, Robinson	To Commissary Man 3	South
Martinez, Manuel	To Senior Engineer Manager-Electronics	South
Roddy, William	To Special Projects Assistant II	North
Segovia, Carlos	To Computer Programmer 3	South
Tellez, Daniel	To Special Projects Assistant II	North

New Positions

Pinto, Luz	Mountain Administrative Assistant 8	South

Transfers

Espinoza, Juan Pedro	From SMARTS to TelOps (same position)	South
Rojas, Mauricio	From TelOps to CISS as Computer Prog. 3	South

Retirements/Departures

Behmard, Aida	KPNO Summer REU	North
Boroson, Todd	Astronomer/Tenure	North
Chinn, Brian	CTIO Summer REU	South
Deich, Alexander	CTIO Summer REU	South
Dunlop, Christopher	Special Projects Assistant III	North
Finney, Emily	CTIO Summer REU	South
Indahl, Brianna	CTIO Summer REU	South
Knezek, Patricia	WIYN Director	North
Kunder, Andrea	Research Associate	South
Kutsop, Nicholas	KPNO Summer REU	North
Marks-Murphy, Cheryl	Administrative Assistant	North
Miller, James	Public Program Specialist I	North
Orrego, Raul	Commissary Man 2	South
Pakzad, Sabrina	Data Reduction Specialist	North
Paredes, Leonardo	Research Assistant	South

continued

NOAO Staff Changes continued

Phillips, Daniel	La Serena Houses Coordinator	South
Semple, Travis	Student Intern	North
Siquieros, Johnathan	Special Projects Assistant I	North
Smith, Lois	CTIO Summer REU	South
Smullen, Rachel	KPNO Summer REU	North
Toro, Eduardo	Computer Programmer	South
Valladares, Simon	Assistant Observer 1 (SMARTS)	South
Williams, Molly	CTIO Summer REU	South
Winfield, David	Craftsperson II-HVAC&R	North

Deaths

Encina, Eugenio	Former Financial Analyst	South
Guajardo, Dario	Former Telescope Mechanic	South

2013 AURA Outstanding Achievement Awards

Award for Service	Walker, Alistair	South
Award for Technology	Valdes, Francisco (Frank)	North
Team Award	*NOAO DECam Installation, Commissioning, and Science Verification team:* Tim Abbott, Claudio Aguilera, Eduardo Aguirre, Victor Aguirre, Alberto Alvarez, Rodrigo Alvarez, Juan Andrade, Marco Bonati, Gale Brehmer, Jorge Briones, Rolando Cantarutti, Alfonso Cisternas, Francisco Delgardo, Cristian Diaz, Omar Estay, Enrique Figueroa, Mike Fitzpatrick, Samuel Flores, Sergio Franco, Petri Garagorri, Chuck Gessner, Will Goble, Gerardo Gomez, Brooke Gregory, Dario Guarjardo, Mike Hawes, Diego Hernandez, Ximena Herrera, Daniel Hoelck, Karianne Holhjem, David James, Katie Kaleida, Andrea Kunder, Ron Lambert, Rodrigo Leiva, Erik Mamajek, Manuel Martinez, Eduardo Mondaca, Andrés Montane, Jose Montes, Freddy Muñoz, Dara Norman, Nelson Ogalde, Humberto Orrego, Esteban Parkes, Victor Pinto, Rolando Puño, Rossano Rivera, Victor Robledo, Mauricio Rojas, David Rojas, Javier Rojas, Oscar Saa, Ricardo Schmidt, German Schumacher, Patricio Schurter, Rob Seaman, Chris Smith, Betty Stobie, Roberto Tighe, Hernan Tirado, Eduardo Toro, Frank Valdes, Nicole van der Bliek, Alistair Walker, Michael Warner, Fred Wortman	North & South

2013 NOAO Excellence Awards

Science	Kunder, Andrea	South
Service	Harris, Ron	North
Service	Cáceres, Blas	South
Service	Núñez, Oscar	South
Service Team	*CFO Tucson Team:* Brenda Kouratou, Jim Phillips, Bill Porter, Rod Rutland, Earl Shackelford, Luis Villarreal	North

The National Optical Astronomy Observatory is operated by the Association of Universities for Research in Astronomy (AURA), Inc. under a cooperative agreement with the National Science Foundation

NOAO
950 North Cherry Avenue
Tucson, AZ 85719
USA

Main Number: 520/318-8000
Director's Office: 520/318-8283
Outreach Office: 520/318-8230

Web Site: *www.noao.edu*
General Information: *outreach@noao.edu*

NOAO Science Archive User Support
archive@noao.edu
IRAF Software Information: *iraf@noao.edu*
Observing Proposal Information:
noaoprop-help@noao.edu

Kitt Peak National Observatory
950 North Cherry Avenue
Tucson, AZ 85719
USA

Research Support Office: 520/318-8135 & 8279
General Information: *kpno@noao.edu*

Visitor Center/Public Programs: 520/318-8726
Visitor Center Web Site:
www.noao.edu/outreach/kpoutreach.html

Cerro Tololo Inter-American Observatory
Casilla 603
La Serena, Chile

Phone: (011) 56-51-2205200
General Information: *ctio@noao.edu*

NOAO System Science Center
950 N. Cherry Avenue
Tucson, AZ 85719
USA

Phone: 520/318-8421

Web Site: *www.noao.edu/nssc*
General Information: *nssc@noao.edu*