

MOSFIRE

Multi-Object Spectrometer for Infra-Red Exploration

FIRST LIGHT

Adapted from a presentation to the
WMKO Science Steering Committee by
Ian McLean, Chuck Steidel & Sean Adkins on
April 17, 2012



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MOSFIRE Status

- **MOSFIRE arrived at the summit 2/16/12**
- **Installation plan at Keck 1 worked well**
- **Cool down started 3/8/12, reached operating temperature on 3/18/12**
- **First spectra (week of 3/19/12) showed optics and internal systems were all OK**
- **Mounted and balanced on the Keck I**
- **Successful First Light on April 4 & 5, 2012**



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MOSFIRE transportation to the summit of Mauna Kea



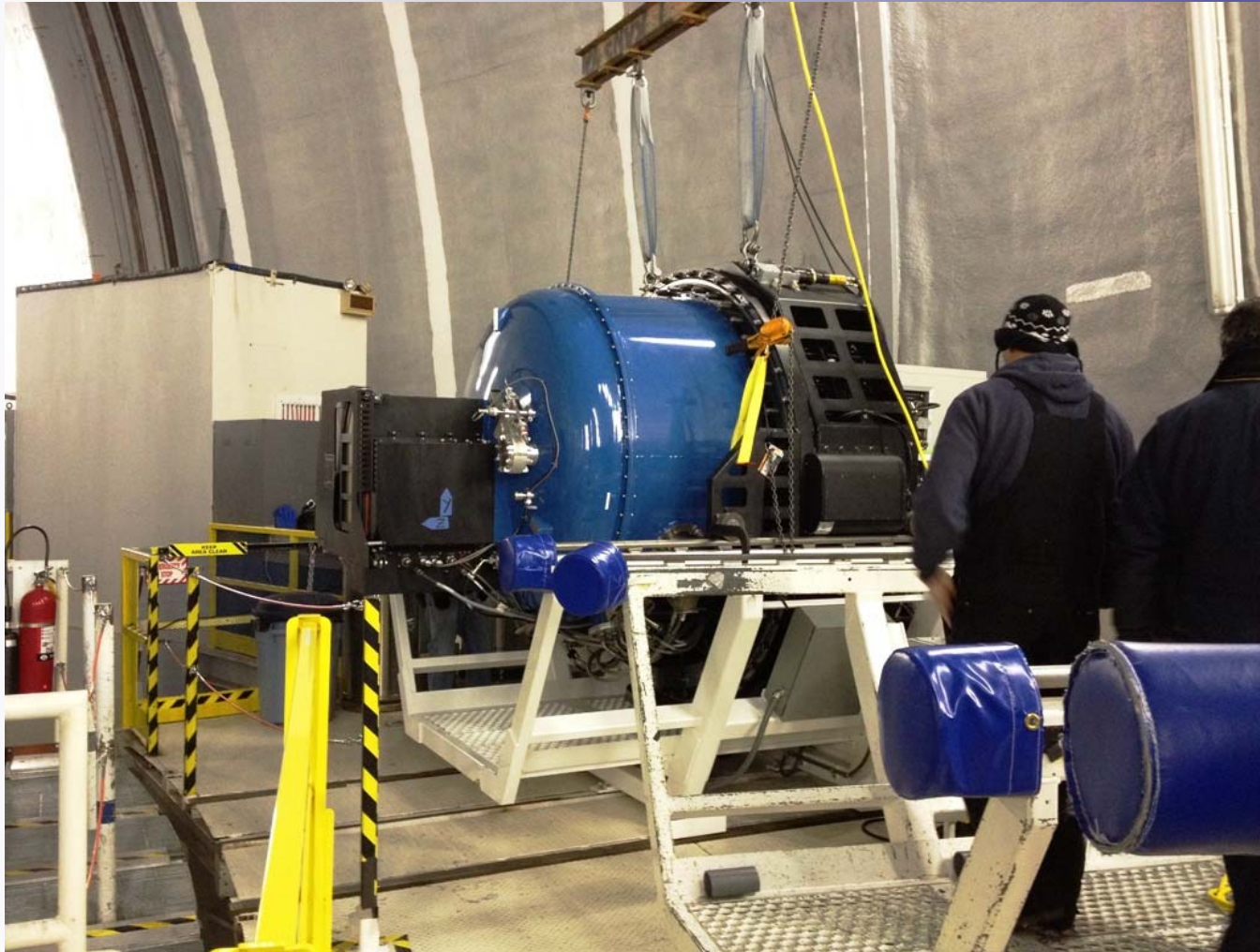
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MOSFIRE placed safely inside the Keck 1 dome



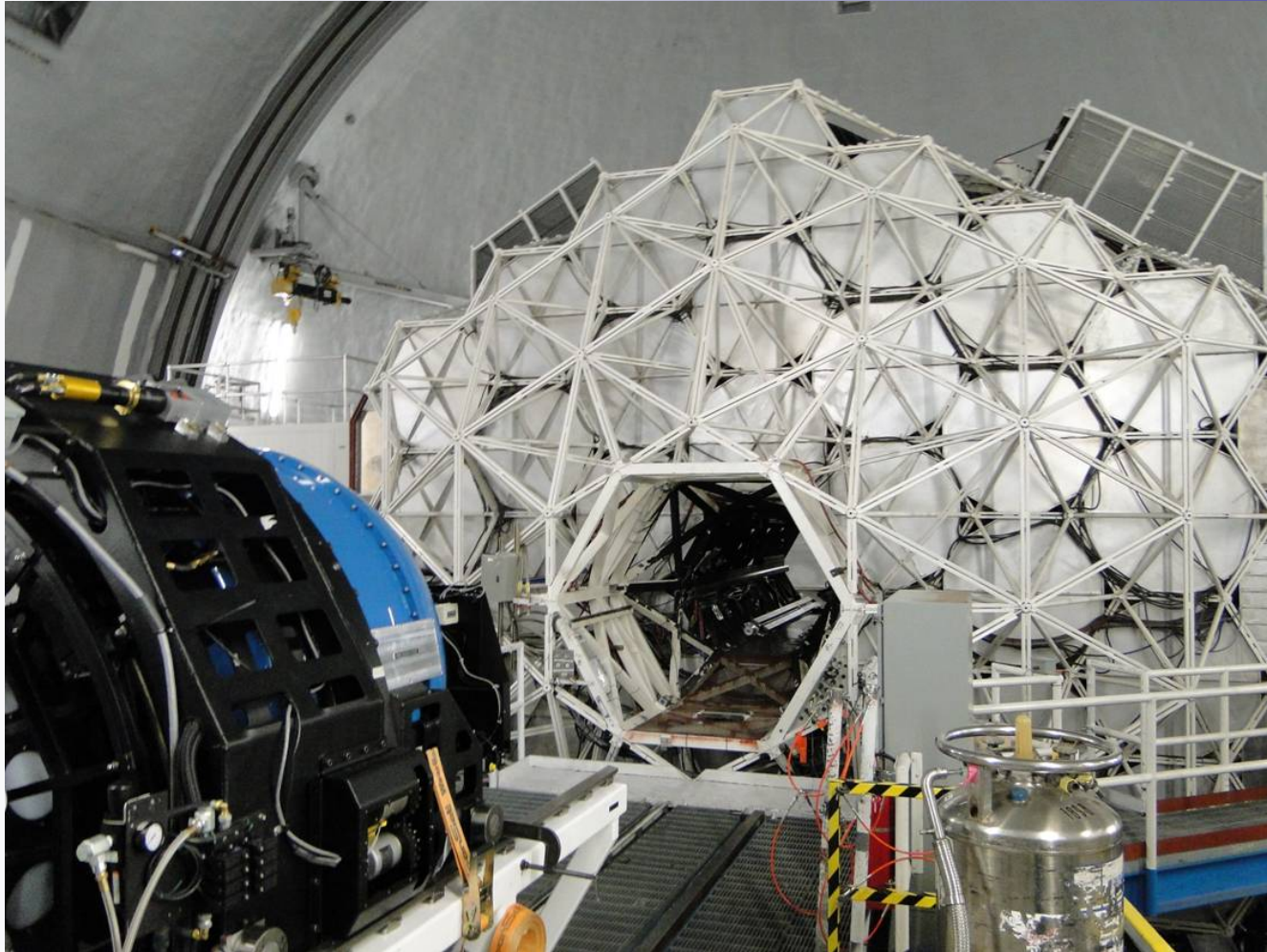
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MOSFIRE “lands” at RT1



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MOSFIRE ready to install



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Commissioning Night 1: 4/4/12

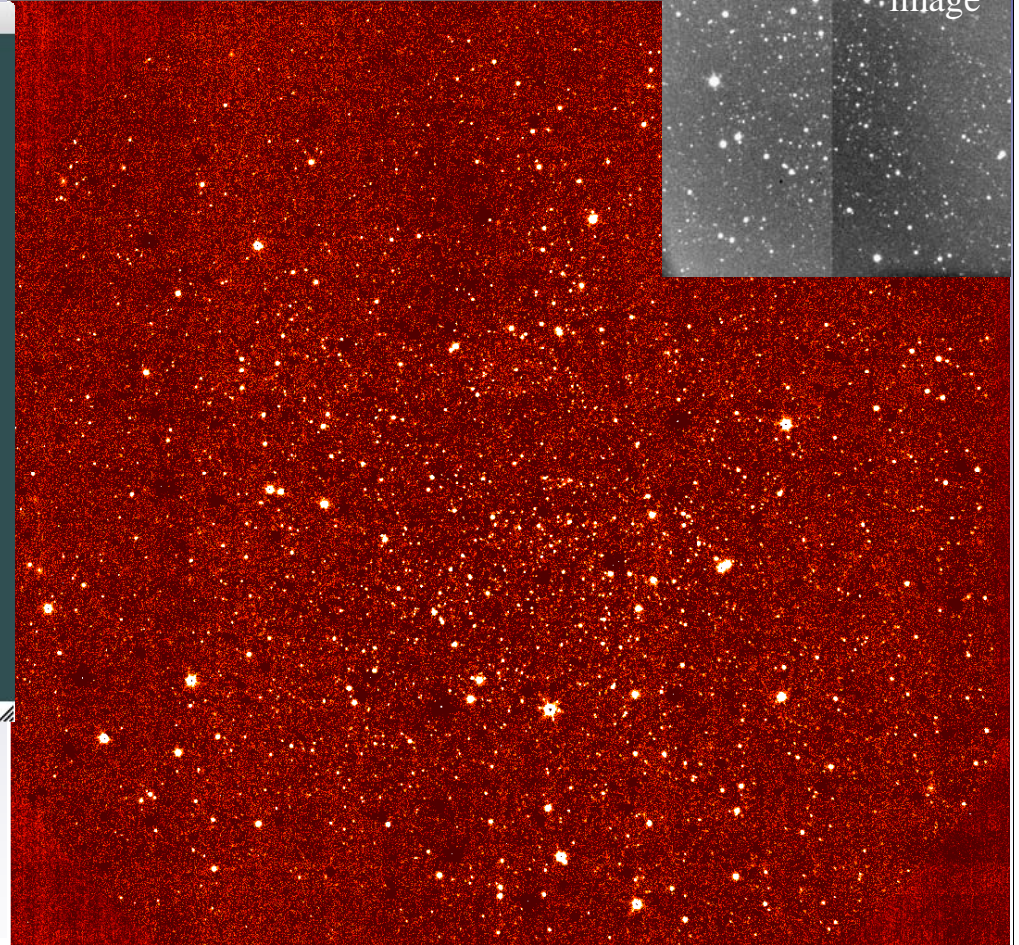
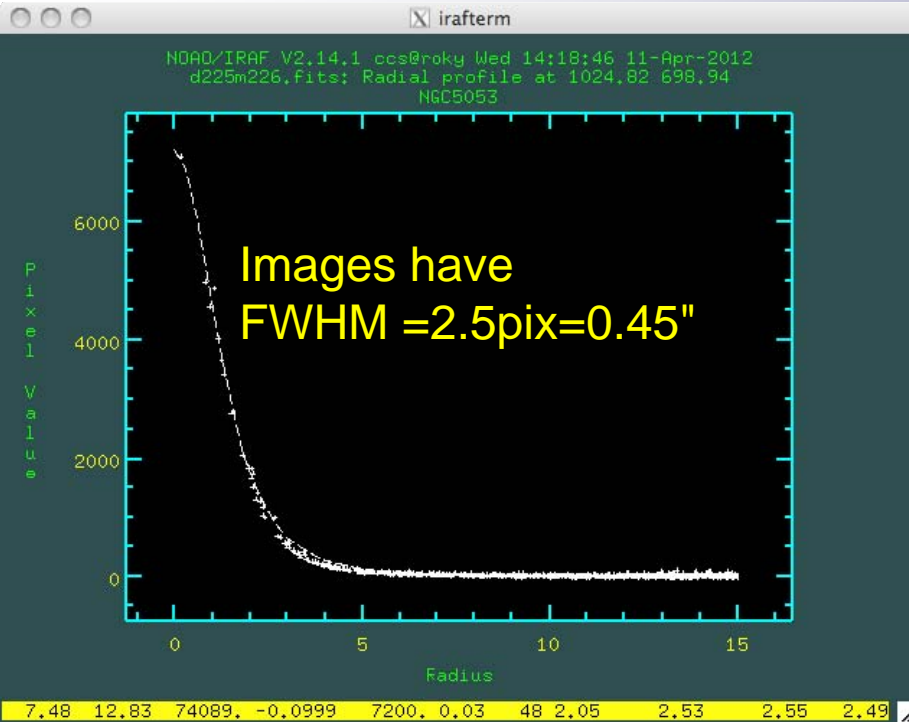
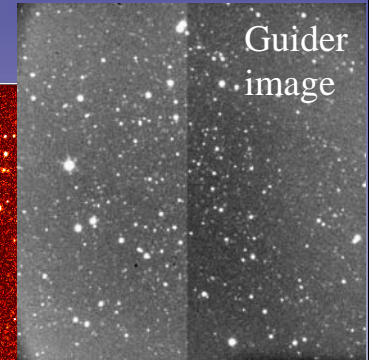
- **Cirrus clouds throughout the night, some times very thick ☹**
- **Accomplished many of the planned tasks, including:**
 - Established pointing origins (exactly as predicted for science field!)
 - Confirmed ability to guide with MAGIQ system
 - Calibrated rotator system for tracking while guiding.
 - Established orientation and handedness of instrument and guider fields
 - Confirmed alignment of pupil image with Lyot mask (alignment of instrument and telescope axes); established rotational zero point for pupil tracking
 - Obtained images to check MOSFIRE astrometric calibration and our assumptions about the telescope focal plane astrometry
 - Obtained night sky spectra in each band (Y, J, H, K, J2)
 - Obtained a few “pretty pictures” through clouds
 - Best MOSFIRE images: FWHM~0.4" over full imaging field
- **Problem found with CCD Guider, corrected for second night**



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NGC5053 – star cluster at J

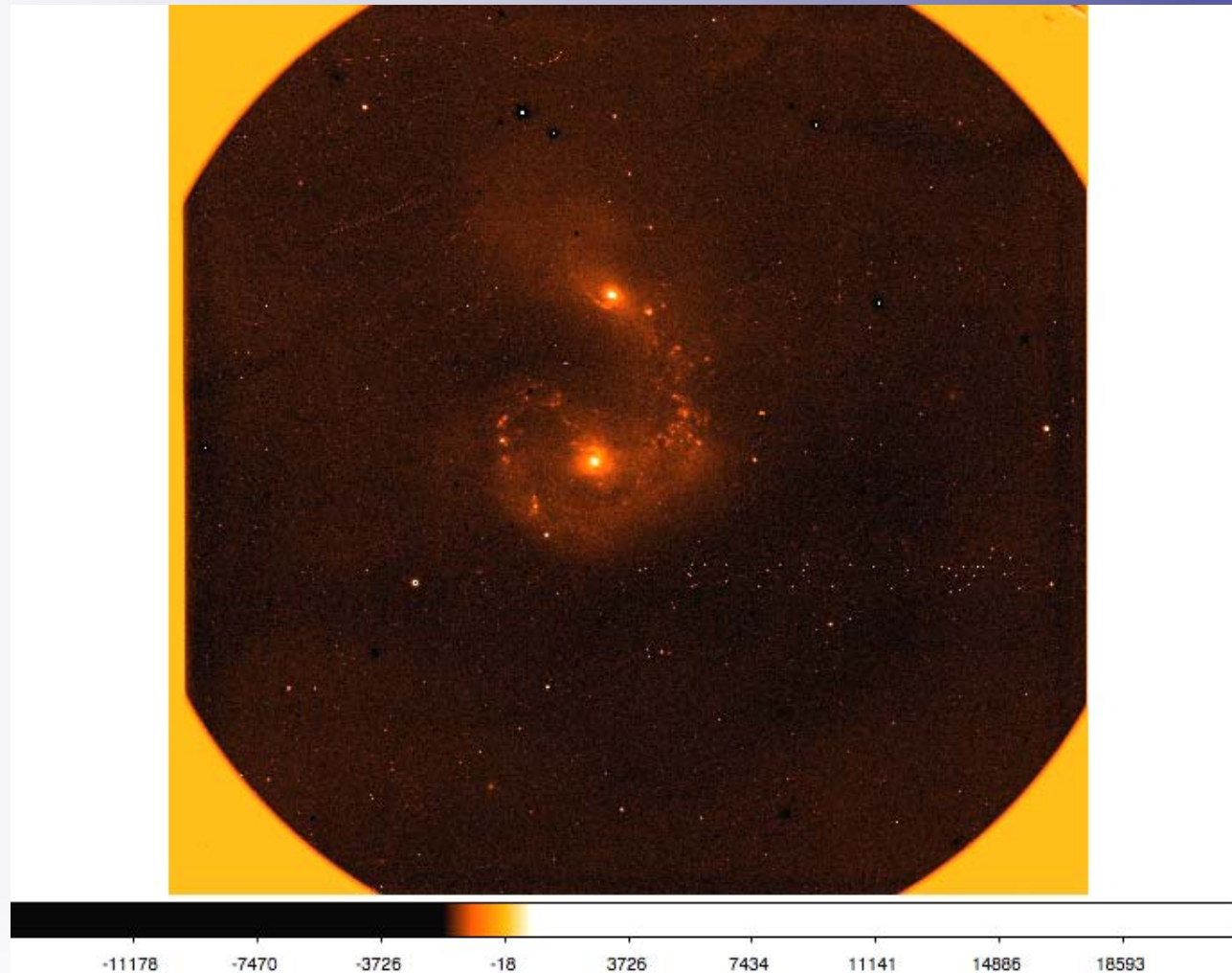
Difference of two frames



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Antennae Galaxies – J-band

A 58 s
exposure
through
clouds!



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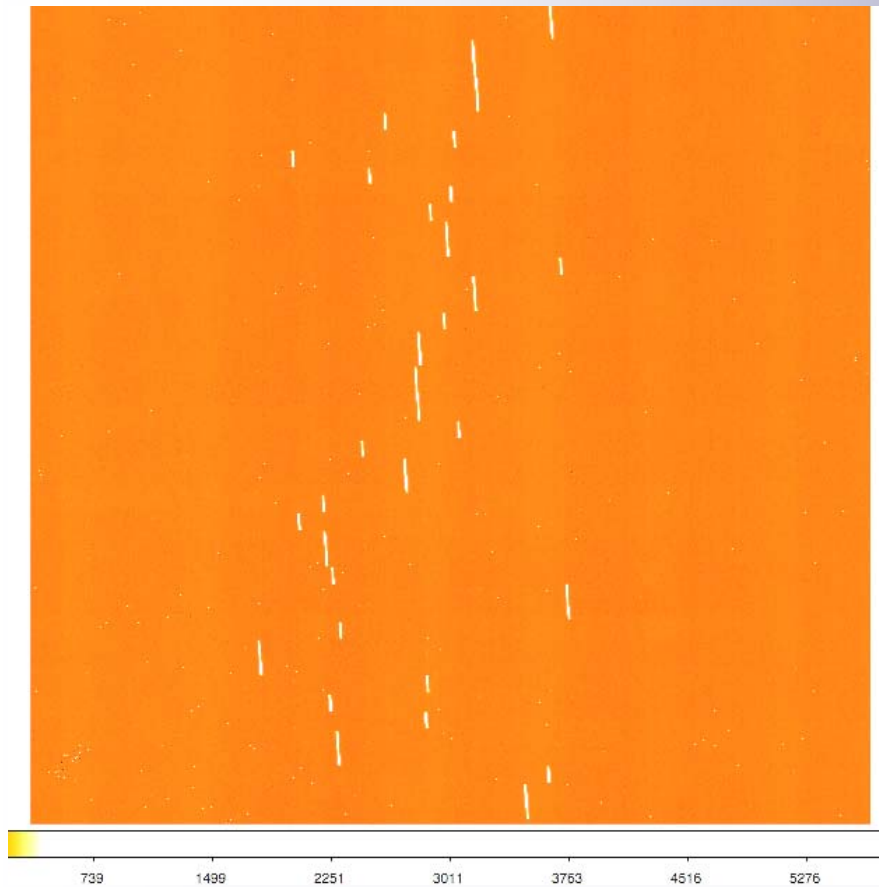
Antennae - zoomed



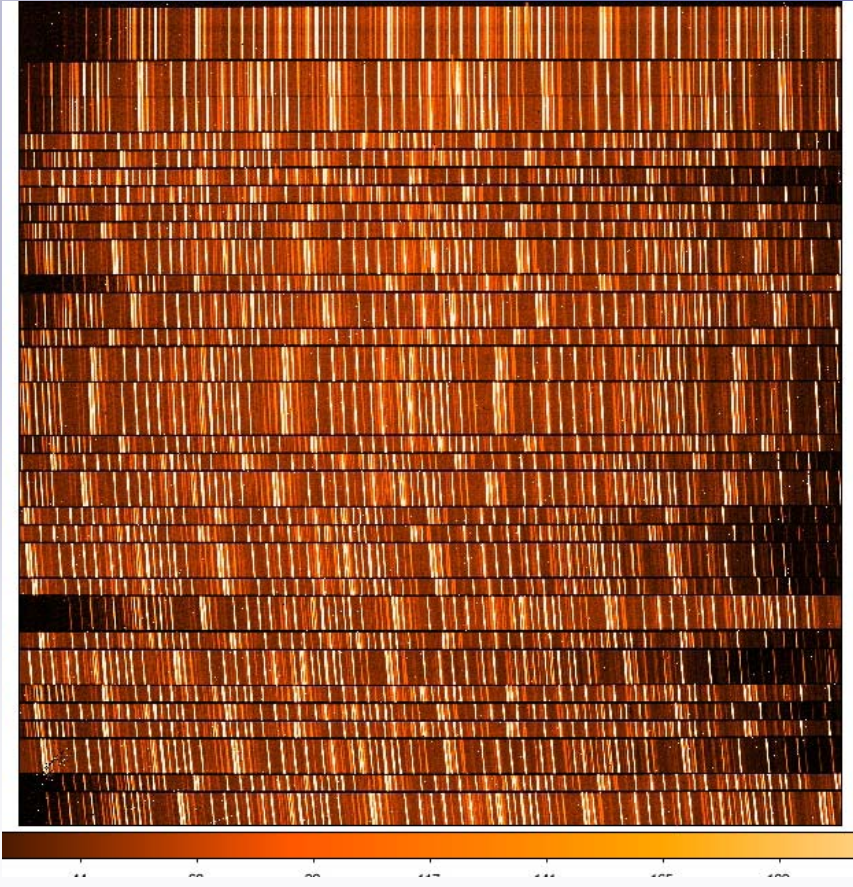
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First slit mask – looking at sky

Slit mask image



OH Sky Spectra at H-band, 30 s exposure



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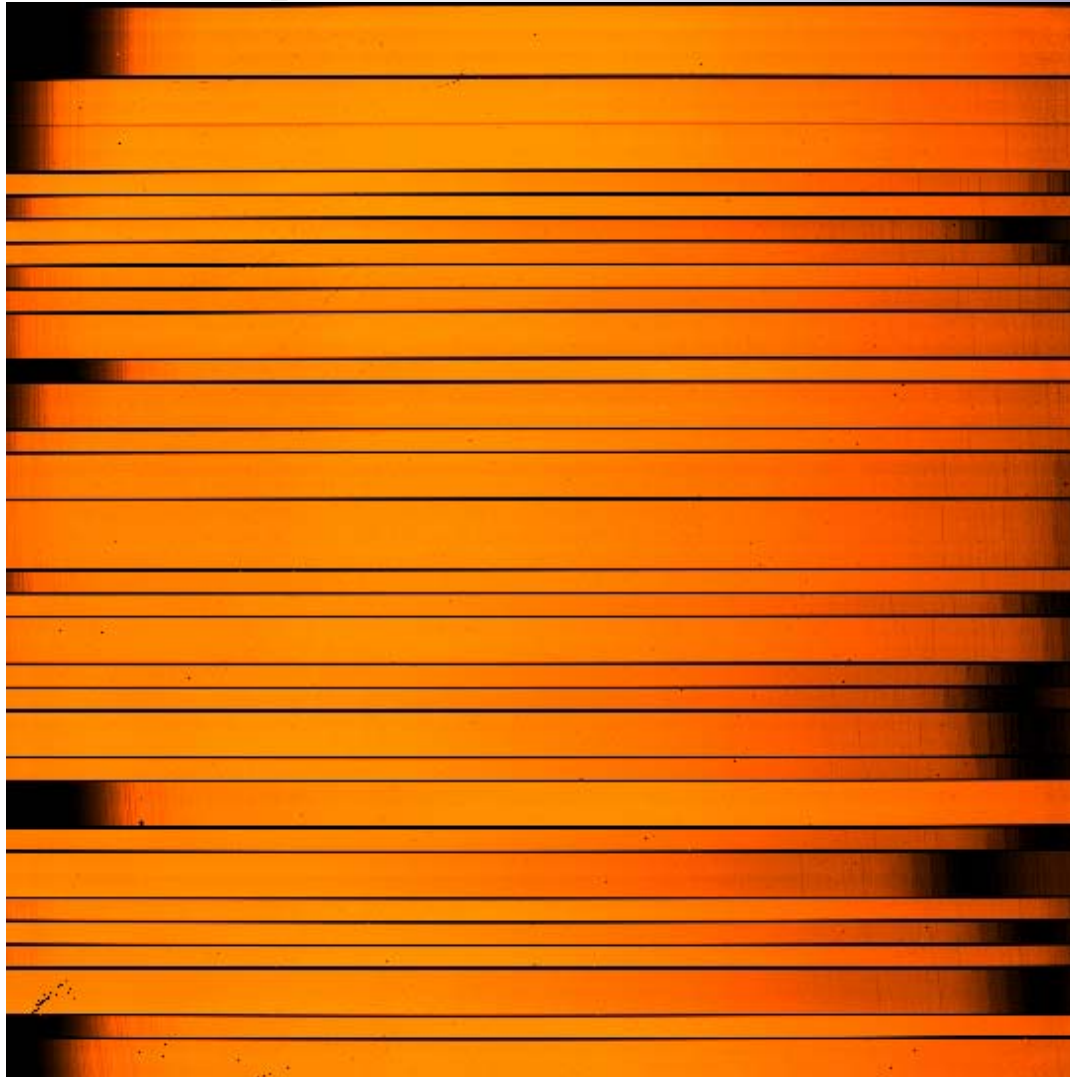
Commissioning Night 2: 4/5/12

- **Second night also thick cirrus with occasional clear periods**
- **Commissioning tests completed include:**
 - Additional data for final check of FCS system with MOSFIRE on telescope
 - Verified new scheme for spectroscopic dome flats
 - Tested MOSFIRE calibration script
 - Verified guider is quite sensitive, working very well. Images obtained have FWHM~0.6" centered 6.7' off of the telescope axis
 - Tested scripts for offsetting telescope in various coordinate systems
 - Obtained super-long slit spectra of M82, M57
 - Successfully aligned our first slit mask, using "Slitmask Alignment Tool"
 - Stars in boxes, and in 0.7" slits, no tweak to PA needed
 - Obtained J-band spectra with automatic nodding between 2 slit positions
 - Continued verification that all mechanisms function as expected
 - Software generally in excellent shape; punch list of improvements based on experience on the sky



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Spectroscopic Dome Flats



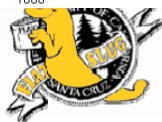
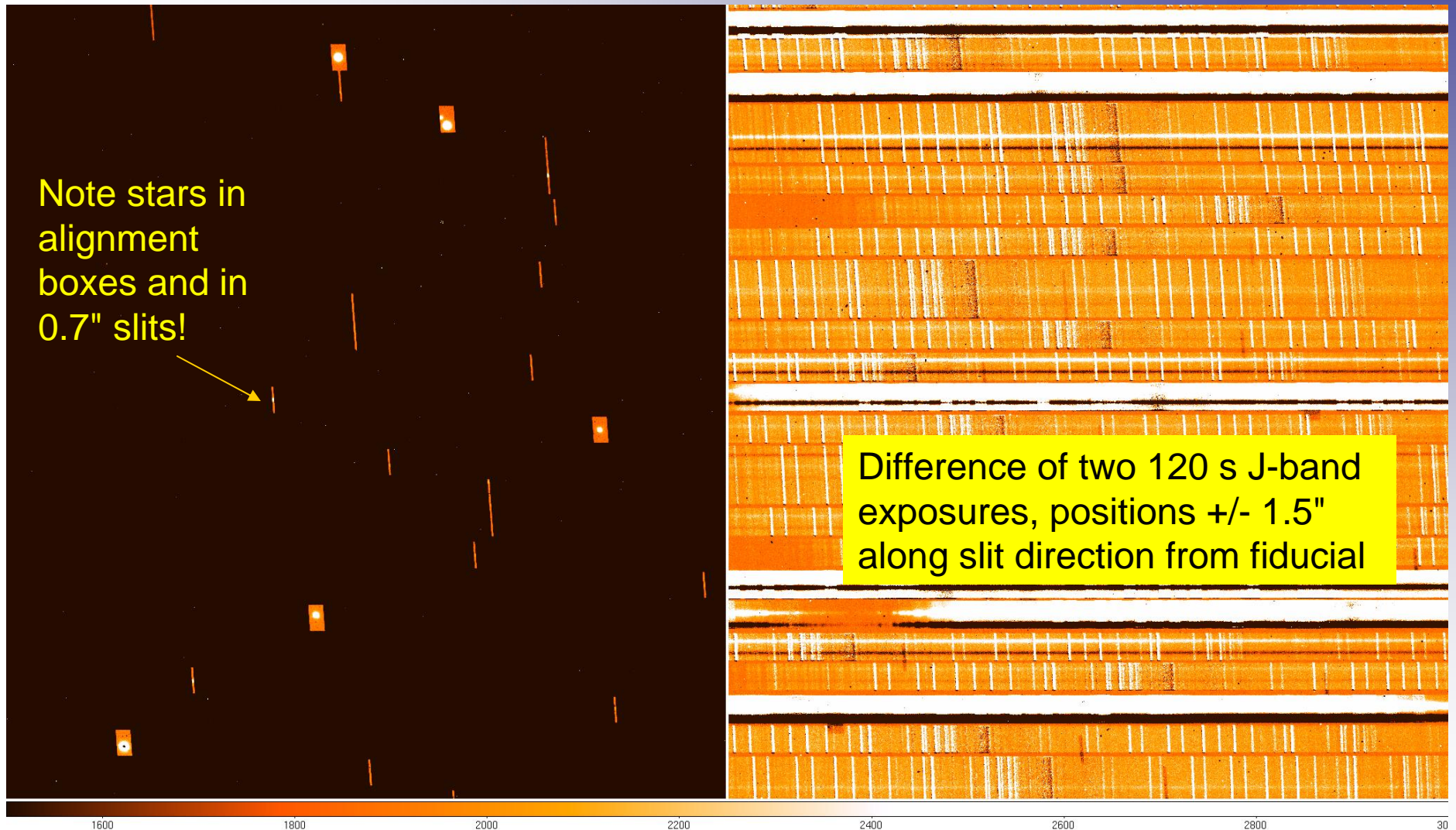
Afternoon of night 2, we tested a new spectroscopic flat field lamp system, verified that it works well for all MOSFIRE bands.

H-band flat for
test mask (30 slits)



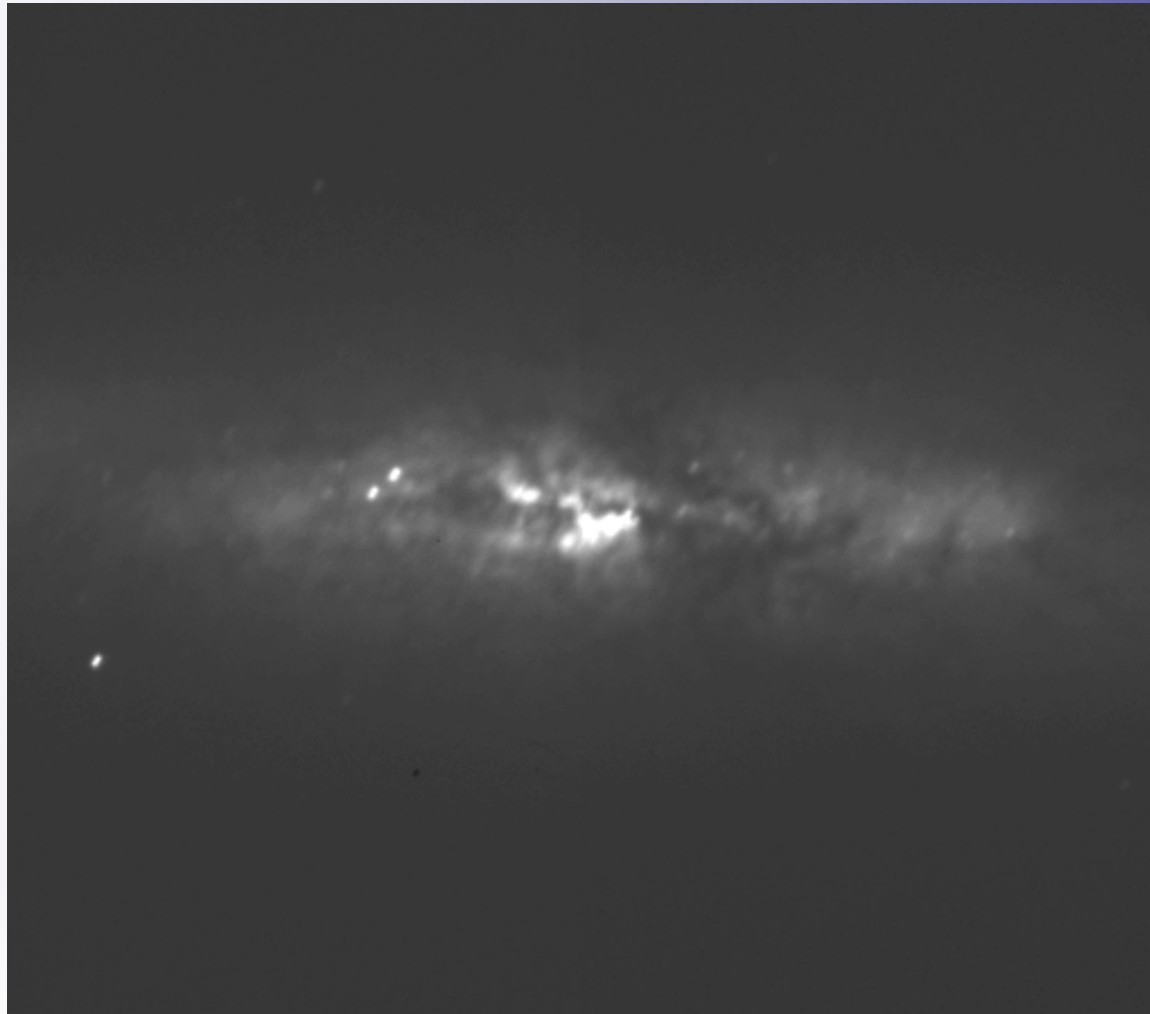
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First Mask Alignment, MS Nod Sequence



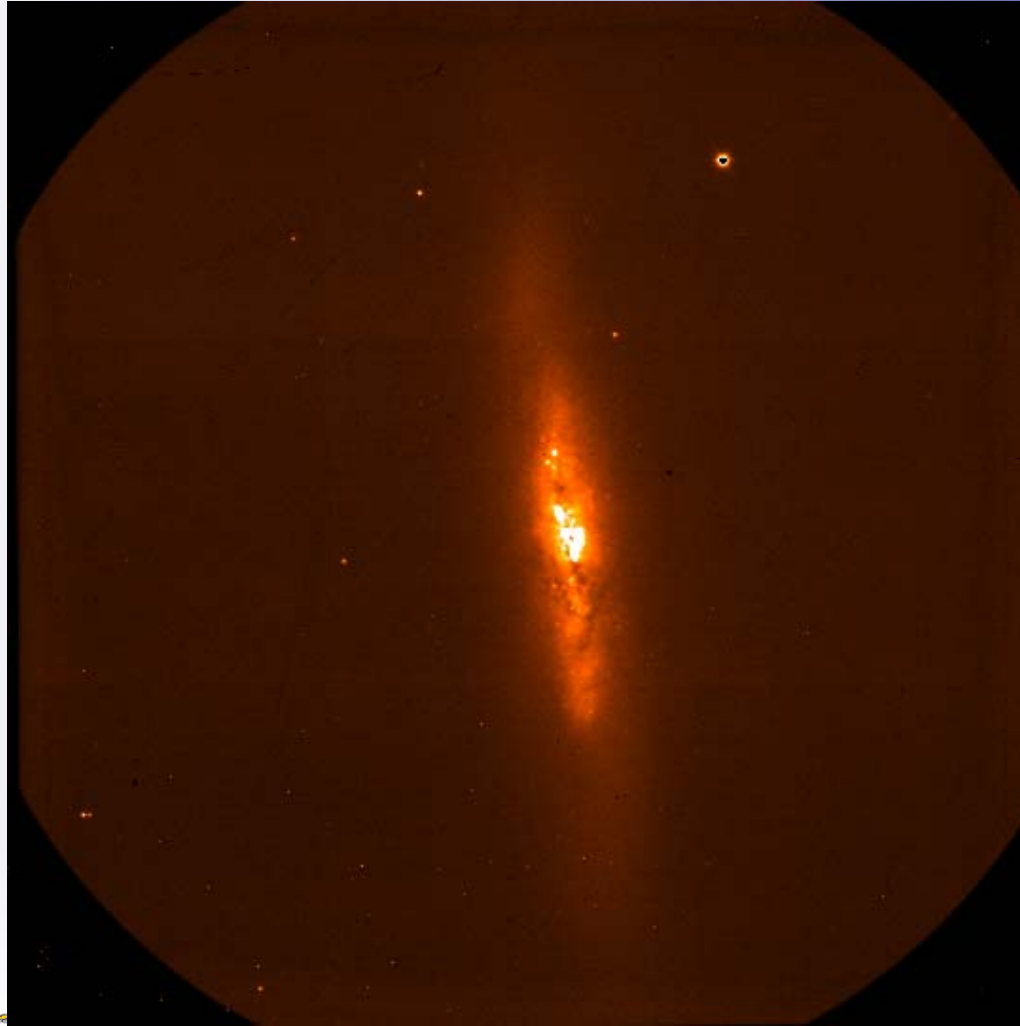
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M82 in MAGIQ guide camera



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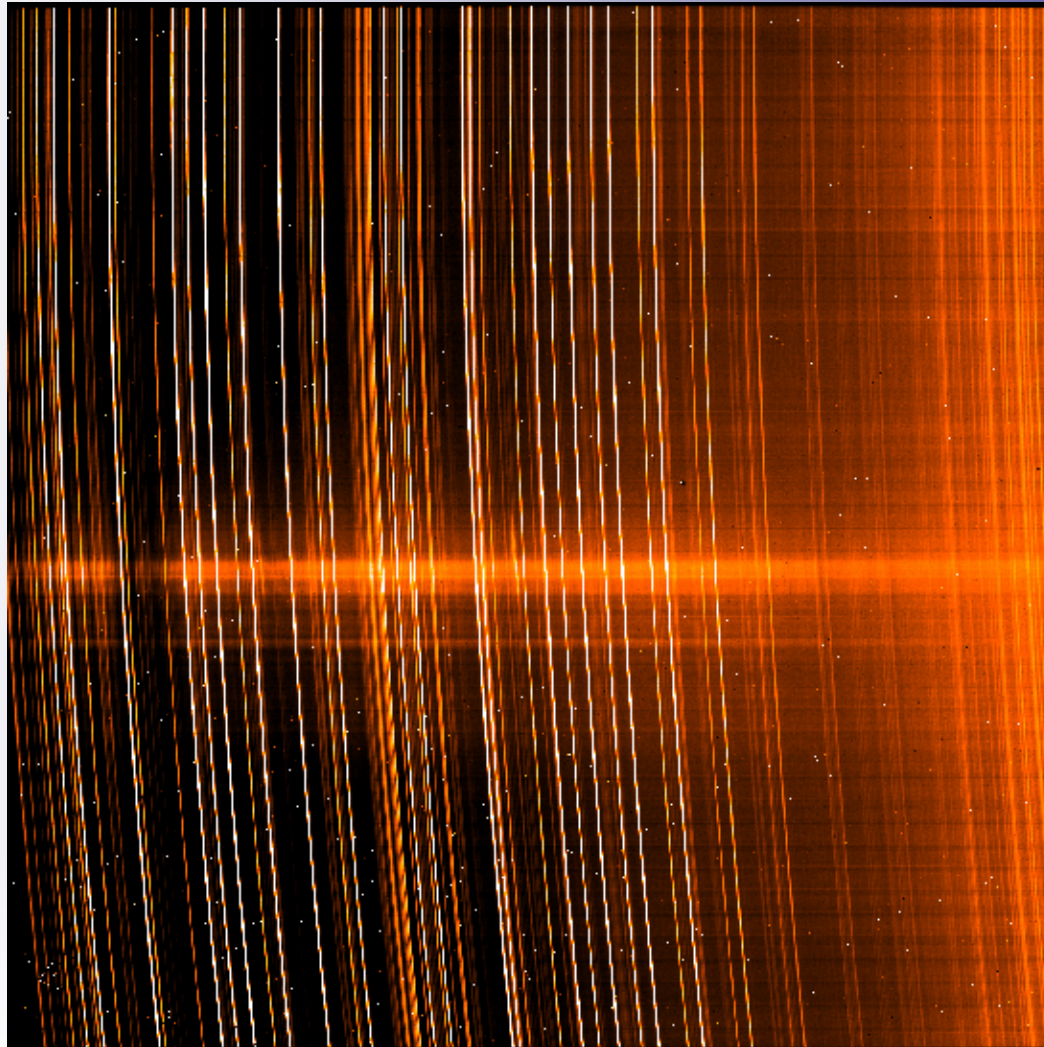
M82 with MOSFIRE, J-band



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Super-Long Slit spectrum of M82 in K-band

Lots of OH emission lines plus thermal infrared emission on the right

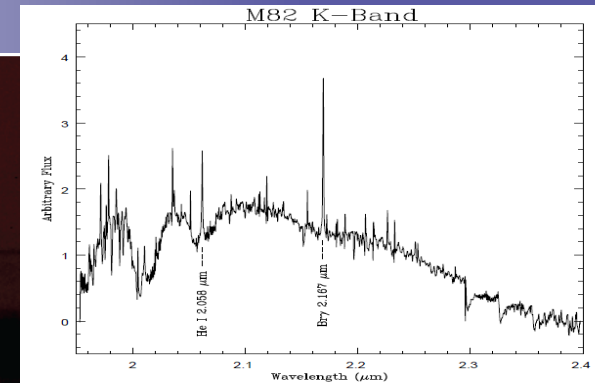
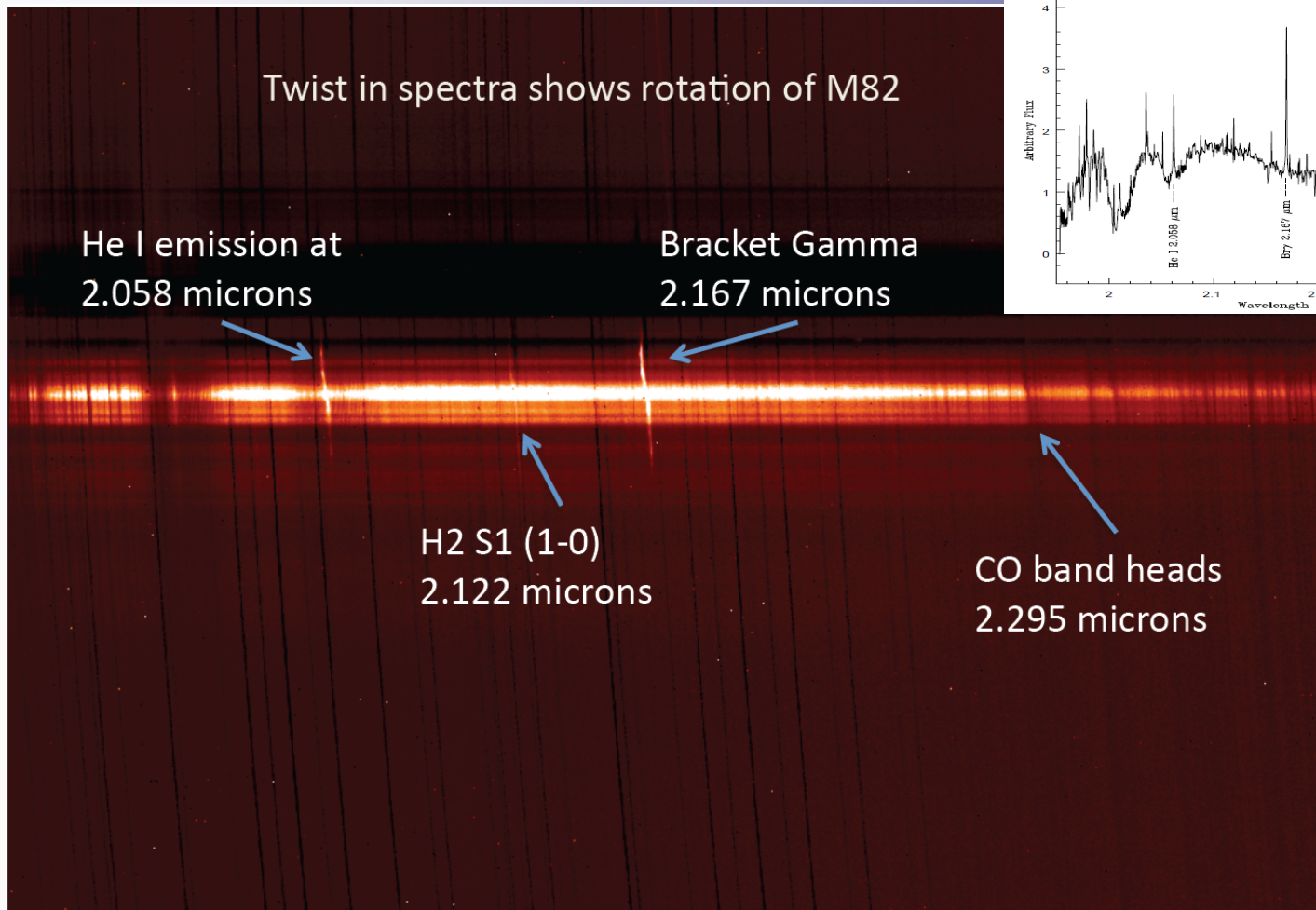


The slit is 6.1' long, the longest contiguous slit possible using any Keck instrument!



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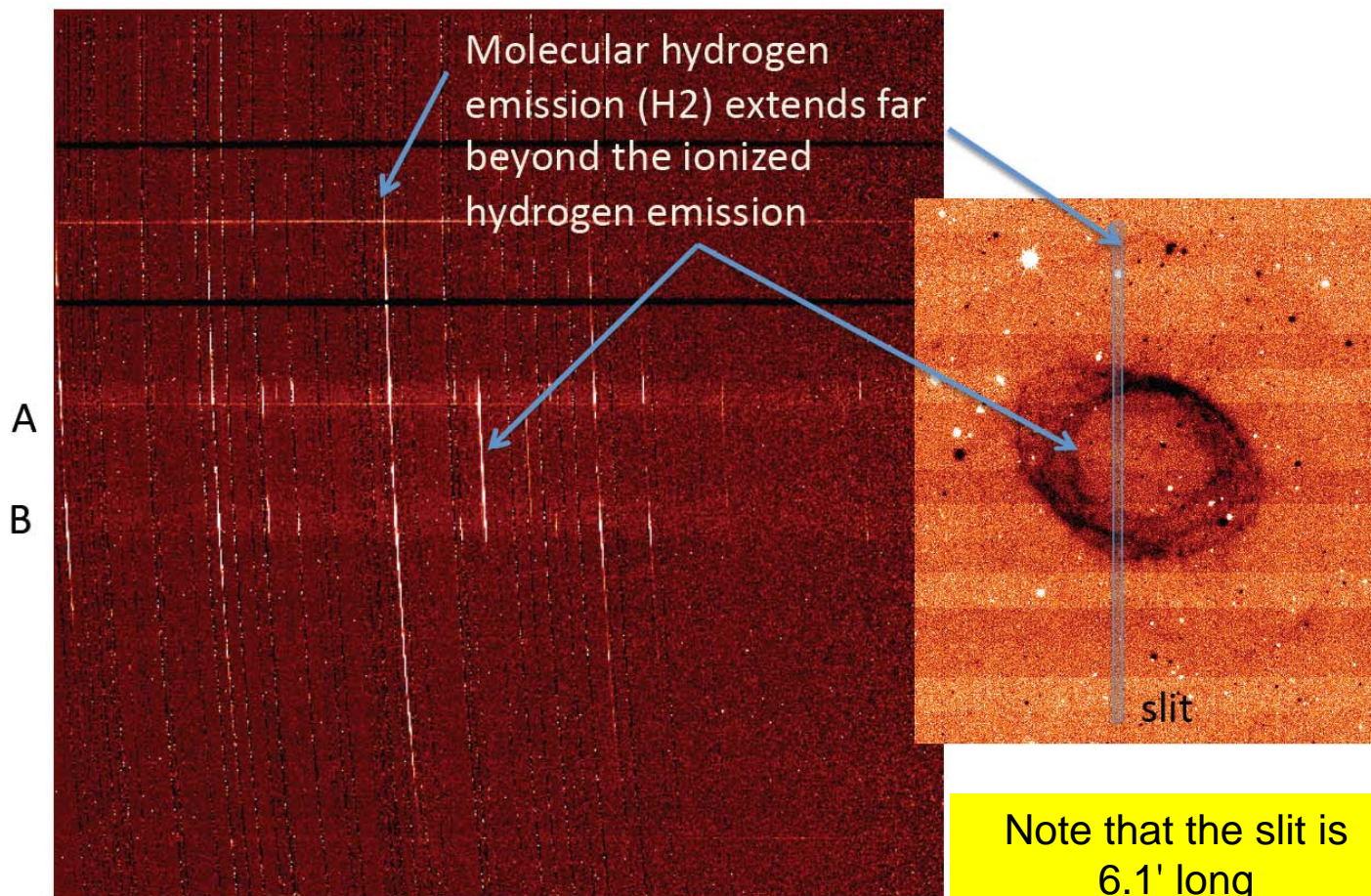
M82: Sky-subtracted K-band spectrum



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M57 (“Ring Nebula”): long slit spectra (difference of two nodedded frames)

The MOSFIRE slit was vertical and cut through the ring nebula at these two points.



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Tests Postponed until next run

- **Throughput tests in all modes (imaging and spectroscopy)**
 - Need clear weather!
- **Tests for differential flexure between guider and MOSFIRE field**
 - Need at least some consistency in the transparency so that guide stars are not lost



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Punch List

- **Relatively short**

- CSU electronics don't work well cold; start working for $T_{\text{cab}} > 14\text{ }^{\circ}\text{C}$
 - discussing with CSEM, may need to add temperature regulation to electronics cabinet cooling system
- Electronics cabinet doors/cover modified successfully to eliminate interference with telescope yoke, but clearance is tighter than ICD
 - evaluate clearance in the case of a seismic event
- Rotator encoder index is noisy, but rotator worked very well
- Identified a few software improvements for better operator efficiency and error protection
- All tasks, even minor ones, captured on Twiki



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Stay Tuned!

- **8 more commissioning nights**
 - May 4, 5, & 6
 - June 1, 2, & 3
 - June 26 & 27
- **Planning to offer MOSFIRE for shared risk observing in 2012B**



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The Happy MOSFIRE Commissioning Team on April 5 2012



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