CTIO & NOAO South

Steve Heathcote

NOAO UC, Tucson, May 2017 (D1)
Dark Energy Camera @ Blanco
Reliable & Performing Well

- Blanco+DECam delivers excellent image quality
  - Median DIQ 0.94” @ riz
  - Best DIQ ~0.6” close to theoretical system floor
- Blanco+DECam remains very reliable
  - Technical downtime 3% over last year
- Preparing for in-house support post DES including purchase of critical spares

See slide 36 for remote observing
• Four of five DES seasons completed
  – 54712 survey-quality wide-field exposures obtained so far
  – 68% of planned total for survey, 15% behind target for this stage
• Y4 was the best season so far
  – Only 6.4% of time lost to weather versus 33% in Y3
  – Recovered some, but not all, ground lost in Y3
• New public data release schedule agreed (see slide 30)
  – Data products (calibrated, co-added images and catalogs) from Y123 available Dec 2017
Dark Energy Camera
Continues Producing High Impact Science

- DES: 65 papers published, 32 more submitted
  - Mostly from SV, Y1 and Y2 data
  - First DES cosmology results from Y1 data products imminent
- Community: 55 papers (15 based on DES archival data)

Lensed QSO system DES J0408-5324

Z=1.06 lensing cluster SPT-CLJ2011-5288
Collett et al arXiv 1703.04810
Continues Producing High Impact Science

Faint stellar systems in the Sagittarius stream
Luque et al. 2017 MNRAS 468, 97

Discovery of 2nd most distant dwarf planet 2014 UZ 224 “Dee Dee” through image subtraction of DES survey data

The not so simple globular cluster ω Cen.
Spatial distribution of the multiple stellar populations.
Calamida et al. 2017 AJ in press

More on slides 37-45
• DES have advocated for an additional partial year to complete the survey to the original plan
  – DES is in discussion with DOE over a potential extended program

• DOE and NOAO have agreed that any DES Y5.5 must not impact completion of the DESI targeting survey (DECaLs)
  – NOAO has committed ~30 nights for DECaLs in 2018B
  – NOAO has agreed to pre-allocate time for DECaLs and DES Y5.5
  – DECaLs will go forward, DES Y5.5 now only depends on DOE approval

• DECaLs and DES Y5.5 would together leave little community time in 2018B
Dark Energy Camera
Technical Support Beyond DES

- Per agreement DECam remains at Blanco for 5 years after the end of the survey.
  - What happens after this is a matter for negotiation
  - There is no obligation on Fermi lab to provide support beyond DES and key staff will move onto other projects
- We envision a role for DECam in LSST follow-up extending at least a decade beyond this planned life
  - We have in-house expertise in many areas and are well stocked with spares
  - Negotiating with Fermi lab and OSU regarding limited ongoing support in specific areas of concern
    - Software (SISPI)
    - Cooling system and refurbishment of LN2 pumps
    - Opening Dewar to address failed detectors under evaluation
- Will hold a post-DES operational readiness review in July
• Blanco+DECam are most suited to produce large homogenous data sets
  – Demand for “traditional surveys” remains high
  – Growing interest in “time-domain surveys” to sample the variable sky on a variety of cadences
• What is the right balance between
  – Large surveys ~ 100s of nights
  – Small surveys ~10s of nights
  – PI programs a few nights
• What new scheduling modes are needed?
  – Time domain surveys need support for specific cadences and long time series e.g. 1h every 3 nights
  – ToO mode for transient events, gravitational wave follow up
• Plan to poll community via currents and e-mail
F/8 Instruments @ Blanco
Funded by ReSTAR

COSMOS

- Optical long-slit & multi-slit $R \leq 3000$ spectroscopy, plus imaging
- Peak Throughput $\sim 40\%$

ARCoIRIS

- Moderate resolution near IR spectrograph
- $0.9 < \lambda < 2.4 \mu m$ simultaneously in 5.5 cross-dispersed orders @ $R \sim 3000$
- Data reduction package available on first night
- Many thanks to Dr. Katelyn Allers!!
- Moving to SOAR to increase availability, good for LSST follow-up (see slide 55)
ARCoIRSIS @ Blanco
Early Science Results

Spectrum of J=19.1 YSO
- 8x180sec exposures
- Reduced at telescope within 10 min of readout.
Credit: Katelyn Allers

A short-period planet orbiting a pre-main sequence star in the upper Scorpius OB association
Mann et al 2016 ArXiv:1604.0615
Commissioning run data
Blanco Telescope
Preparing for recoating in July

• Coating plant refurbished
  – Coating tests underway

• Mirror lift repair
  – All purchased and fabricated parts ready
  – Installation nearing completion
  – 12 week program, 7 week contingency

• 4 week shutdown starts 10 July
  – Includes annual servicing of DECam
SOAR Telescope
Preparing for the future

• SOAR partnership fully engaged in planning for the future beyond the end of the current agreement in 2020
  – SOAR 2020 workshop (March 2017) of science plans and priorities
  – Input to planning & assessment by SOAR Board in August
• Further progress as been made over the last year to improve observing efficiency and scientific productivity
• Community demand for SOAR remains strong
• NOAO considers SOAR to be a key component of the LSST follow up capability being developed in collaboration with Las Cumbres, Gemini and SOAR (See presentation by R. Blum)
SOAR Telescope

Maintenance & Improvement activities

• Preparing for recoating optics in Oct 2017
• Goodman spectrograph
  – New red camera in service, computer/software for blue camera upgraded to same version
  – Scripting capability being developed at UNC
  – Data reduction pipeline being developed at SOAR. Beta release expected in December
• Detailed opto-mechanical design of wave-front sensing guider underway. Will allow closed loop control of low order aberrations significantly improving observing efficiency
SOAR Telescope
SIFS & STELES – Getting Close

- First Science Verification run successful
- Post-ship test and fit check on telescope completed successfully
- Commissioning starts in July
Survey: Next generation low-z SNIa sample for cosmology
PI R. Foley

A subtle IR excess associated with a young WD in the Edinburgh-Cape blue object survey

AO assisted variability study of four globular clusters.
Salinas et al 2016 AJ 152, 55

More on slides 65-74
Improvements On Tololo & Pachón

Tololo Dining Dormitory

- Remodeled Kitchen

Pachón two-unit building conversion

- Dormitory repainted inside & out, roof repaired
- New WiFi
- New ambulance
Collaborative effort to construct new shared office building and data center & refurbish existing offices bringing them to similar standard

Will provide an integrated facility for scientific and technical staff creating a collaborative environment

Schedule:
- Phase I (remodeling): Some preparatory work has already begun. Principal contractor started work Mar 15 2017
- Phase II (new construction): Reviewing bids received, work expected to start in July 2017
New La Serena Office Building
A new look for new times

View from garage

View from Gemini lobby

View from “modulux”

Credit Andes Architects group
Detail Slides

- Slides 20-22 Key Performance Indicators (KPI)
- Blanco
  - Slides 23-44 DECam
  - Slides 46-55 F/8 Instruments
  - Slides 56-59 Blanco improvement projects
- Slides 60-74 SOAR
- Slides 75-79 Small Telescopes
- Slides 80-88 Facilities Operations
- Slides 89-93 New headquarters building
Key Performance Indicators
OA-01Down Time, Blanco

Top: % of ALL time scheduled for MT&E; % scheduled for science

Bottom: % of scheduled science time used for science, lost to weather; lost to unscheduled technical downtime.

NOAO UC, Tucson, May 2017 (D1)
Key Performance Indicators
OA-01Down Time, SOAR

Top: % of ALL time scheduled for MT&E; % scheduled for science

Bottom: % of scheduled science time used for science, lost to weather; lost to unscheduled technical downtime.

NOAO UC, Tucson, May 2017 (D1)
Key Performance Indicators
Nights Available & Oversubscription

- Time allocated by the NOAO TAC including standard, long term and survey proposals for a given semester
Blanco 4-meter
DECam @ Blanco
Science requirement riz FWHM 0.9” (weak lensing) actual I band for “good” exposures Y2 = 0.92”, Y3 = 0.94”, Y4 = 0.93”
Delivered Image Quality Y2

FWHM riz scaled to i band @ zenith

median = 0.85''

quality
good
bad
DECam @ Blanco
Telescope improvements → Better DIQ

The plot shows measured image quality minus DIMM seeing, on a night by night basis (thanks to Eric Nielsen).

- Atmospheric seeing subtracted DIQ vs night for DES seasons 1 to 4
  - Dates of improvements & resulting median DIQ are marked
  - The calculated instrumental floor of 0.55” is now often achieved
Closing the M1 AO loop

Wave front measurement using extra-focal images
A. Roodman & K. Riel (SLAC)

Higher precision control of M1 pneumatic actuators

Look-up table based control of astigmatism

Closed loop control of astigmatism

• Closing M1 control loop around “donut” wave front measures
  – Builds on upgrade of M1 pneumatic actuator control
  – This is now the default mode of operation with DECam
DECam @ Blanco
Operating Very Reliably

DES TECHNICAL DOWN
CY2013: 9.1%
CY2014: 2.0%
CY2015: 3.5%
CY2016: 3.3%

LN2 pump failure
Hexapod Connector
Facility Air, CCD electronics
Earthquake
PLC
Power House
Hexapod

NOAO UC, Tucson, May 2017 (D1)
And keeping it that way

- Conservative schedule for replacement of the LN2 pump
  - Swap out every 8 months
  - Pump built with new bearing material was installed in Oct 2016. Lab tests suggest this will be good for >12 months
- LN2 supply/return lines continue to be a concern
  - Aug 2015: replaced 2 segments that had thermal shorts
  - Feb 2016: addressed vacuum leak in one segment
  - Oct 2016: found and fixed major leak through vacuum gauge
  - but continue to have leaks/poor vacuum needing attention
- “hot sparing” the SISPI data acquisition computer system
  - 4 hot spares allow replacement of any of the 30 computers with minimal reconfiguration of the system
  - Implementing plan for transfer of knowledge from OSU software creators to CTIO staff
- Procuring a complete set of key spares for all systems
• DES uses 4 complimentary techniques to probe cosmic acceleration
  – Clusters
  – Weak Lensing
  – Large-scale Structure (BAO)
  – Supernovae
• Two multiband imaging surveys:
  – 5000 deg$^2$ grizY to 24$^{th}$ mag
  – 30 deg$^2$ griz time-domain (SNe)
• Collaboration built & helps maintain:
  – DECam 3 deg$^2$ FOV imager
  – DESDM & Community pipelines
• Survey 105 nights/year 2013-2018
Dark Energy Survey (DES) Status at end of Y4

- DECam Commissioning Sep-Oct 2012
- DES Science Verification Dec 2012-Feb 2013
- The survey proper started in Aug 2013
- With 4 of 5 seasons completed
  - 54712 survey-quality wide-field exposures so far
  - 67.9% of survey total (~15% behind target)
  - A very good Y4 made up some but not all of the ground lost in a miserable Y3
- A possible Y6 is under discussion

Light blue Y1+Y2+Y3, Dark Blue Y4.
• DES have advocated for an additional partial year to complete the survey to the original plan
  – DES is in discussion with DOE over a potential extended program
  – DOE and NOAO have agreed that any DES Y5.5 must not impact completion of the DESI targeting survey (DECaLs)
• DES, DECaLs and NOAO are working together to develop a joint observing strategy which could achieve the science goals of both projects should Y5.5 go ahead. Initial indications are that this is plausible

“Non DES” time in Y6 (red) depending on weather in Y4+Y5
Dark Energy Survey (DES)
Public Data Releases

- New schedule for data release agreed with DES (See CSDC presentation by Bolton)
- DESDM-processed, calibrated single-epoch Y1 images released late 2014-early 2015
- SV value-added catalogs (galaxies, photo-z’s, shear, etc.) released Jan. 2016
- Processed images for Y123 expected release May 2017
- DR1: Calibrated, co-add images and catalogs from Y123 to be released Dec 2017
- DR2: Calibrated, co-add images and catalogs from Y123, nominally 2020 (survey ends 2/2018)
- DR1, DR2 will be served initially by NCSA, with long-term curation by NOAO.
Community Use of DECam
Demand Remains High

• Diverse science from NEOs, to crowded field photometry, to local group structure, to far universe

• Community Surveys
  – SMASH (PI D. Nidever): 30n over 3 years (done)
  – DECam NEO Survey (PI L. Allen): 30n in 3 “A” semesters (done)
  – DECaLS: (PI D. Schlegel): 64 nights over 3 years

• Many community PI programs
  – DECam accounts for ~81% of all Blanco requests
  – Blanco oversubscription: 15A 2.62; 15B 5.20; 16A 2.13; 16B 2.24; 17A 2.71; 17B 1.9
  – 125.5 nights for 26 programs scheduled in 2016B+2017A
  – B-semester scheduling remains challenging:
    • 77 nights requested for 24 DECam proposals in 2016B
    • Only 37.5 nights for 8 programs could be scheduled
Remote observing from La Serena now in regular use by staff and visitors and successfully used from Tucson & Fermi lab
- New tools recently added to facilitate remote assessment of data quality
- Improved hardware for communication with telescope operators

Will make more widely available starting in 2017B
- From Tucson for general users – discussing practical aspects
- From Fermilab as option for DES observers
- Open to tests from other locations with required infrastructure

Support for remote observing w/ COSMOS and ARCoIRIS will follow
- Beta tested with both instruments in 2017A
Dark Energy Survey (DES)
Early Science Results

- 97 papers published or in press
  - New Milky Way dwarf satellites
  - Large-scale weak lensing mass map
  - Cluster weak
  - Photo-z catalogs
  - Z > 6 QSOs
  - ~1000 high-z Sne
  - Superluminous supernovae
  - Strong lenses
  - Cosmology from cosmic shear
  - Galaxy clustering
  - Properties of SZ-selected clusters
  - Cluster scaling relations
  - LMC structure
  - Two new L4 Neptune Trojans

Large-scale Weak Lensing mass map (Vikram, et al arXiv:1504.03002)
Discovery of 2nd most distant dwarf planet 2014 UZ 224 “Dee Dee” through image subtraction of DES survey data Gerdes et al. (2016)

Globular Clusters

- Tidal tails around the outer halo globular clusters Eridanus and Palomar 15
  Myeong et al 2017 ArXiv 1704.07690

- The not so simple globular cluster ω Cen. Spatial distribution of the multiple stellar populations
  Calamida et al. 2017 AJ in press
DECam Science Highlights
New Milky Way Satellite Galaxies

DECam discoveries almost double the number known

NOAO UC, Tucson, May 2017 (D1)
Faint stellar systems in the Sagittarius stream
Luque et al 2017 MNRAS 468, 97
Next Generation Fornax Survey

DECam Science Highlights

Galaxy-CMB Cross-Correlation

Giannantonio et al 2016 MNRAS 456, 3213

NOAO UC, Tucson, May 2017 (D1)
Strong Lensing Discovery & modeling of lensed QSO system DES J0408-5324
Agnelo et al 2017

Time delay (A-B) ~85 days

Z=1.06 lensing cluster SPT-CLJ2011-5288
Collett et al arXiv 1703.04810
DECam Science Highlights
High-Z DES SN light curve $Z=1.0$

- ~200 spectrally confirmed SNIa
- 500+ SNIa with host galaxy redshifts from OzDEZ (AAT)

Credit C.D'Andrea
Blanco f/8
Instrument capabilities

• COSMOS:
  – in regular science use since 2015A (~10% of requests)
  – 2016A: 18 nights for 7 programs scheduled
  – 2016B: 9 nights for 2 proposals requested, none scheduled
  – 2017A: 6.5 nights for 3 proposals scheduled
  – 2017B: 8 nights requested by 3 proposals

• ARCoIRIS:
  – Offered for community use starting in 2016A (9% of requests)
  – 2016A: 18 nights for 8 programs scheduled
  – 2016B: 13 nights for 6 programs scheduled
  – 2017A: 3.5 nights for 2 programs scheduled
  – 2017B: 12.6 nights requested by 5 proposals

• Time trade with AAO
  – Instruments: AAOmega, HERMES, IRIS2, UCLES, UHRF
  – From 2016A onward trade is 5 nights per semester
  – Oversubscription: 2016A 3.8; 2016B 3.2; 2017A 2.8; 2017B 1.6
COSMOS @ Blanco
In Regular Science Use

- Twin of KOSMOS @ Mayall
- Long-slit & multi-slit spec $R \leq 3000$ + imaging
- Peak throughput 40%
- All modes offered as of 2015A

Successful first science run May 2015

COSMOS@ Blanco Throughput

40%

30%

400nm

900nm

NOAO UC, Tucson, May 2017 (D1)

Nova LMC 2015  F. Walter
COSMOS (4-m Blanco telescope)

KOSMOS (4-m Mayall telescope)

Identical high-throughput multi-object/longslit spectrometer/imagers

- Peak total system throughput ~40%

Currently available configurations:

- Spectroscopy, R~2200 w/ 0.9 arcsec slit; long-slit coverage options:
  - 3700-6200A
  - 3800-6600A
  - 4150-7050A
  - 5000-8900A
  - 5600-9600A
  - 6150-9800A
  - Also provides 0.6, 1.2, 1.5, 3.0 arcsec slits; resolution scales accordingly

- Multi-slit coverage similar; details depend on mask design
  - Recommended mask FOV ~5x10 arcmin

- Imaging: 10 arcmin diameter FOV, available filters comprise most KPNO and CTIO 4-inch filters. 
  - Narrowband filter passbands shift to blue
  - Some filters aren't optically flat and degrade images
  - Consult manual for details on what's useful

- Detector is an e2v CCD: deep-depletion device with broadband coating

- Check back for detector and grism upgrades!
A collaborative project of NOAO with Cornell and U Va (PI. T. Hurter) funded through ReSTAR
- Heritage from earlier versions on Palomar and ARC
- $0.9 < \lambda < 2.4 \ \mu m$ simultaneously in 5.5 cross-dispersed orders
- $R \approx 3000$ with 1.1 arcsec slit (no moving parts)
- Near-IR slit-viewing camera for guiding & acquisition, $\sim 30'' \times 30''$ FOV
- Hawaii-2RG 2kx2k HgCdTe detectors
- Delivered 4/24, First light 4/29
- Commissioning completed
- Performance meets requirements
Response comparable to TS1 @ Palomar in H & K, better in J
Resolution ~3600 from night sky lines
ARCoIRIS @ Blanco

Data Reduction Software & YouTube Tutorials

- Data reduction package available on first night
  Many thanks to Dr. Katelyn Allers!!
  - Adaptation for ARCoIRIS of the IDL package Spextool
  - Complete with four video tutorials on YouTube
  - Available at the telescope and on a public machine in La Serena

ARCoIRIS
A Successful Collaborative Effort

Team work by Cornell & NOAO staff during integration

- Results from a close collaboration of NOAO with Cornell & UVa
- Significant contributions by NOAO-S staff
  - Fabrication of detector test Dewar
  - Characterization and optimization of detectors
  - Detector control software
  - Full participation in integration and test at Cornell
  - Design and fabrication of telescope interface and handling cart

Instrument interface & handling cart
• Instrument design contemplates simple fore-optics change to accommodate different telescope focal ratios
• Heavy use of DECam on Blanco leaves little time for anything else and this is unlikely to change soon
• SOAR equipped with modern near-IR and optical spectrographs would be an agile platform for follow-up of transients
• Moving forward with relocation of ARCoIRIS to SOAR
  – Encouraged by NSF
  – Agreement reached with SOAR Board on value of instrument and that this will be considered as an in-kind contribution towards NOAO’s obligation to SOAR
  – Cornell have interest and availability in doing internal opto-mechanical changes. Final details under discussion preparatory to writing MOU
  – Work could start in May 2017 with duration ~9-12 months driven by lead time for procurement of optics
Blanco Improvements in FY16 & FY17
Focus on Robustness

• Prepare coating infrastructure for aluminizing in 2017
  – Automate coating plant following Mayall experience
  – Repair mirror lift. The implementation at Mayall suffered several problems with the vendor selected, so a different approach taken by AAO is being followed, but incorporating improvements from the Mayall design
  – New Cass cage cart to support increased weight

• Critical electric power infrastructure
  – Upgrade Tololo power house equipment for increased redundancy & robustness and ease of maintenance

• Dome & Shutter
  – Align dome trucks to increase bearing life
  – Beef up shutter drive mechanism following Mayall experience
  – Rework emergency brake using improved AAO design
  – Last two no longer fit within “No Cost Extension” funding box
Blanco Improvements
Coating infrastructure

• Goal is to be ready to recoat Blanco primary in July 2017
  • Refurbish coating chamber & automate process, building on KPNO experience
    – Hardware already purchased (ARAA funds)
    – Hardware integration completed
    – Testing and process tuning has begun

• Build new cage handling cart
  – Fabrication complete
  – Assembly underway

• Repair mirror elevator
  – All purchased and fabricated parts ready
  – Installation nearing completion
  – 12 weeks program with 7 week contingency

NOAO UC, Tucson, May 2017 (D1)
Blanco Improvements
Dome & Shutter

• Address issues with ageing hardware of Dome & Shutter
  – Remanufacture severely worn gears for reduction gear box of dome rotation drives (next slide)
  – Precise alignment of dome trucks to reduce frequency of bearing failures (next slide)
  – Replace aluminum foil on outside of dome
  – Upgrade shutter drive mechanism to increase safety factor
  – Replace current “centrifugal” emergency brake with external brake following AAO design
Blanco Improvements
Dome & Shutter

Replacing failed bearings on dome trucks
Precise alignment of dome trucks to increase bearing life

Dome drive gear box before & after refurbishment
SOAR Telescope
SOAR Instruments

SPARTAN IR Camera

BTFI

OSIRIS

SOI: SOAR Optical Imager

SAM

Goodman Spectrograph

SIFS IFU Fed Spectrometer

STELES (under Nasmyth Platform)

In Service
In Commissioning
Future Instrument
SOAR Telescope Improvement Projects

- Telescope improvements:
  - TCS software upgrade completed and in service
  - New “earthquake proof” read head mount for Azimuth encoder
  - Automated control of focus and astigmatism using guide camera
    - Conceptual design & prototyping phase completed
    - Detail design in progress with goal of design review by end of CY2017
SOAR Telescope Improvement Projects

• Goodman Spectrograph
  – Multi-slit mode, fully commissioned & available since 2014B
    • Seeing significant use from all SOAR partners
  – Acquisition camera now in service greatly reducing overheads
  – New, red optimized CCD camera (SOAR funding) provides higher red sensitivity and less fringing
    • Commissioning completed offered for 2017A semester

Acquisition camera

Existing blue camera

Dual CCD Cameras

New red camera
SOAR Telescope Improvement Projects

- **SAM (SOAR Adaptive Module)**
  - Increasingly in demand from all SOAR partners (24% of 16B requests for NOAO)
  - Successful tests with BTFI Fabry-Perot providing a spectral imaging mode.
  - Special calls for 2x4 night SV runs attracted 20 proposals from all partners

- **SIFS**
  - Recommissioning of instrument is underway
  - SV testing underway

- **STELES**
  - Post ship assembly & test complete
  - Fit checked on Telescope
  - Commissioning starts in June
OBJECTIVE: Characterize sub-km NEOs.

Thirouin et al. 2016, AJ, 152, 163 → Rotational periods and light curves for 86 sub-km NEOs

**2013 TG6, SOAR/GOODMAN**

\[ P > 227s, \Delta m = 0.18 \text{ mag} \]

**2014 FA44, SOAR/GOODMAN**

\[ P > 2h, \Delta m = 0.7 \text{ mag} \]
Debris disks around WDs

<table>
<thead>
<tr>
<th>Case</th>
<th>Contamination</th>
<th>Fixed i (deg)</th>
<th>$T_{\text{inner}}$ (K)</th>
<th>$T_{\text{outer}}$ (K)</th>
<th>$R_{\text{inner}}$ ($R_*$)</th>
<th>$R_{\text{outer}}$ ($R_*$)</th>
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</thead>
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<td>Contamination</td>
<td>45</td>
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<td>1030</td>
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<tr>
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<tr>
<td></td>
<td></td>
<td>80</td>
<td>920</td>
<td>650</td>
<td>43</td>
<td>68</td>
</tr>
</tbody>
</table>
First parsec-scale jet in a Brown Dwarf

The Next Generation Low-z Type Ia SN Sample for Cosmology

NOAO 2015B-0313 – PI: R. Foley, UC Santa Cruz - Goodman spectroscopy


ASASSN-15lh

Days since maximum (observer frame)

Rest Wavelength (Å)

peak decline valley rebrightening fading
Discovery of the densest galaxy


*M59_UCD3: densest galaxy*  
$M_v = -14.6$ (g=16.81, r=16.00)  
$r_h \sim 20pc$, $\sim 2 \times 10^8 M_\odot$, 9 Gyr
AO Time Series Photometry in Crowded Fields


SAM
High angular resolution by SAM => better photometry down to cluster cores

Discovery of 15 new variables in M 2 (12 RR Lyrae stars and 3 SX Phe stars), 12 new variables in M 10 (11 SX Phe and 1 long-period variable), and 1 new W UMa-type variable in NGC 1261
Clusters in the Bridge between the SMC and LMC


B, V photometry of 14 clusters and 2 OB assoc in tidal bridge connecting LMC and SMC

Clusters not coeval: ages ~1-5 to 100-200 Myr

Find evidence that the studied part of the Bridge is evolving into a tidal dwarf galaxy, decoupling from the Bridge.
Characterizing unknown transients


- IR-selected transient lasting ~5 yr
- Large mid-IR/optical outburst of faint X-ray source detected with Chandra
- Possibly a YSO ~1 Msun, but does not fit FU Ori outbursts
Stellar Multiplicity studies at SOAR: Field stars


d = 36.5 pc, Li I, Hα emission, X-ray, no IR excess

Aa, Ab P = 8.8 yr

Aa1, Aa2 170 d

Aa, Ab 8.8 yr

A, B 205 yr

HD 91962

2009.26
2010.86
2012.18
2014.04

Ab
B
K5V

G0V
M3V?

Ab
K5V

B
Stellar Multiplicity in Pre-main sequence stars in nearby SFRs
C. Bríceño, A. Tokovinin, M. Petr, two papers in preparation - SAM+HRCam

SAM provides initial AO correction → go ~1-2 mag deeper

~100 T Tauri stars in the Orion OB1 association (d~400 pc; ~5-10 Myr)

~60 T Tauri stars in ε Cha (d~110 pc; 3-5 Myr) and η Cha (d~97 pc; 6-10 Myr)
Small Telescopes
• SMARcS MOU and Funding:
  • 1.3-m & 1.5-m administered by Yale
  • 0.9-m administered by GSU
    – Operation of the 1.3-m and 0.9-m is fully funded for FY16 and funding appears to be on track for FY17
    – 1.5-m closed for 2016B and 2017A due to funding limitations. Future funding situation under discussion within the SMARTS partnership
• Current mode of operation
  – 1.3-m service queue mode only, 0.9-m classical mode only
  – Day time support duties taken over by telescope observers, leaving fewer (work) hours for observations: 8hrs/night
• New CCD controller for 0.9m (funded by Georgia State):
  successfully commissioned in May 2016
  – Similar performance, but greatly improved reliability & maintainability
  – Exit the last Arcon & Sun SparcStation on Tololo

NOAO UC, Tucson, May 2017 (D1)
Students from High Point University discover new pulsating white dwarf using SMARTS 0.9-m (picture credit B. Barlow / High Point U. News)

Cumulative number of southern single M dwarf systems from RECONS survey on 0.9-m Telescope (Winters et al 2015 AJ 149,12)

RECONS the Movie
https://www.youtube.com/watch?v=up_MqNBv0FE
Tololo Tenants

NOAO UC, Tucson, May 2017 (D1)
Tololo Tenants

- Ongoing: GONG, WHAM, etc.
- UM Schmidt – Continuing debris search with UM funding
- SARA (ex-Lowell) – Remote operations
- LCOGTN – 3x 1-m + 2x 0.4-m telescopes complete & functioning
- PROMPT – PROMPT 8 (Thai), telescope commissioned & operating
- Chilean 24” – Being commissioned
- MEarth (Charbonneau, Harvard) – 8x 0.4-m telescopes, commissioned and operating
- KASI (Korean Microlensing project)
  - Telescope installed & fully operational
  - CCD camera commissioned, science program underway
- T80 (Brazilian project)
  - Telescope installed & fully operational
  - CCD Camera delivered in April 2015
- USNO URAT astrometric survey begun Oct 2015
NOAO-S Facilities Operations
Recovering a Strong Basis

- Staffing – recover critical mass & fill gaps in expertise
  - Electrical & Civil engineer are both on board and fully engaged leading the efforts in their areas;
  - Financial analyst added to improve reporting
  - Recruiting 3rd heavy equipment operator, Janitor, & craftsperson

- Restore damaged and decayed infrastructure
  - Near term priorities electrical power system, water system, roads
  - Developing 5-year infrastructure improvement plan & budget

- Maintain for the future
  - Reinforce preventative maintenance plan
  - Regular renewal of equipment and purchase of key spares

- Requires an increase in shared costs for all users
  - 16% increment to facilities budget in FY16 settling to 10% for FY18 onward

- Working to build/improve collaborative relations with clients
NOAO-S Facilities Operations

Staffing

NOAO SOUTH - FACILITIES AND OPERATIONS

SERVICES

KITCHEN SERVICES
- Samuel Aguirre
  Head Kitchen Services
  - Pedro Ramos
  - Cupertino Calis
  - Jorge Lopez
  - Nelson Jeraldo
  - Robinson Layana
  - Jaime Munizaga
  - Juan Jeraldo
  - Christian Aguirto

HOTEL & JANITORIAL SERVICES
- Patricio Valencia
  Head Hotel Services
  - Juan Jose Patel
    Mountain Assistant
  - Alex Jeraldo
    Mountain Assistant
  - Alfredo Rojas
    Janitor Mnt. on Shift
  - Hector Pasten
    Janitor Mnt. on Shift
  - Luis Araya
    Janitor Mountain
  - Juan Calleyas
    Janitor Mountain
  - Mario Lara
    Janitor La Serena
  - Víctor Rojas
    Janitor La Serena
  - Xxxxx Xxxxx
    Janitor Hotel Serena
  - Kadur Flores
    Reception
  - Dixon Morgado
    Reception

INFRSTRUCTURE

Patricio Verdelio
Head Utilities
- Xxxxx Xxxxx
  Business Analyst
  OPEN
  - Xxxxx Xxxxx
    Gasfier Water/Gas
  OPEN
  - Xxxxx Xxxxx
    Operator Mechanic
  OPEN (FY 2017)

Marco Nuñez
Administration Assistant
- Xxxxx Xxxxx
  Operator/Driver

Fabrizio Bruno
Head Civil Works
- Xxxxx Xxxxx
  Operator Mechanic
  OPEN
  - Bryan Pacheco
  - Luis Santa Maria
  - Jeronimo Jiménez
  - Carlos Pacheco
  - Patricio Araya
  - Mario Lara
  - Xxxxx Xxxxx
    Maintenance Group
  - Xxxxx Xxxxx
    Maintenance Group
  - Xxxxx Xxxxx
    Maintenance Group

JULY 2016
Infrastructure Investments Past & Planned

- Investments in critical infrastructure support tenants as well as NOAO’s own facilities
  - FY10-FY14: US$1.64M of ARRA funding during invested in upgrades of shared infrastructure
  - FY15: Base funding used for Repair of Tololo power house equipment and additional costs of generation
  - FY16: US$1M NCE funding planned for upgrade of Tololo power house
  - FY16: ~US$0.5M total for planned upgrade projects. This cost will be shared between all users, but NOAO will absorb part of the cost for the Tololo tenants
  - FY17 onward: plan to invest ~10% of annual facilities budget in maintenance and upgrade of shared infrastructure
- These investments are consistent with our NSF mandate and are made with AURA and NSF oversight and approval, through review of our ARRA and NCE proposals
NOAO-S Facilities Operations
FY16 and FY17 Improvement Projects

• Electric Power infrastructure
  – Continue upgrade of Tololo power house equipment for increased redundancy, robustness and ease of maintenance
  – Circuit reclosers installed at key points on main HT power line
  – Refurbish medium tension distribution network on Tololo
  – Certification of electric substations

• Water system
  – Repair of earthquake damage to Tololo water tanks completed
  – Install additional tank(s) on Pachón to handle increased use

• Road
  – Critical repairs of storm/earthquake damaged sections including construction of a ford where the road washed out during FY16
  – Planning multi-year improvement/repair program starting in FY17

• Renovation/repairs of hotels & upgrade/certification of kitchens
  – Work on Tololo Kitchen completed in Jan, Pachón starting April
• New Electrical Engineer started work in Dec 2015
• Commercial power finally restored on Jan 16 2016
  – Using original mechanical frequency converter – demonstrated to be in good condition
  – Dual redundant generators with automatic fail over operational
• Effort now focused on making a robust system for the future with built in redundancy
  – New transformer installed, spare on hand
  – Automatic installed on reconnectors in power line at entrance and at bifurcation on on line to each summit
  – Protection circuits at output from power house
  – Soft starter for frequency converter
  – Evaluating options for redundant frequency converter
• Cost of new equipment is being covered by NCE funding
NOAO-S Facilities Operations
New and Restored Electrical Infrastructure

Tololo Power House

- Larger capacity fuel tank
- Dual redundant generators
- New main transformer and electrical yard

Pachón Substation

- Pachón sub-station safety fences
NOAO-S Facilities Operations
Building Refurbishment & Remodeling

Tololo Dining Dormitory

Remodeled Kitchen

Dormitory repainted inside & out, roof repaired

Pachón two-unit building conversion
• Blanco: exterior refurbishment including replacement of aluminum foil on dome
  – Work starting in March
• Tololo visitor centre: handicap accessible public restrooms will be provided on the summit and at the entrance gate to the property
  – Bids solicited for design & construction work
• Costs covered by NCE funding
New La Serena Office Building

Credit Andes Architects group
New La Serena Office Building
LSST, NOAO, AURA Joint venture

• Collaborative effort to construct new shared office building and data center and refurbish existing offices
• Will provide an integrated facility for scientific and technical staff creating a collaborative environment
• Phase I: preparing contract, work started Mar 15 2017
  – Remodel existing offices bringing them up to a similar standard
  – Includes new heating / AC system
  – Universally accessible entrances and bathrooms
  – Utility work in preparation for new construction
• Phase II: preparing bid process, work starts July 2017
  – New two story office building
  – Modern data center (one of largest in S. America)
  – Entrance lobby and visitor gallery
New La Serena Office Building
Mix of Remodeling & New Construction
• Work proceeds in stages with staff from each area moved to temporary accommodation leaving work area unoccupied
• Work starting ~now with each stage expected to take ~3 months
New La Serena Office Building
A new look for new times

View from garage

View from Gemini lobby

View from “modulux”

Credit Andes Architects group
Thank you!