

UT Astronomical Observing

75

McDonald Observatory
THE UNIVERSITY OF TEXAS AT AUSTIN

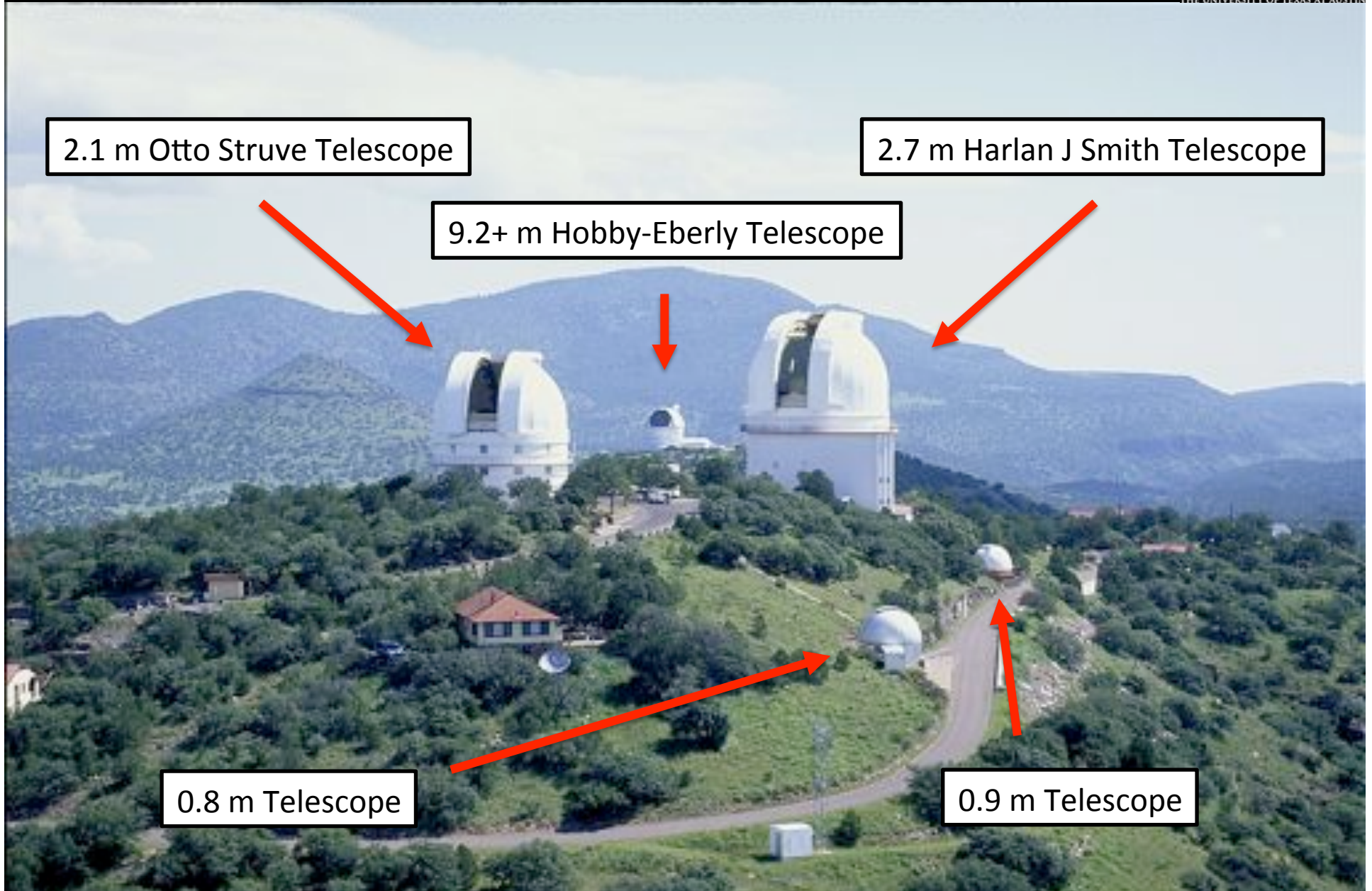
"Telescopes and CCDs and Spectrographs, oh my!
Observing at McDonald, LCOGT, and SALT"

Keaton Bell

Graduate Student / Postdoc Seminar

4 April 2014

What's what?



2.1 m Otto Struve Telescope



2.1 m Otto Struve Telescope

History/general:

- 82-inch primary
- Completed: 1938
- This *was* McDonald
- Named for the Observatory's first director (served 1932 to 1947) in 1966.



2.1 m Otto Struve Telescope

Detectors:

Prime f/3.9 focus

- Argos

Cassegrain f/13.7 focus

- Sandiford Cass Echelle Spectrometer (SES)
- Cassegrain Spectrometer (es2)
- CCD WHT Camera
- Imaging Grism Instrument (IGI)
- CQUEAN

2.1 m Otto Struve Telescope

Detectors:

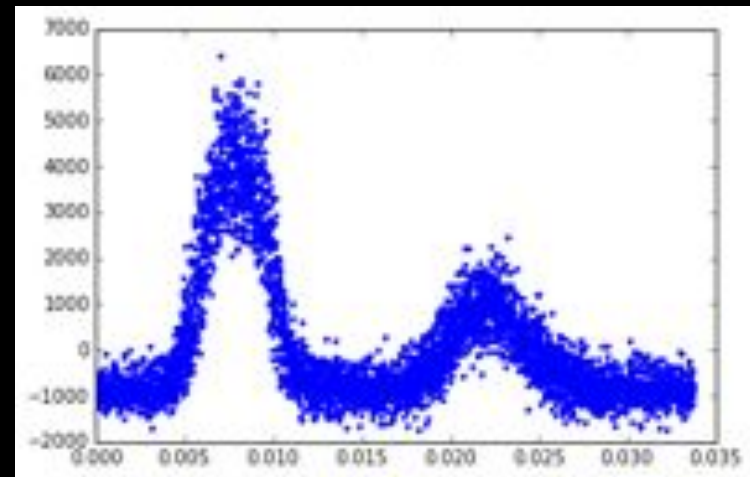
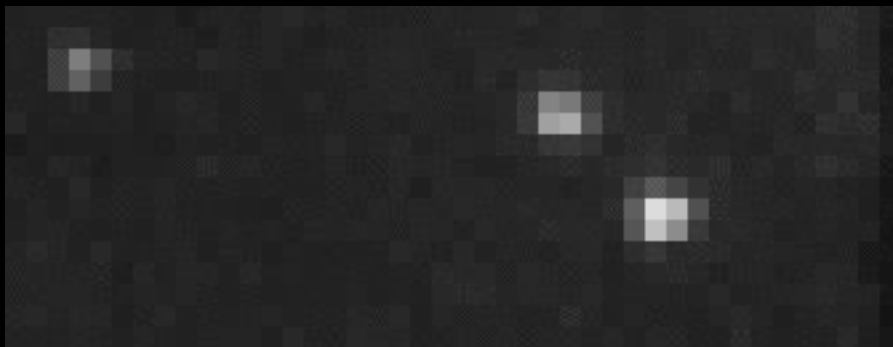
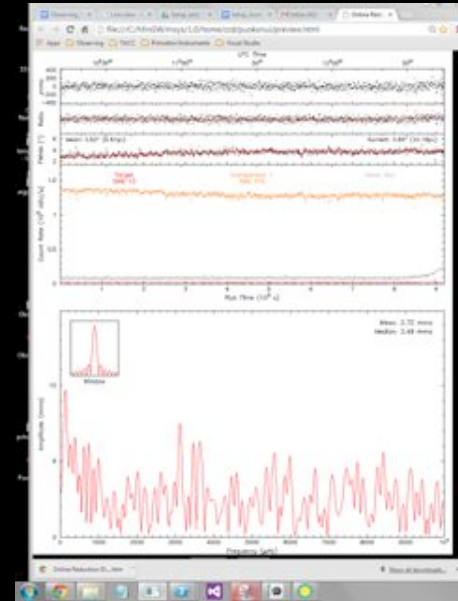
Prime f/3.9 focus

- **Argos**

Cassegrain f/13.7 focus

- Sandiford Cass Echelle Spectrometer (SES)
- Cassegrain Spectrometer (es2)
- CCD WHT Camera ?
- Imaging Grism Instrument (IGI) ?
- CQUEAN
- ProEM

ProEM Camera



13um pixels; plate scale 0.09 arcsec/pix; field of view 2.3' x 2.3'

Sandiford Cassegrain Echelle Spectrometer

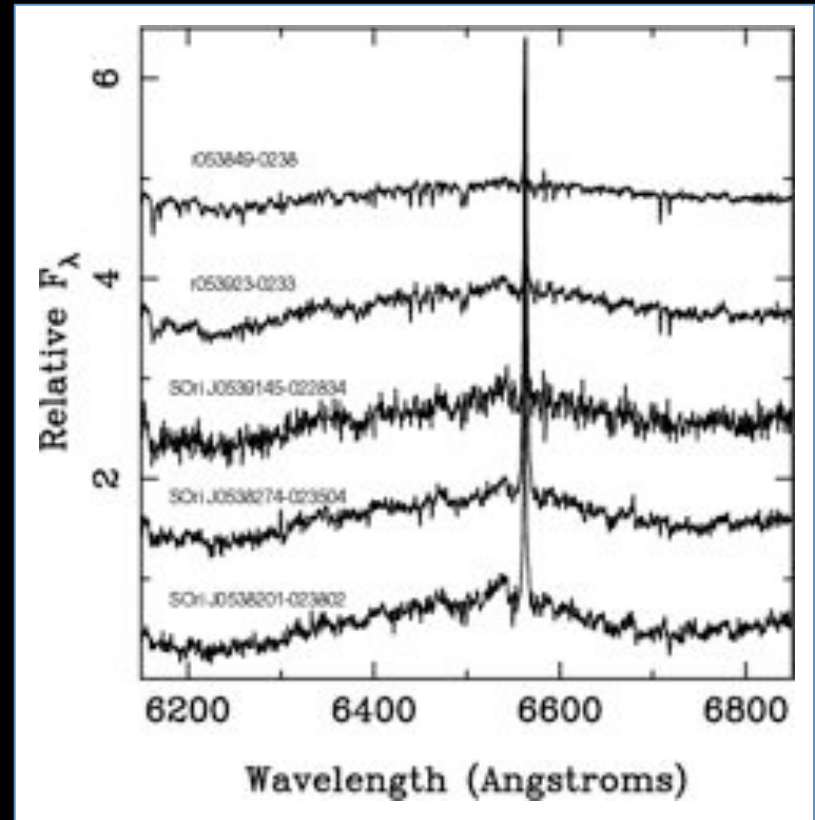


Capable of $R = 60,000$ (5 km/s)
Coverage: 3,700 Å to 11,000 Å

Cassegrain Spectrometer (es2)

Both spatial and spectral coverage:
R=600-2,500 for 0.3-1.1 micrometers
Slits 0.5-120 arcseconds long

Limiting magnitude $m_v = 18$ mag
Autoguiding



Zapatero Osorio et al. 2002, A&A, 384, 937

CQUEAN

Camera for Quasars in the Early Universe

- Red-optimized imager (0.7 to 1.1 microns)
- SDSS griz + Y filters
- Fast, with 0.1-0.5 sec readout
- 4.7 x 4.7 arcmin FoV
- 0.276 arcsec/pix plate scale
- Koreans





2.7 m Harlan J Smith Telescope

Photos courtesy Emily McLinden,
Marshall Johnson, and Jeff Silverman

This 7-8 story building houses the 107”
telescope

Construction completed in 1968

Named after the first UT director
(served 1963 to 1989) in 1995

Notable Event 1

Vandalism:

1970, worker suffered mental breakdown and shot the primary mirror with a handgun.

Reduced effective diameter to 106".



Notable Event 2

NIBIRU 2014:

Brave whistleblower astronomer Dr. Kaplan risks career to expose NASA cover-up.

Still funny.





This is the awesome view from telescope (i.e. my [Emily's] office)!

The telescope tube is about 2 stories tall! The mirror has a 107" diameter. The counterweight is about the size of a small school bus!



Emily with the telescope for perspective





This is where we sit all night and work. Astronomers are nocturnal when they're observing!

We use all the computers you see to run lots of programs that control the telescope.

We use these programs to tell the telescope where to point, when to move to a new position, how long to open the shutter and expose for.

Since the objects we're studying are REALLY far away, they're REALLY faint → so you have to take really long exposures, like 6 hours long, instead of the 0.001 second exposures your cellphone camera uses.

When the telescope takes an image or spectrum, it gets sent to these computers and we can analyze it.

The Control Room



2.7 m Harlan J Smith Telescope

Instruments:

Cassegrain f/8.8 Ritchey-Chretien focus

- DIAFI
- VIRUS-P
- CCD WHT Camera (Guider)
- Imaging Grism Instrument (IGI)
- *IGRINS*

Coudé f/32.5 focus

Robert G. Tull Coudé Spectrographs

- Tull Spectrograph (TS1)
- Cross-Dispersed Echelle Spectrograph (TS2)

DIAFI

- 40 filter wheel (SDSS, Bessel/Johnson, 6x H-alpha, O[III])
- 8.8 x 8.8 arcminute FoV
- Can be mounted with VIRUS-P (10 minute switch time)
- Frame transfer mode available (?)
- New CCD being constructed (?)
- Has accompanying guide camera





VIRUS-P

- Visible Integral-field Replicable Unit Spectrograph – Prototype
- 246 fixed fibers
- 1/3 fill factor (dither)
- 4.16 arcsec/fiber
- High-efficiency
- Low- to moderate-resolution
- 340 - 685 nm
- 2.82 square arcminute FoV
- Arc lamp calibrations
- reduction package “vaccine”

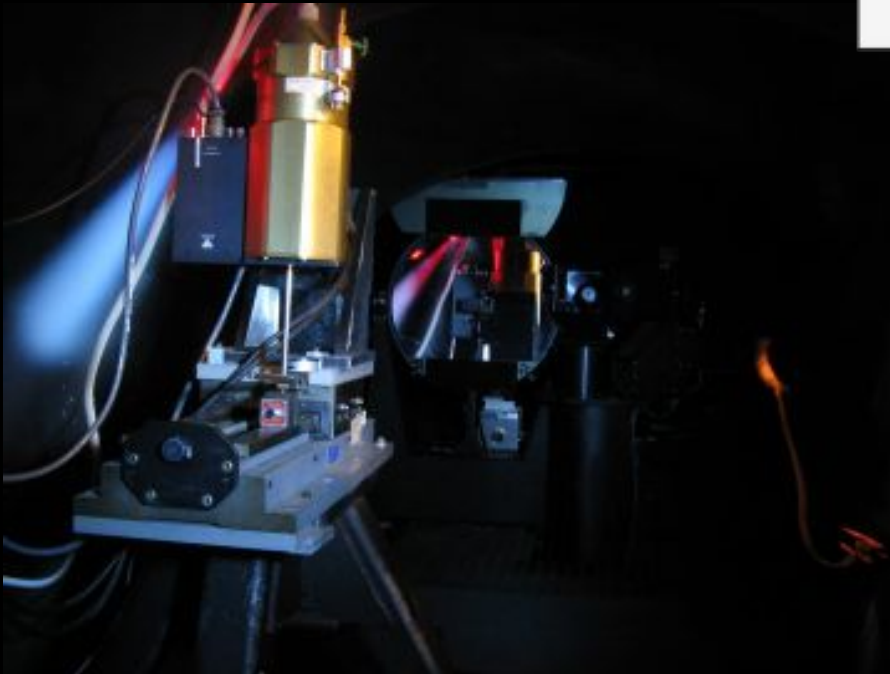
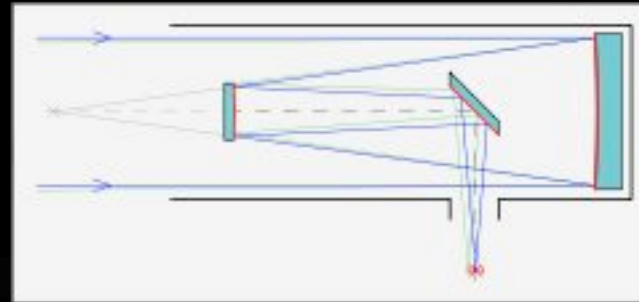
Imaging Grism Instrument (IGI)

- Imaging and spectroscopy modes.
- Imaging: $m_V = 22$ mag in 3 minutes and $m_R = 23.5$ in 15 minutes with a 7 arcmin field (BVRI filters available).
- Spectroscopy: $m_V = 20$ mag in 30 minutes and cover a wavelength range from 0.4 to 1.0 micron (not simultaneously) at a low resolution of 12-20 Angstroms.
- Multi-slit (up to 25 object) capability.

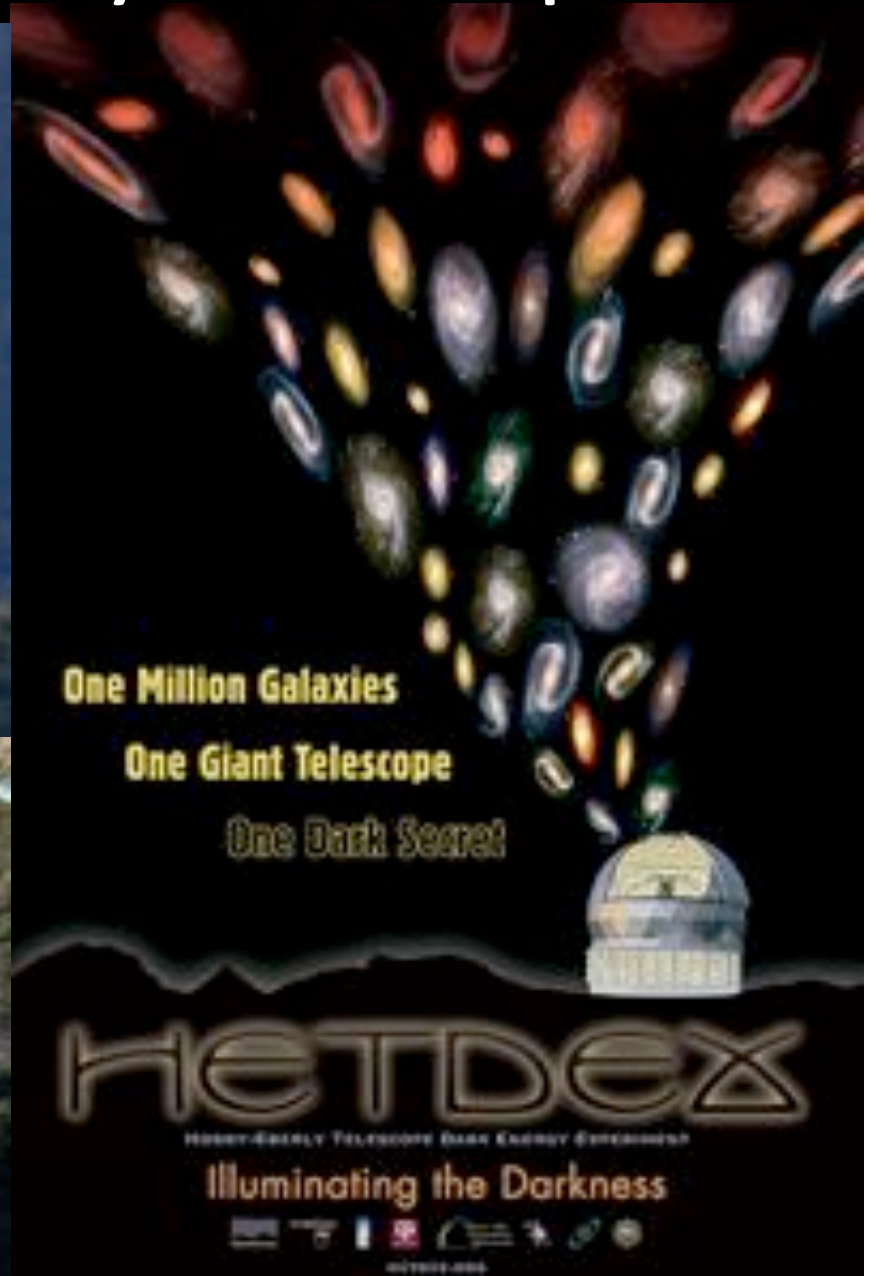
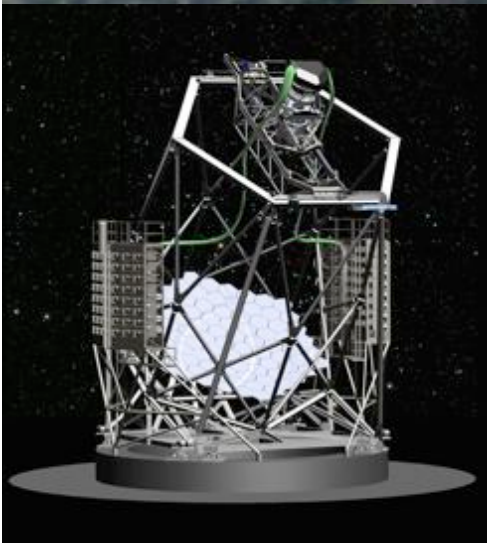


Robert G. Tull Coudé Spectrograph

- This instrument is a big room.
- 4 instruments in the Coudé slit room (different resolutions).
- Highest available resolution at McDonald ($R_{\text{max}}=400,000$)
- 5 gratings, 2 echelles available.

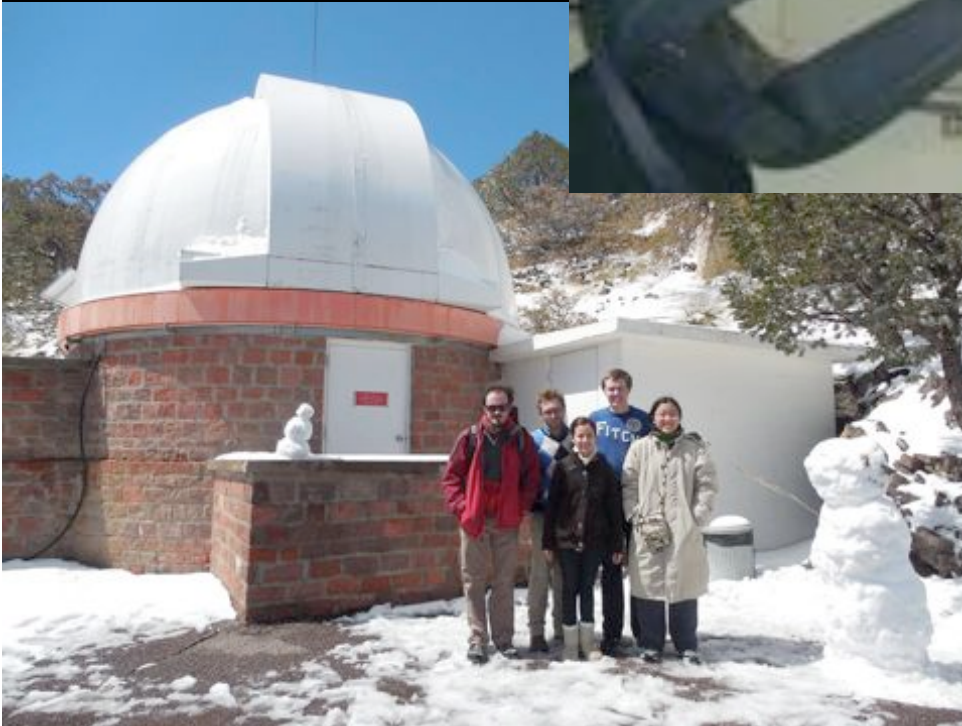


9.2+ m Hobby-Eberly Telescope



0.9 m (36 in) Telescope

Primarily used for Special Visitors Nights, REU Programs, FRI Observing, Teacher's Workshops.



0.8 m (30 in) Telescope



Karen Wingot

0.8 m (30 in) Telescope

Made from the cut-out from the 2.7-meter primary mirror.

Wide-field ~ 0.75 degree across

Original 1970, upgraded 2012 (remotely operable!)

From 2nd 2014 Trimester call for proposals:

McDonald: 30 inch telescope: The refurbished 30 inch telescope will be available for remote operations for full or partial nights. Observers will be required to attend a classical run at McDonald of at least two nights to train to use the telescope before they will be permitted to run it remotely.



Applying for McDonald Time

- Proposals due ~2 months in advance (at 8am of due date!)
- <http://www.as.utexas.edu/mcdonald/observers/proposals.html>
- LCOGT by email???

MONET/North Telescope



“MONET is now fully robotic... McD/UT is welcome to reserve ANY time for ANY purpose.”



Las Cumbres Observatory
Global Telescope Network



LCOGT Sites



Haleakala: 1 x 2 m

Cerro Tololo: 3 x 1 m

McDonald: 1 x 1 m

Sliding Spring: 1 x 2 m , 2 x 1 m

Sutherland: 3 x 1 m



Final configuration:

- 2 x 2 m
- 12 x 1 m
- 20 x 0.4 m



Key Projects:

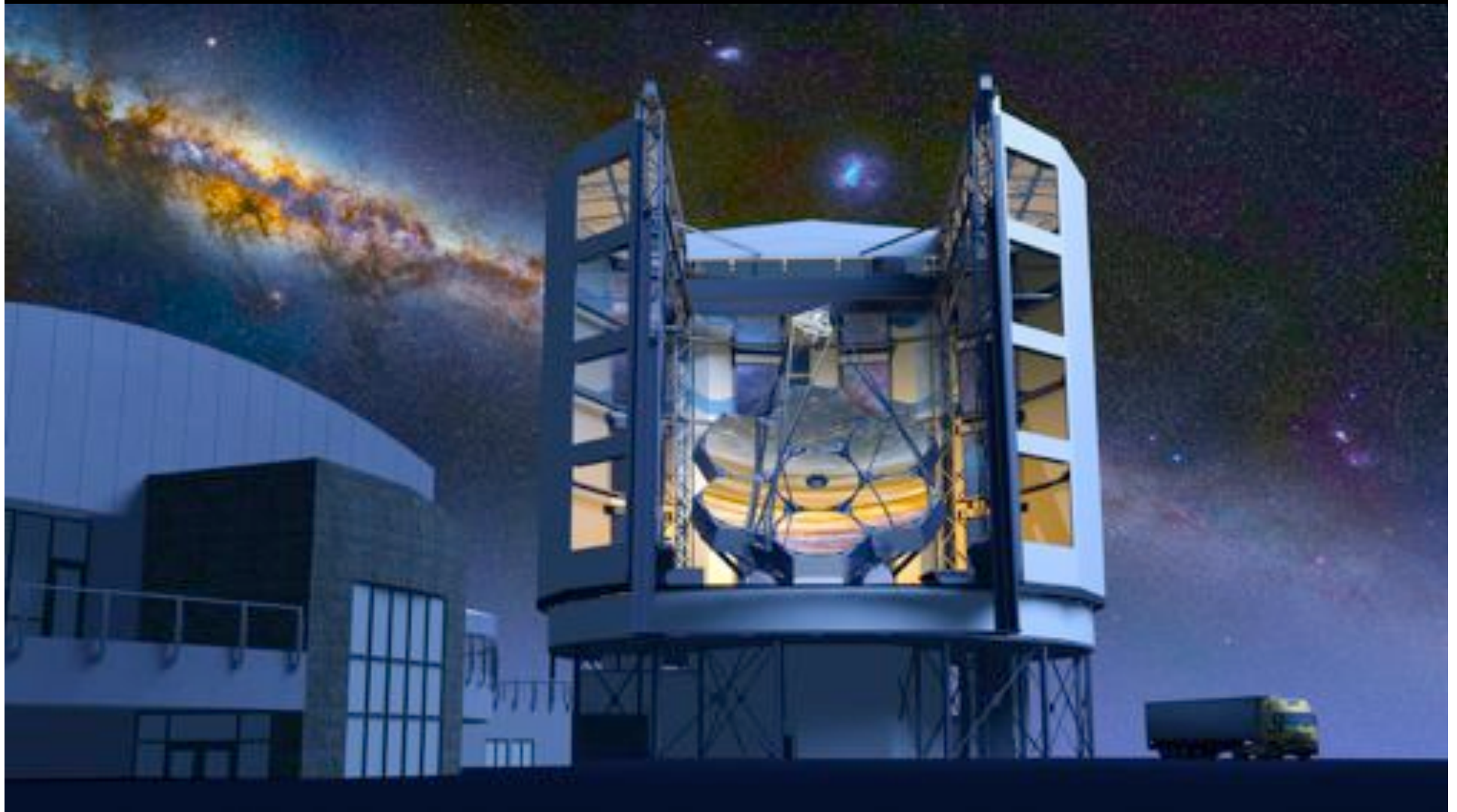
- 500 hours minimum
- 3-4 concurrently
- 5x oversubscribed

McDonald time:

- 150 hours /trimester, any telescope



GIANT MAGELLAN TELESCOPE



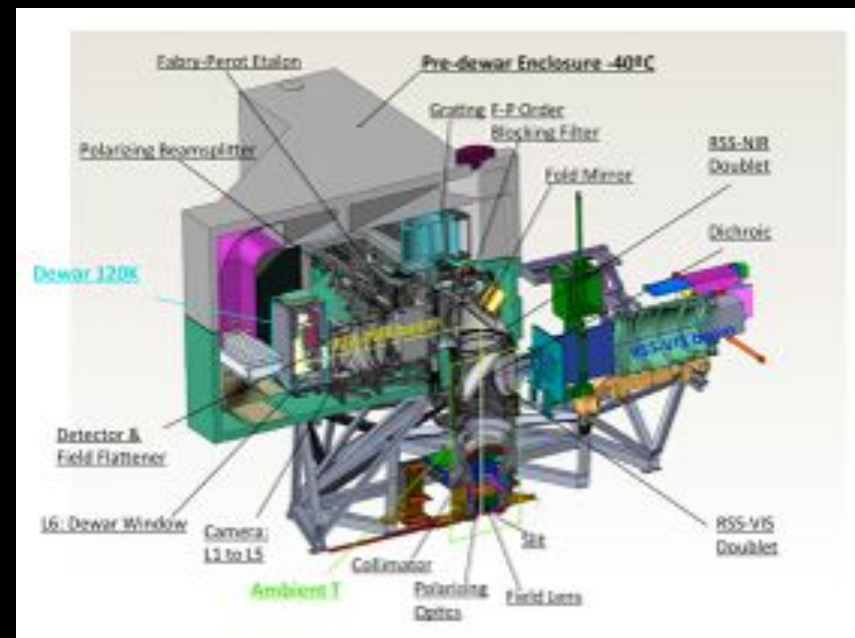
The Southern African Large Telescope (SALT)

- Near-copy of the HET in the south
- Altitude optimized for Magellanic Clouds
- UT has time through the HET board
- 4 instruments:
 - RSS
 - HRS
 - BVIT
 - SALTICAM



Robert Stobie Spectrograph (RSS)

- Low-medium resolution spectrograph: up to $R \sim 9000$; 3200-9000 Å
- Multi-object mode: up to ~ 50 objects
- Fabry-Perot imaging spectroscopy: current limited availability
- Spectropolarimetry and imaging polarimetry: currently unavailable, but may return
- Exposure lengths of >0.05 s



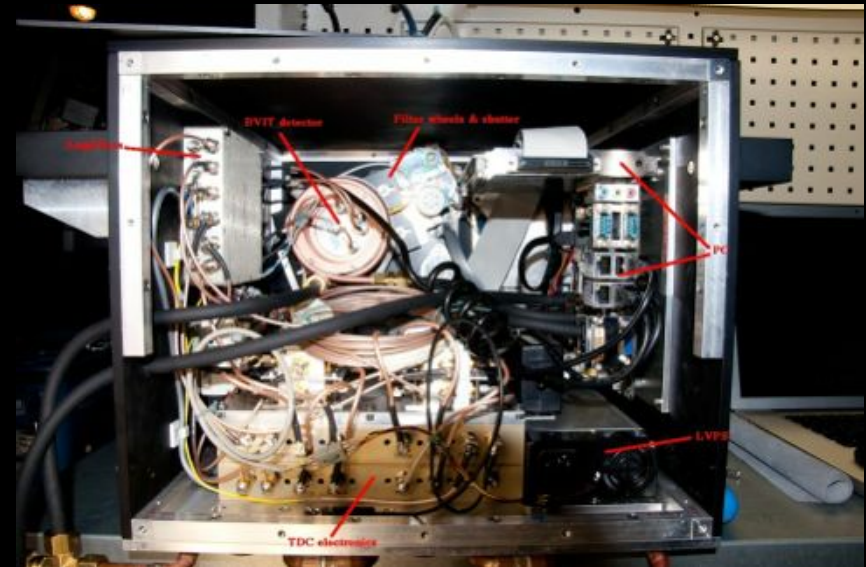
High Resolution Spectrograph (HRS)

- Separate red, blue arms (dichroic at 5550 Å)
- Complete coverage from 3700 to 8900 Å
- 4 modes: R=16,000; 37,000; 67,000; high RV stability (R=67,000)
- Nod-and-shuffle available for R=16,000 mode
- First light Sept. 2013



Berkeley Visible Imaging Tube (BVIT)

- High-speed photon-counting photometer (ms- μ s)
- 1.3' FOV
- B, V, R, H α filters
- Limited to $12 < V < 20$



SALTICAM

- Imaging and acquisition camera
- 10' FOV; two 2k x 4k chips
- Frame rates up to ~10 Hz
- Most standard optical filters available (UBVRI, Sloan, Strömgren, H α)



How do I get SALT time?

- All UT astronomers can apply!
- Deadlines: **January 31** (for May-Oct), **July 31** (for Nov-Apr)
- Proposal software: PIPT (handles Phase 1 & 2)
- Queue-scheduled
- More info: <http://salt4scientist.salt.ac.za/>