

Yale Astronomy Telescopes & Resources

September 2, 2010

Outline:

1. Introduction to Telescope/Survey/Computing Resources [Jeff/Marla]
2. Review of proposal guidelines and deadlines [Pieter]
3. Keck Overview [Debra, Marla, Pieter]
4. WIYN Overview [Hector, Charles]
5. SMARTS [Charles]
6. SDSS3 [Nikhil]
7. QUEST [Charlie]
8. Yale-Chile program [Jeff]
9. HPC facilities [Sarbani]

Yale Proposal process

Deadlines

- Proposal deadlines early (e.g., Sept 10 for Spring 2011) - driven by Keck/Caltech
- Pre-proposals for Keck and WIYN due 1 week before proposal deadline
- Pre-proposals allow you to gauge balance and oversubscription

Who can apply ?

- Anyone with a Yale affiliation can apply for WIYN and SMARTS time
- Postdocs and faculty can apply for Keck

Oversubscription

- The oversubscription has been low the past few semesters
- For WIYN, we are often undersubscribed - think big !
- For Keck self-limitation seems to be important - we now ask for “minimum useful” in addition to the optimal number of nights

Info, forms, etc

- www.astro.yale.edu/tac/
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- victoria.gardner@yale.edu

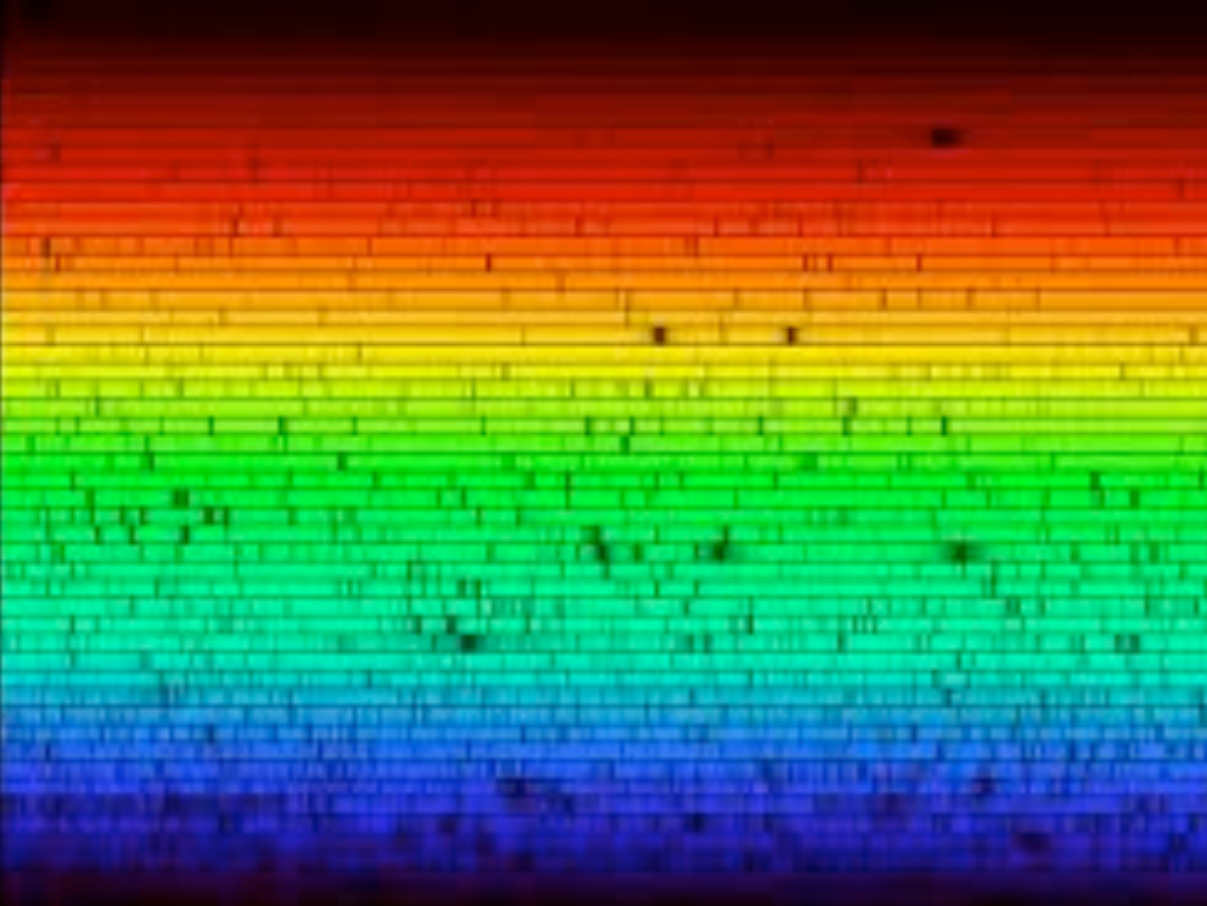
Keck Telescope Overview

- Twin 10-meter telescopes located on Mauna Kea, Big Island of Hawaii.
- Yale has 15 nights per year, shared over both telescopes/moon phase.
- Faculty and postdocs are allowed to lead observing proposals.
- Remote observing facility will be available at Yale for experienced observers.



Current Instruments: HIRES, DEIMOS, LRIS, ESI, NIRC, NIRC2, NIRSPEC

Future Instruments: MOSFIRE, LGS-AO



D. Fischer

Keck Observatory / HIRES

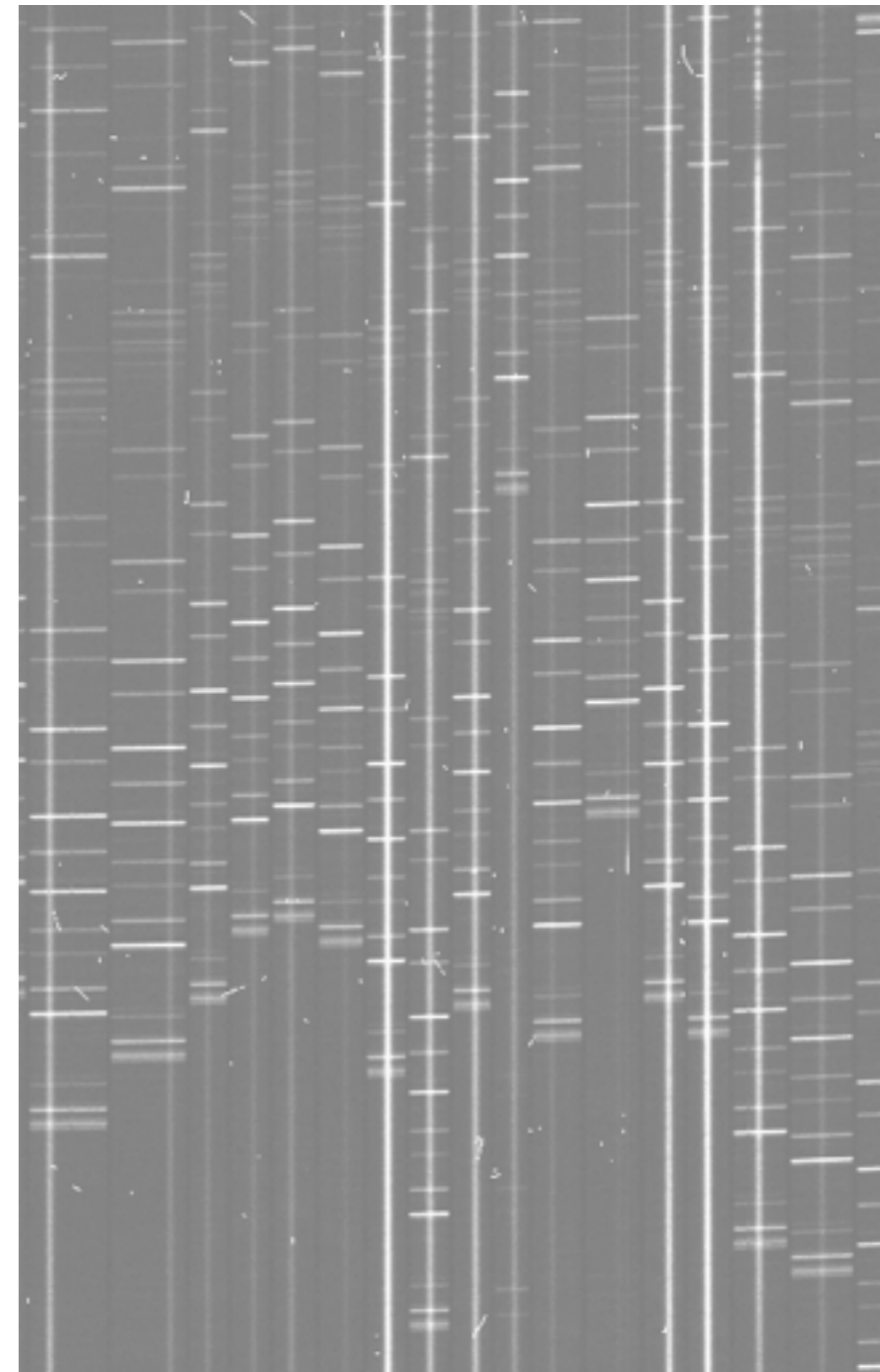
High resolution spectrograph: grating, cross-dispersed echelle spectrograph

3 CCD detectors: Spectral format can be tuned to observe orders from 0.3 to 1 micron with a slit plate that offers resolution between 25,000 and 80,000, approximately 10% efficiency (including the atmosphere).

Particularly useful for: High precision Doppler observations (exoplanets, binary stars, cluster membership) and abundance analysis

Keck/DEIMOS

- Multi-object (~ 150 per mask) or single-slit spectroscopy over full optical range.
- Field-of-view $16' \times 4'$
- Well developed pipeline reductions
- Can reach $r=21.5$ in hour @ 0.3 A/pix



Keck/LRIS overview

- Multi-object or single-slit spectroscopy in the optical
- Really two spectrographs: red arm and blue arm, split by dichroic
- Optics, detectors of each arm optimized for wavelength regime
- Field $\sim 7' \times 7'$

LRIS vs DEIMOS

- LRIS is better in the UV and far red, thanks to optimization
- DEIMOS has $>\sim 2x$ larger field, so is more efficient for surveys
- DEIMOS is much more stable and easier to reduce

Other instruments

- NIRC: old-fashioned, tiny field near-IR imager; not used much anymore
- NIRC2: workhorse AO near-IR imager
ESI: moderate resolution optical single-slit spectrograph - not used a lot
- NIRSPEC: old-fashioned, but still useful, near-IR spectrograph (low + high res)

WIYN Telescope Overview

- 3.5 meter Wisconsin-Indiana-Yale-NOAO telescope located on Kitt Peak near Tucson, AZ.
- Yale has 26 nights per semester (17% share).
- Faculty and postdocs are allowed to lead observing proposals.



Current Instruments: WHIRC, HYDRA, MiniMo

Future Instruments: ODI

WIYN High Resolution Infra-Red Camera (WHIRC)

H. Arce

- WIYN = Wisconsin-Indiana-Yale-NOAO telescope
- High Resolution = “typical” seeing: 0.25”(with WTTM) – 0.6” (without WTTM) (with 0.1” pixels)
- Infra-Red = 0.8 – 2.5 μm (J, H, K_s + 10 narrow band filters)
- Camera = 2048 x 2048 HgCdTe array with a 3.3' x 3.4' FOV

galactic plane globular cluster Glimpse GC-1

Sensitivity

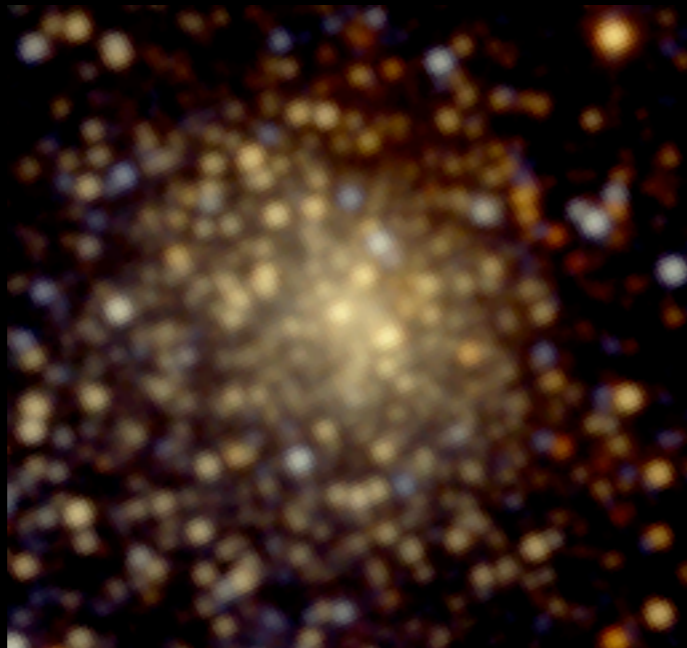
(10σ in 1hr):

J ~ 22 mag

H ~ 21 mag

K_s ~ 20 mag

2MASS



WHIRC



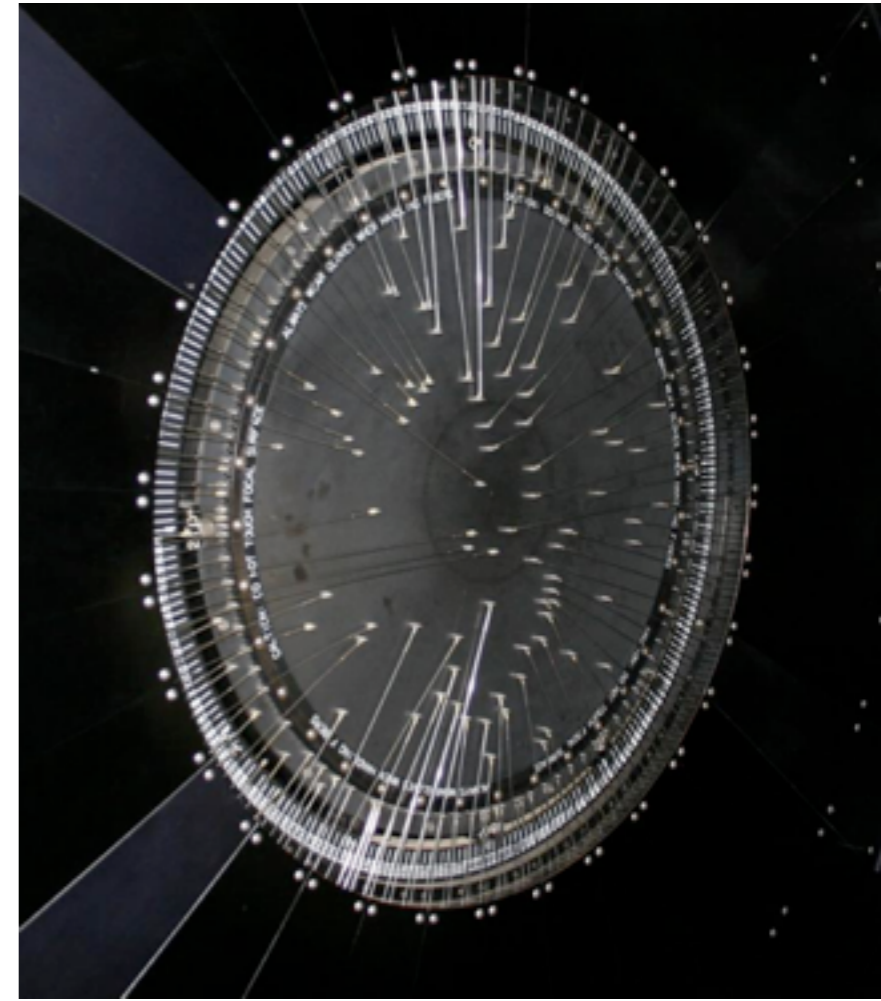
Examples of Science with WHIRC:

- star forming regions
- stellar populations
- ISM in galaxies
- high- z galaxies
- SN + GRBs
- other transients

For more information see PASP article on WHIRC (Meixner et al. 2010): www.wiyn.org/about/whirc-PASP.pdf

HYDRA

- Fiber-fed spectrograph (75 science fibers)
- Full optical range
- Can reach $r \sim 19$ in an hour @ 1 A/pixel
- Hydra is fed into the bench spectrograph, options include SparsePak, DensePak.
- Large FOV: 1 sq. degree, but fiber changes take ~ 25 min.
- Recent upgrade has improved sensitivity.



WIYN Optical Imaging

- Current: “Mini-mo”
 - 10' field, 4K imager
 - Many filters
 - Somewhat awkward reductions
- OPTIC no longer available
- One Degree Imager (ODI) “soon” (?)
- Full one degree field
 - 64 4K imagers (pixel size 0.11")
 - OT tip-tilt correction: $< \sim 0.5''$ seeing
 - ugriz (and H_{α} ?) filters
 - Much (but not all) Yale time to be used for multi-purpose survey

ODI Status

- Opto/mechanical device in good shape
- March 2010 – serious problem with detectors identified – will require new lot of detectors. First batch with corrected design currently being tested, no results yet. **This problem will result in significant costs & delay**
- Complete design/commissioning/management review scheduled for Oct 7-8
- Proposal for data analysis pipeline and archive received from Indiana/NOAO team – also under review
- Software review: Sept 27-28
- New plan will be discussed at WIYN Board meeting (in New Haven) Oct 20-21
- CB guesstimate: 2012A commissioning; 2012B shared

SMARTS

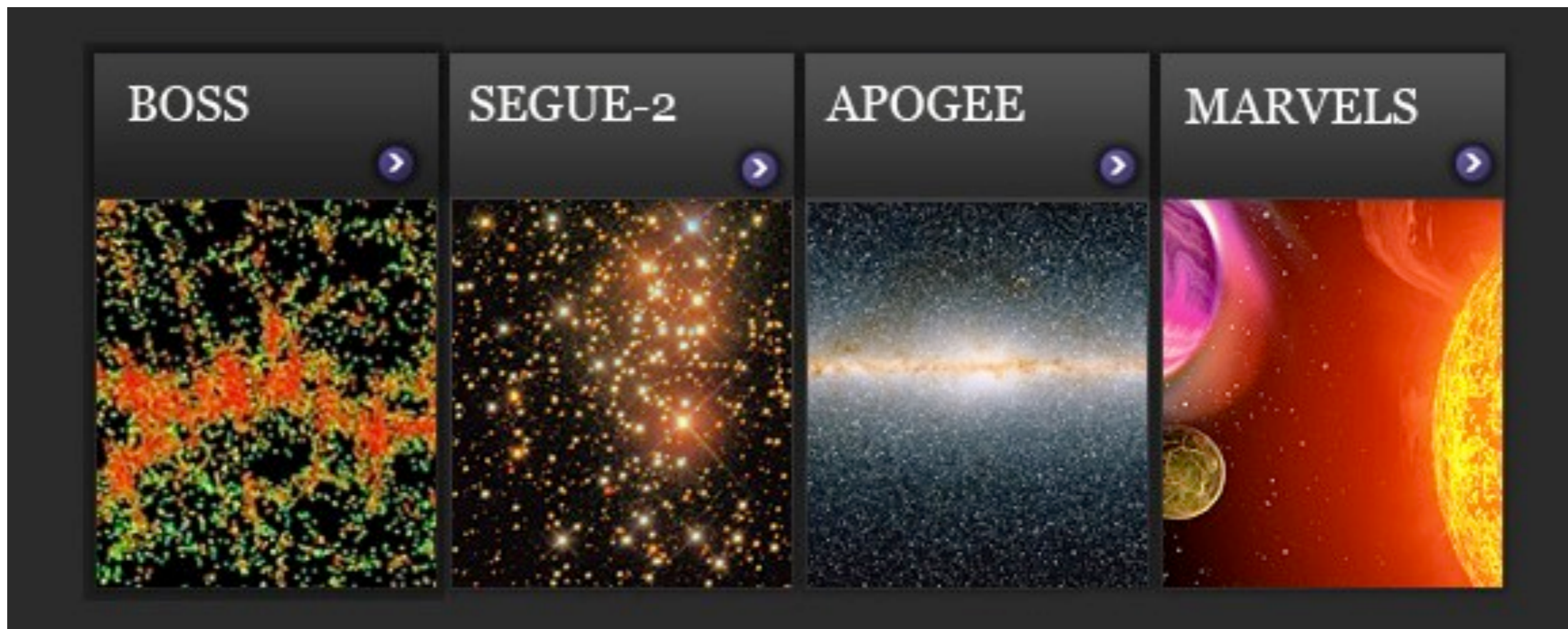
Yale has ~ 45 nights/semester *un-preallocated* time

Service nights count 50% extra

- 1.5m + RCSpec and Chiron (high-res)
Queue scheduled
NO NEW PROGRAMS ACCEPTED IN 2011A
- 1.3m + ANDICAM (optical/IR imager)
Queue schedule – maximum 1hr/project/night
Time is tight!
- 1.0m + Y4KCam (20'x20')
Traditional user runs
Readily available – bright time undersubscribed!
- 0.9m + 2KCam (13'x13')
Week-on/week-off service observing

Sloan Digital Sky Survey – III :

- 4 projects:
- BOSS – mapping dark energy with baryon oscillations
- SEGUE-2 – mapping the outer Milky Way
- APOGEE – high resolution IR spectroscopy of the Galaxy
- MARVELS – Detecting gas giant planets with radial velocities
- Started in 2009, will continue until 2014
- Project very active – lots of data coming in....
- <http://www.sdss3.org>



Yale in SDSS-3

- Yale is a full institutional member
- Any Yale faculty member, postdoc, graduate student has access to these data
- The survey is just getting started, so a great time to get involved. Lots of projects possible.
- SDSS-I, II were a great source of projects of all scales, and SDSS-III will continue this trend.
- How to get involved :
 - Sign up for the wiki : <https://trac.sdss3.org>
 - Sign up for mailing lists : <https://trac.sdss3.org/wiki/MailingLists>
 - sdss3-general a very good list to sign up for – survey wide announcements sent there, low – but important – traffic.
 - Sign up for the mailing list for the particular subproject (eg. Sdss3-boss)
 - Attend science telecons
 - Attend collaboration meetings
 - **Do science with these data!!**
- Whom to ask :
 - **Nikhil Padmanabhan** (nikhil.padmanabhan@yale.edu), JWG 451
 - Meg Urry (meg.urry@yale.edu)
 - Jeff Kenney (jeff.kenney@yale.edu)

Yale-UChile Joint Program in Astronomy Research & Education

A multi-faceted program

Undergrad summer course at UChile

Grad Student “exchange”

Postdocs -- associated with joint research programs

Faculty sabbaticals

Joint Research Programs

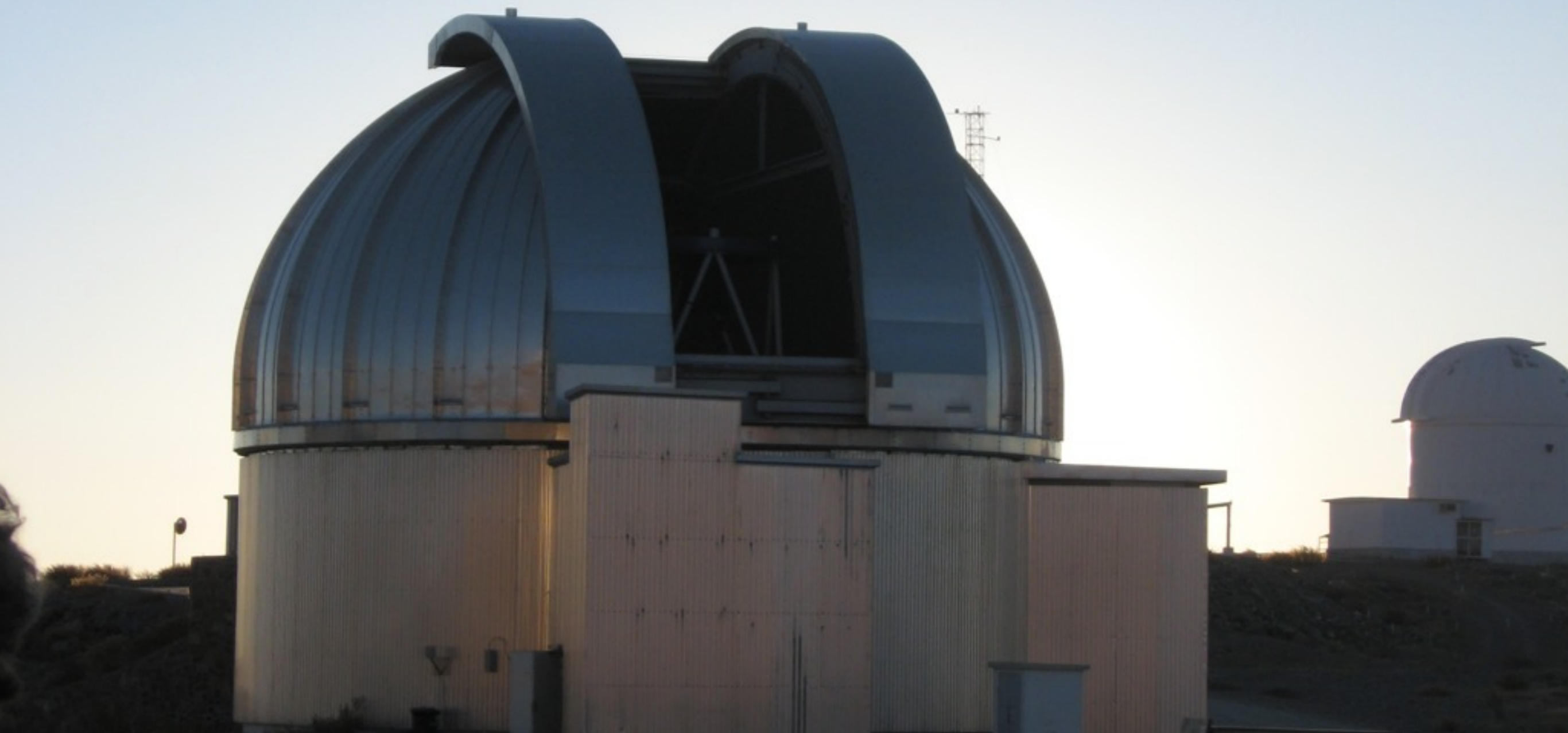
star formation! exoplanets? other?

Access to Chilean telescopes -- thru JRPs

or living in Chile for 8 months

The LaSilla/QUEST Variability Survey

The QUEST 10 square degree Camera
The ESO 1 m Schmidt Telescope



The LaSilla/QUEST Variability Survey

- Uses 100% of the telescope time (10% to Chilean users)
- Started Sept 2009, plan to run for 5 years
- Science Drivers
 - Low redshift Supernovae
 - Trans Neptunian Objects
- Enables lots of other science
 - RRLyrae stars (with Bob Zinn, Lissa Miller)
 - Quasar Variability (with Paolo Coppi)
- Everyone in Yale Astronomy welcome to all of the data

Computer resources for Astronomy

- Departmental resources:

- Centralized disc space divided into home directories (home, 40 GB), and research areas (/net)
- Each faculty member has a /net area. Everybody working under a faculty member has an area under the corresponding research area.
- /home backed up daily
- /net backed up a few times a week.

- 3 fast compute nodes, each with 8 processors for heavy duty computing.
- Software licenses: Intel compilers, IDL etc.
- Some research groups have their own systems too (e.g., van Dokkum, Fischer, Basu, Sofia).

- University resources:

- Several clusters (Bulldog J, K, and L), see <http://hpc.research.yale.edu/wiki/index.php>
- Every faculty member can get a queue and people working with the faculty submit jobs under that queue.
- The queuing system is a bit of an issue, being worked on right now.
- Some astro/physics faculty have access to BullDogM (Nagai, Padmanabhan, Basu, Natarajan and van den Bosch),

Summary

As a member of the Yale Astronomy department, you have access to world-class observing and computing resources.

Go use them !