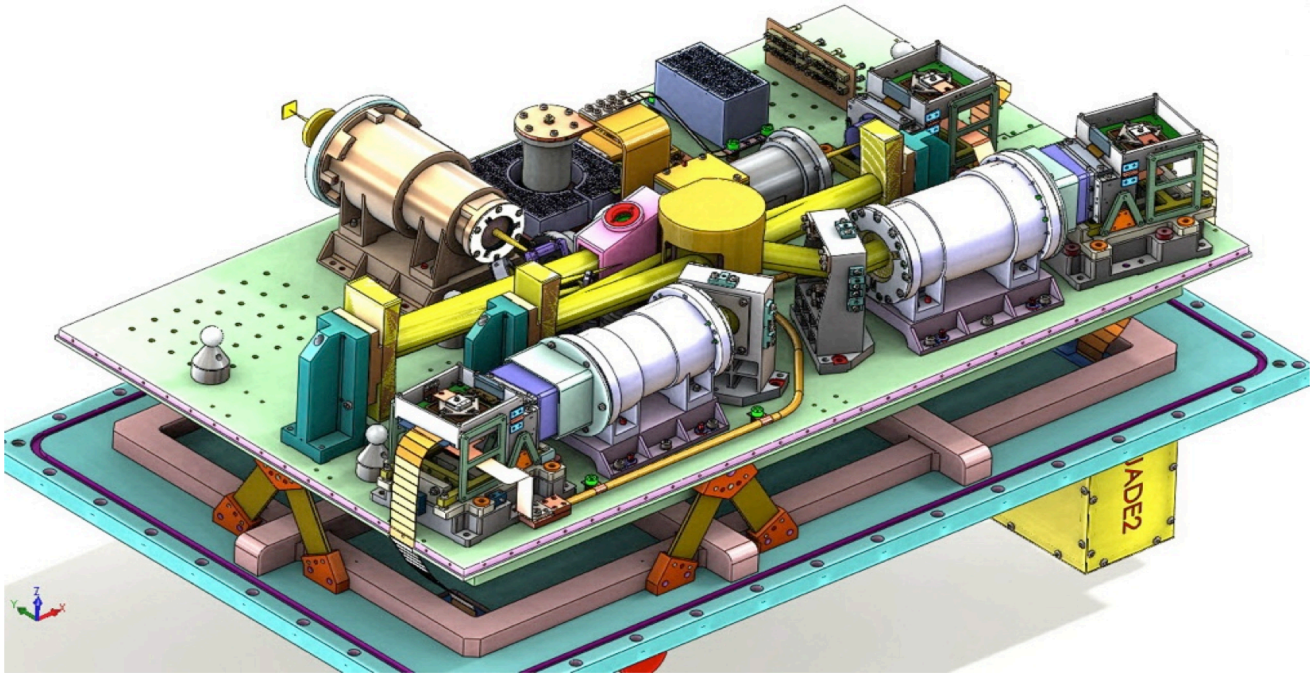
The First IGRINS Visit to Gemini



Hwihyun Kim (Gemini Observatory)

January 8, 2019

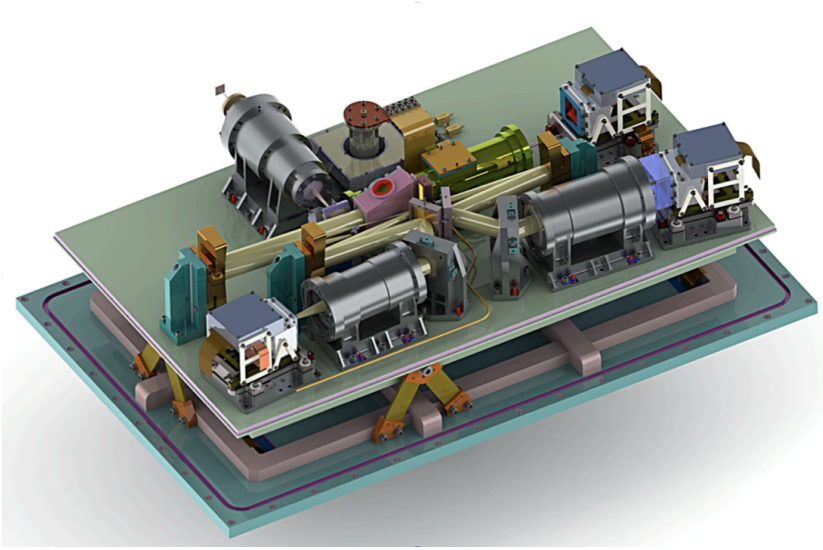
The 233rd AAS meeting in Seattle, WA

NOAO US NGO Mini-Workshop:
The Resurgence of High-Resolution Spectroscopy at Gemini

IGRINS

Immersion Grating Infrared Spectrometer

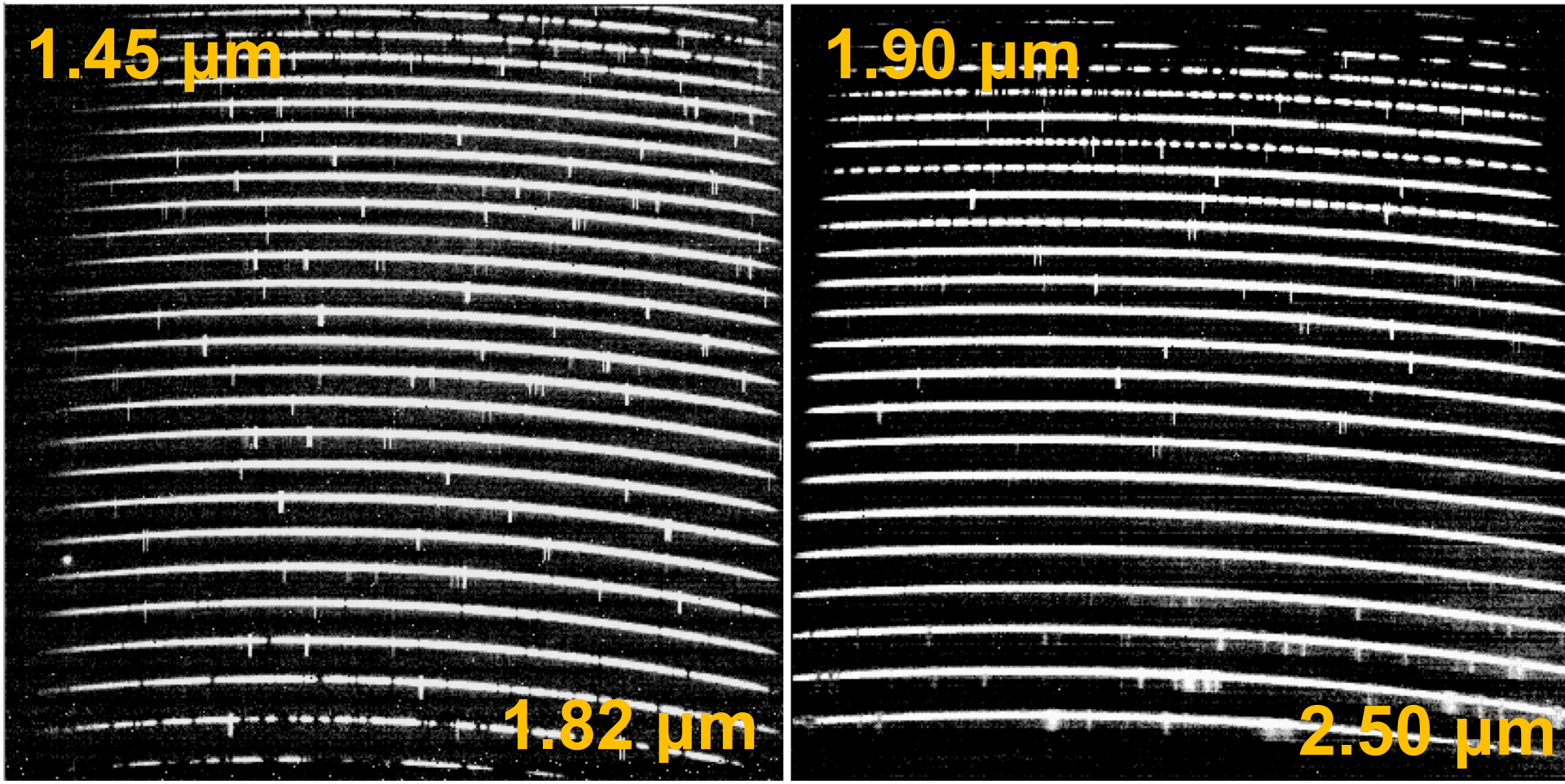
- High resolution: R (λ/Δλ) ~45,000
- Simultaneous H and K exposures
  - 1.45 - 2.50μm
- Stable and simple to use
  - No moving parts in the cryostat
  - Point and shoot
  - Same setup for different telescopes
- High sensitivity
  - Competitive S/N per unit time



Korea Astronomy and Space Science Institute

McDonald Observatory
The University of Texas at Austin

Raw data – A0V star



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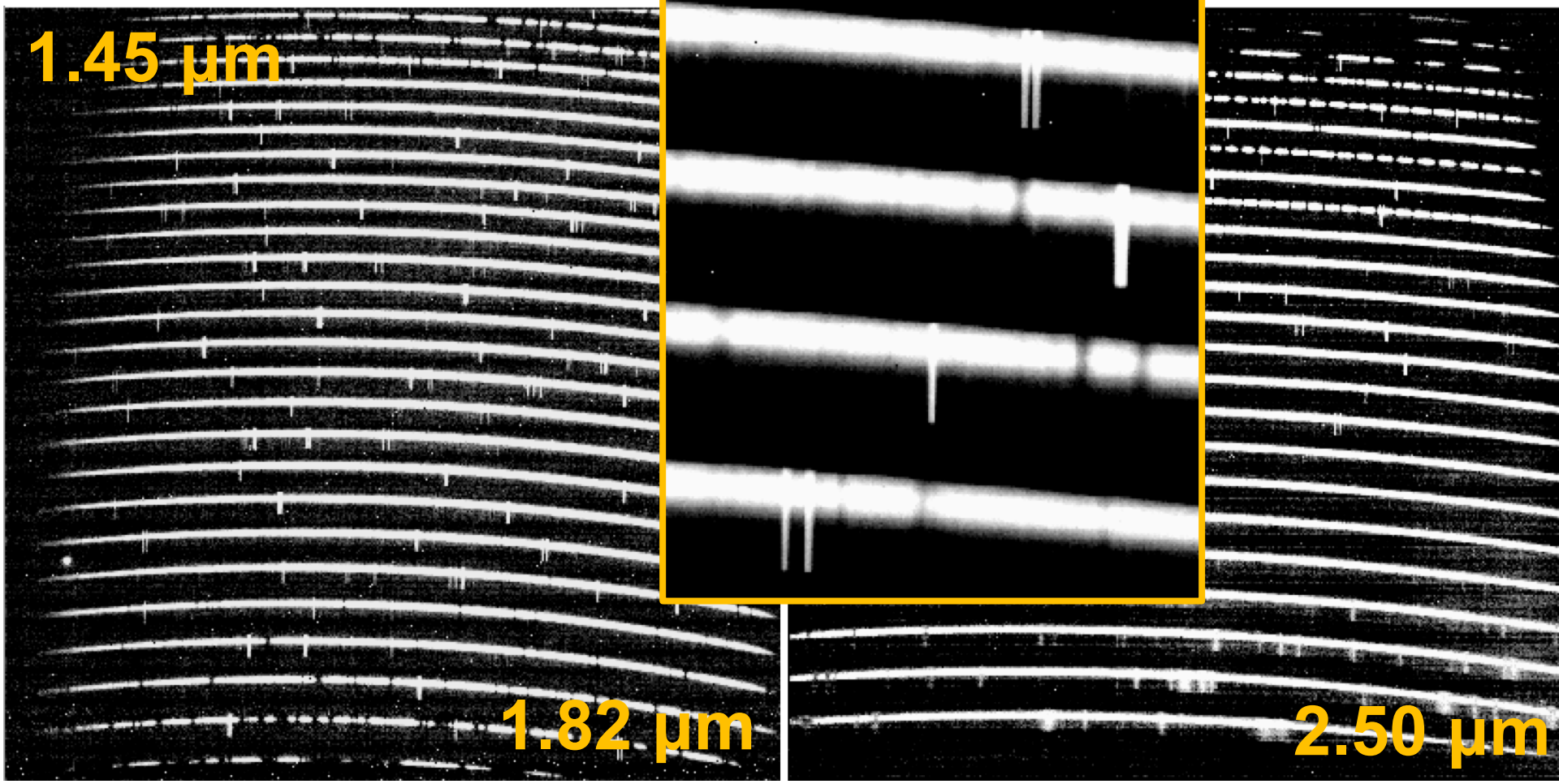
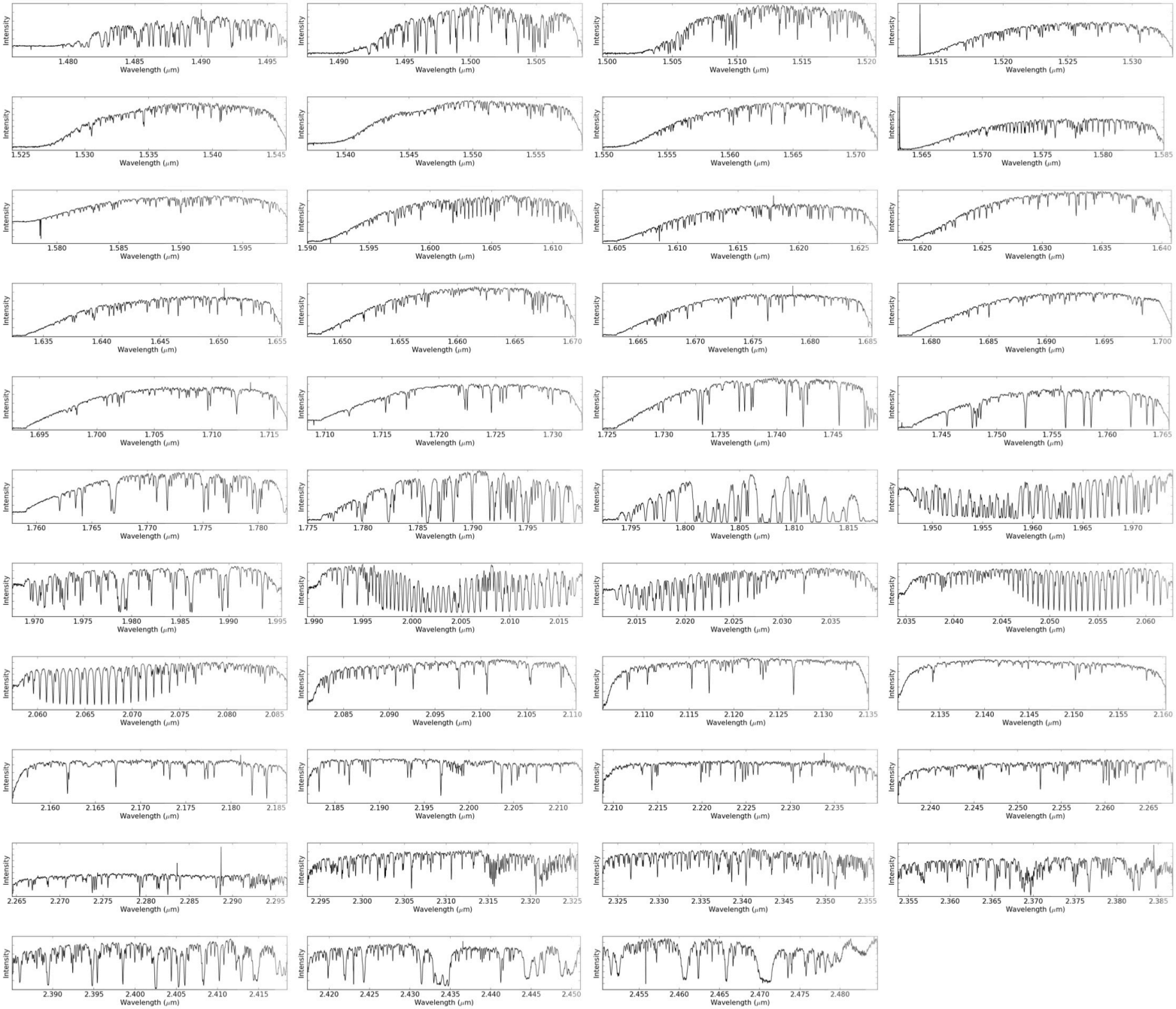
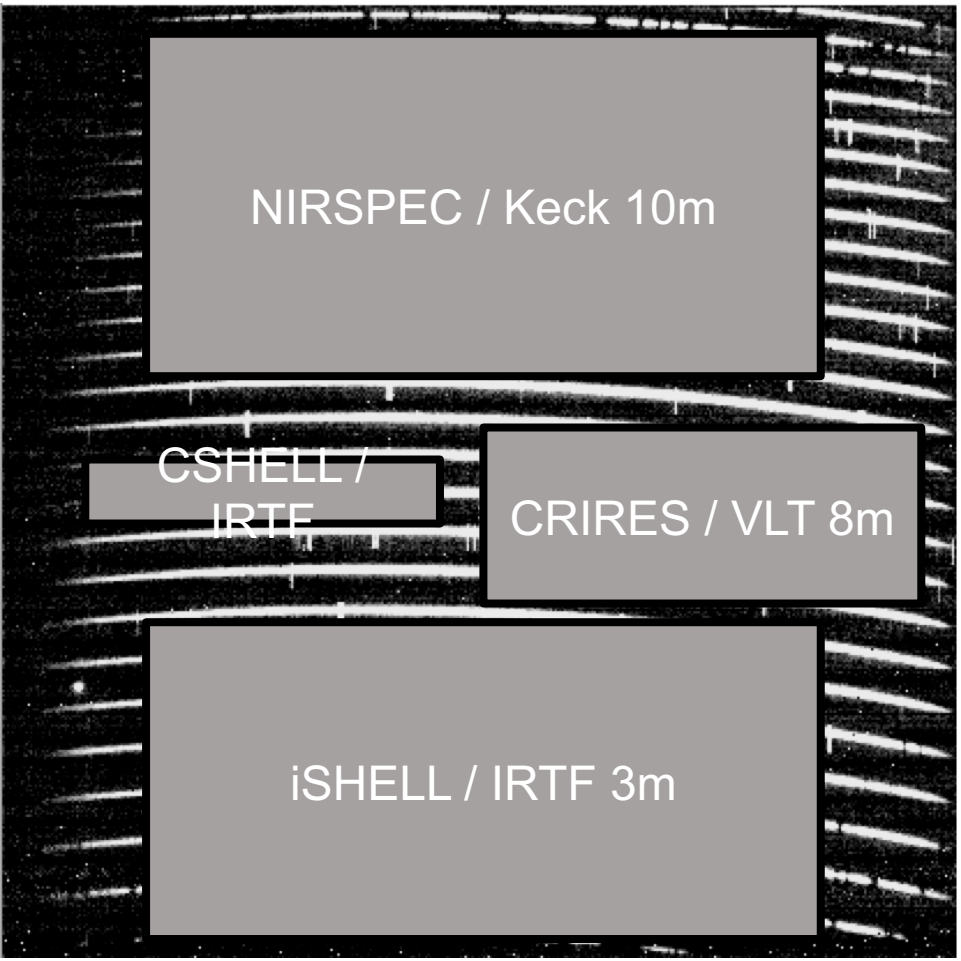


IGRINS total coverage: 43 orders – all of 1.45-2.50 microns

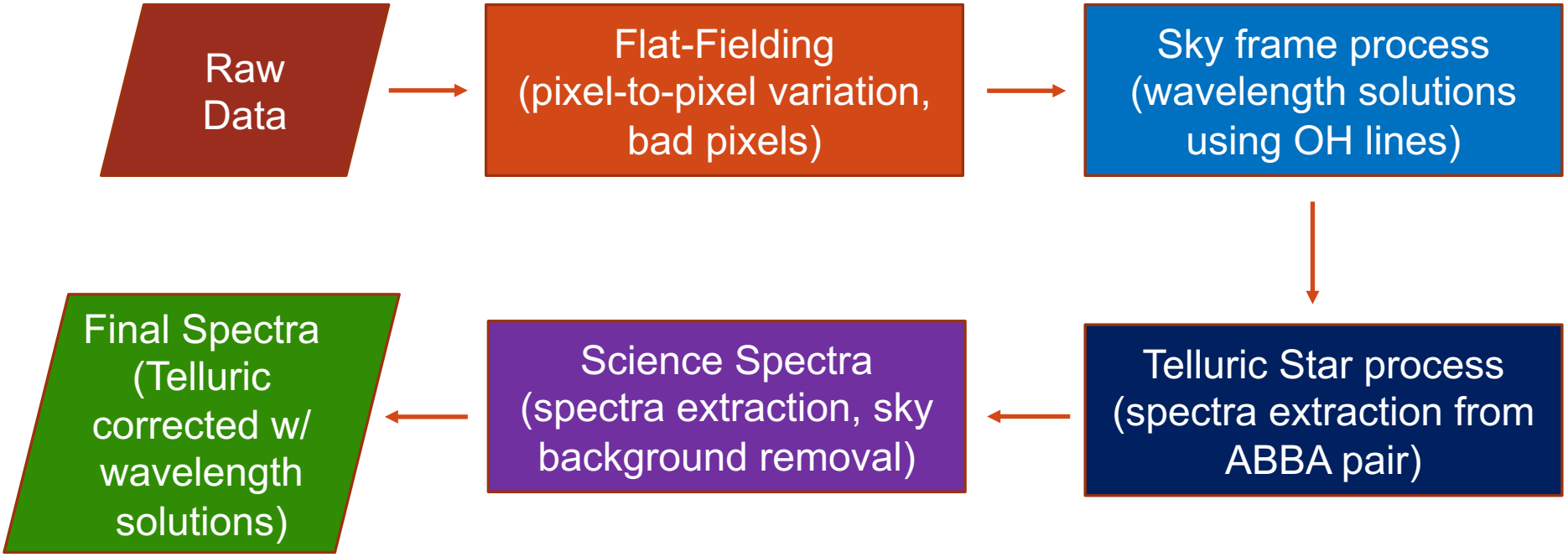


Wavelength coverage:
Comparison to other high resolution spectrographs



IGRINS Pipeline v2.2

- Available to download from **https://github.com/igrins/plp**

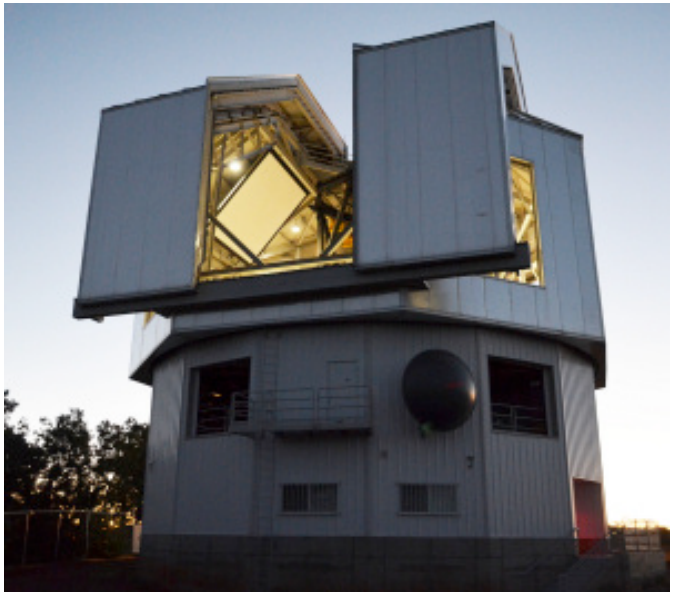


IGRINS is traveling!!

Since Spring 2014: McDonald 2.7m

http://www.as.utexas.edu/mcdonald/facilities/2.7m/2.7.html

Fall 2016 – Spring 2019: 4.3m DCT



https://lowell.edu/research/research-facilities/4-3-meter-dct/

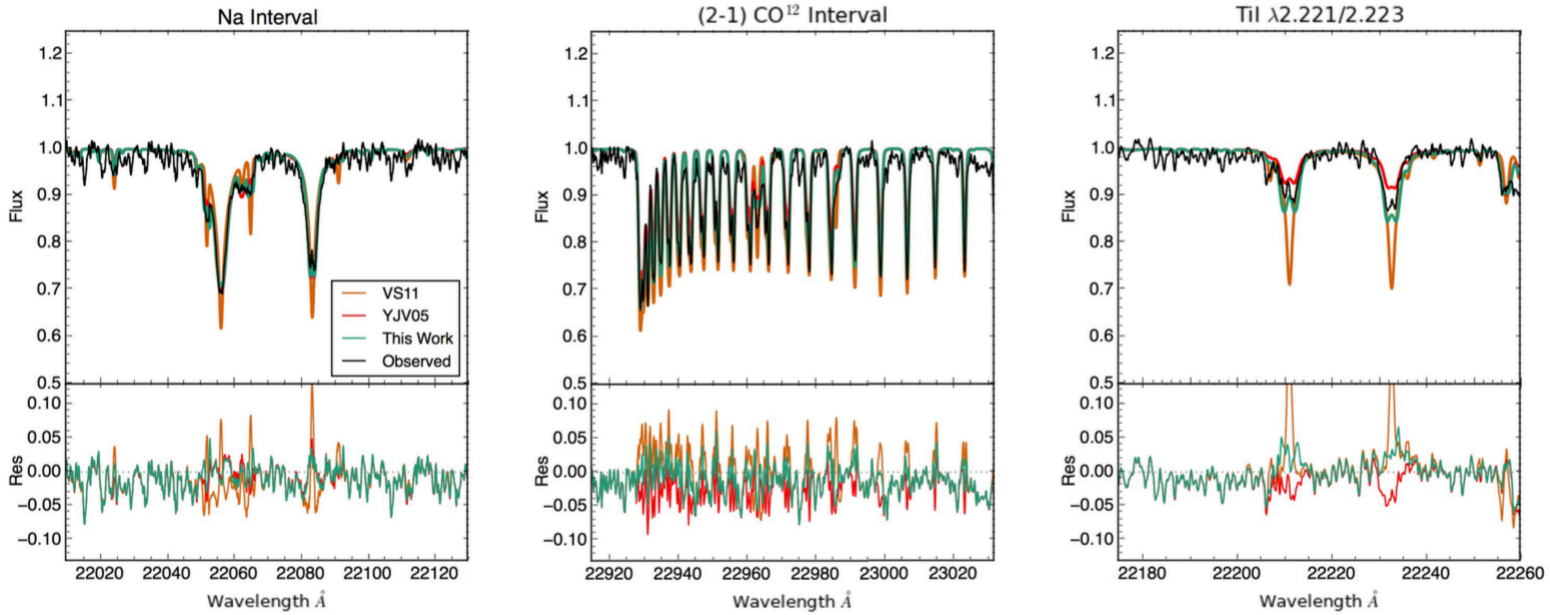
2018A: Gemini-South

	McDonald Obs.	Lowell DCT	Gemini South
Mirror Size	2.7-meter	4.3-meter	**8.1-meter**
f-ratio	f/8.8	f/6.1	**f/16**
FWHM in K-band	~1.0”	~0.8”	**~0.6”**
Slit size (Width x Length)	1”x15”	0.63”x9.3”	**0.34”x5”**
Limiting Magnitude in K-band[1]	11.10	11.15	**11.85**

[1] 1hr exposure, SNR=100, airmass < 2, typical seeing

TW Hydra at McDonald

4 epoch observations between Jan 2015 and Mar 2017
S/N ~ 50-60 in the final ”combined” spectra (total ~5,280sec)



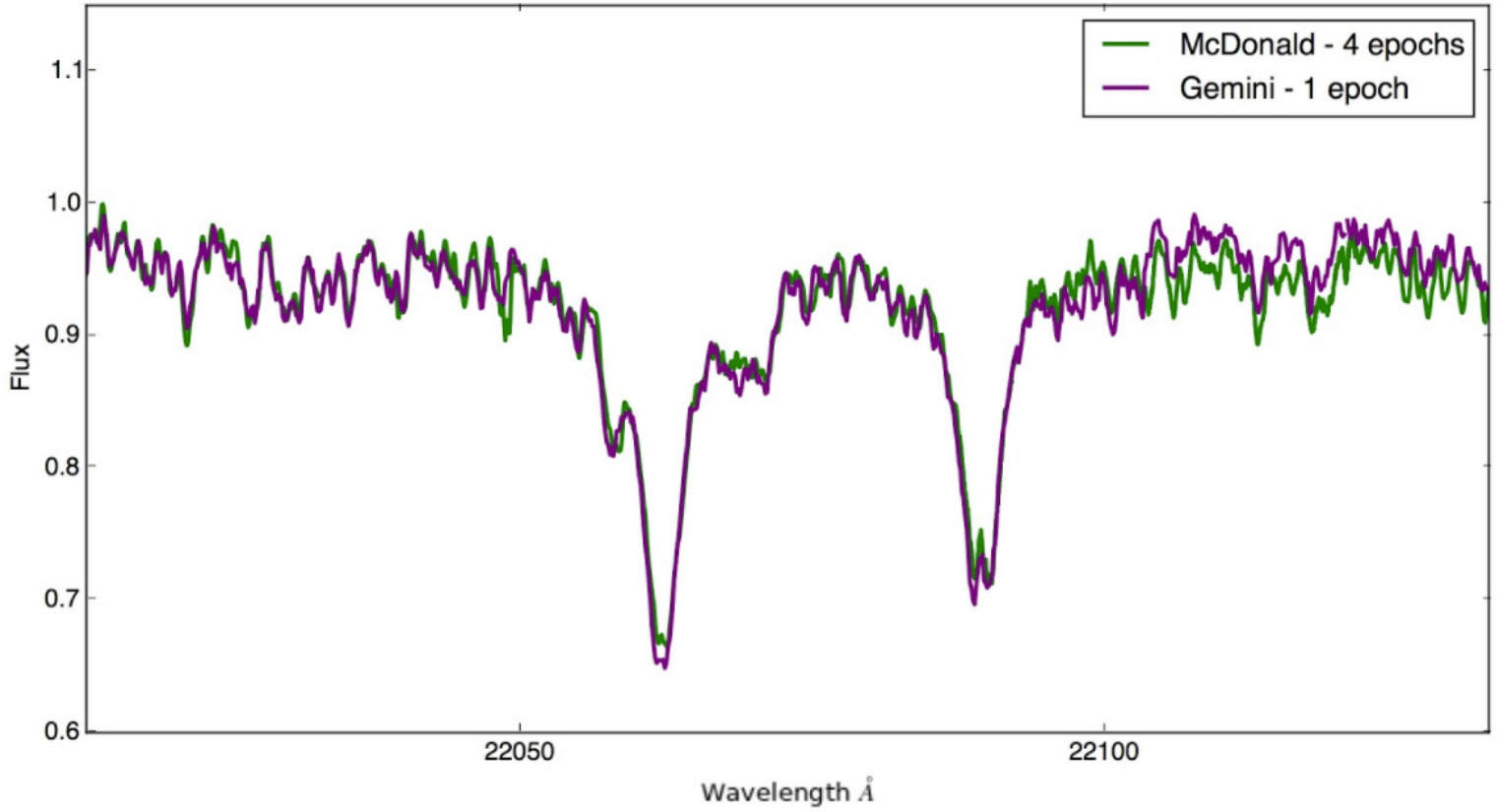
T_{eff} = 3800 K, log g = 4.2 dex, and B= 3.0 kG

Sokal et al. (2018)

Spectral type of M0.5 and an age of 8 Myr

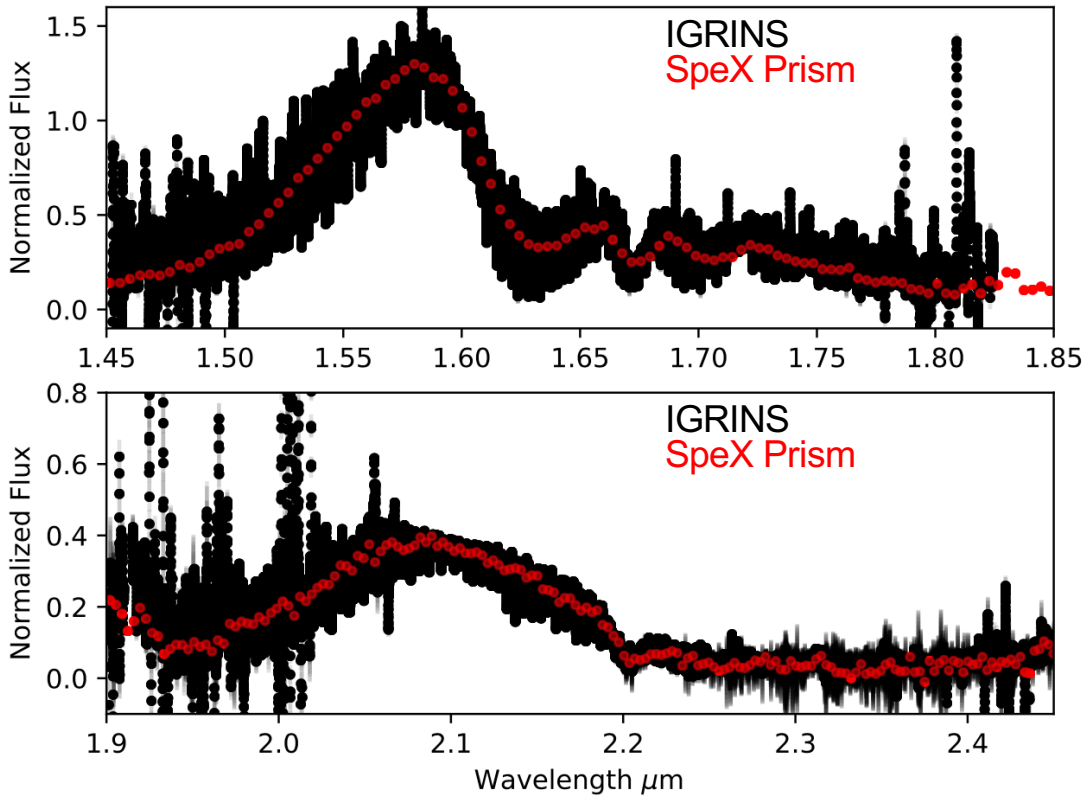
TW Hydra at Gemini

Total 240sec -> S/N ~ 200 at Gemini-South (Airmass = 1.07)



T6 brown dwarf at Gemini

- PI: Megan Tannock (UWO)
- K=13.5 mag
- 80 minutes
- SNR=60-80



SpeX Prism Library; Burgasser et al. (2006) ApJ, 639, 1095

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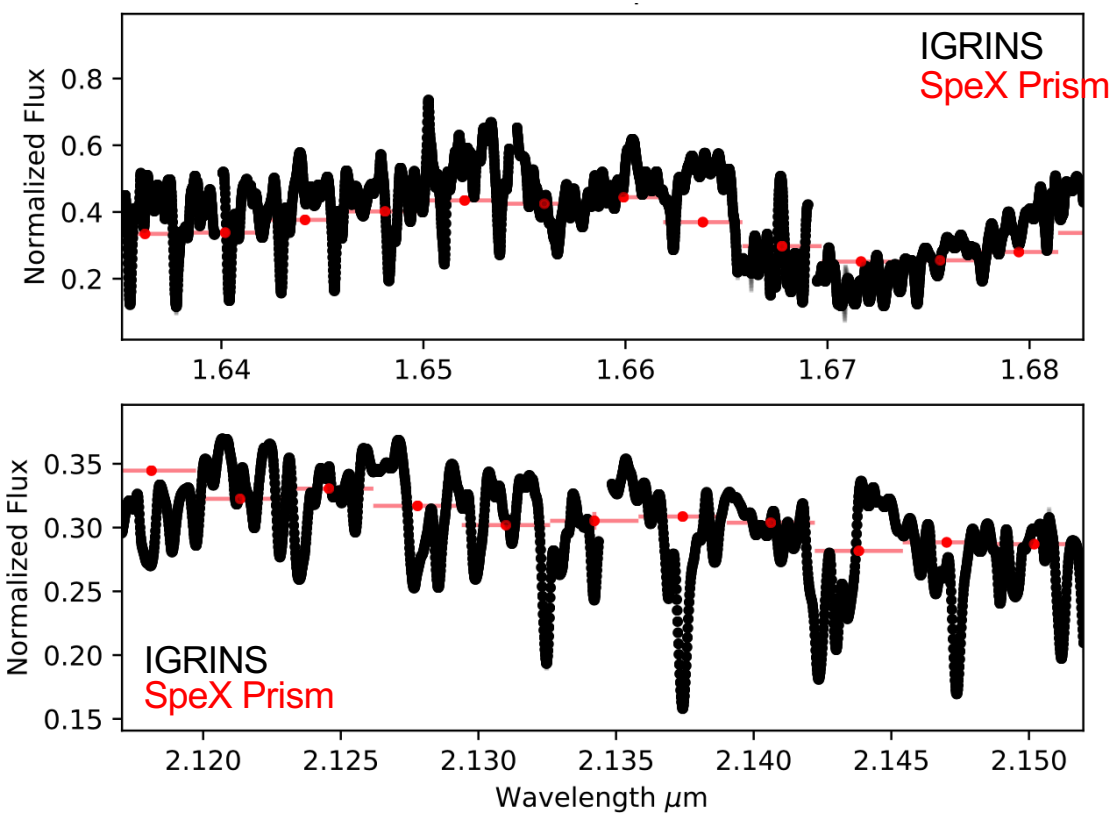


SpeX Prism Library; Burgasser et al. (2006) ApJ, 639, 1095

IGRINS@Gemini observed various targets

- Many of Young Stellar Object systems
  - Characterization, variability studies, …
- Spectroscopic binary characterization (mass ratios, orbits)
- Symbiotic stars
- Galactic chemical evolution
- Brown dwarf evolution
- Exoplanets and their hosts
- Late stellar evolution (CNO abundances, $^{12}C/^{13}C$ ratios)
- ISM: Central Molecular Zone, several molecular clouds
- Multi-stellar populations in globular clusters

GLIMPSE-C01:
A massive intermediate-age globular cluster

Discovered by Kobulnicky+05 on Spitzer image → Av~15mag!!

Distance?

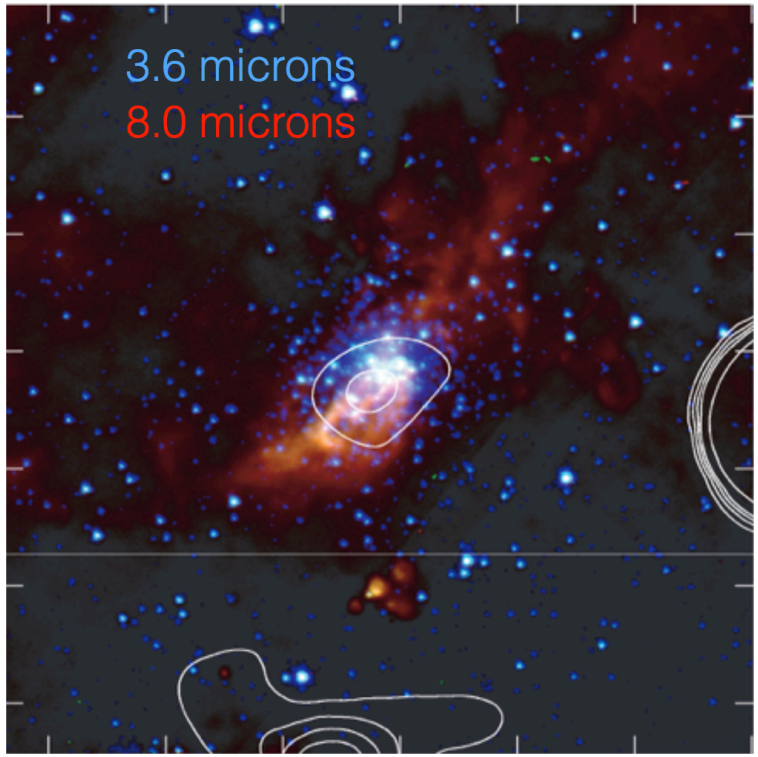
- 3.1 – 7.2 kpc (Kobulnicky+05): Spitzer
- 3.8 kpc (Ivanov+05): NTT/SOFI
- 5.2 kpc (Davies+11): VLT/Issac

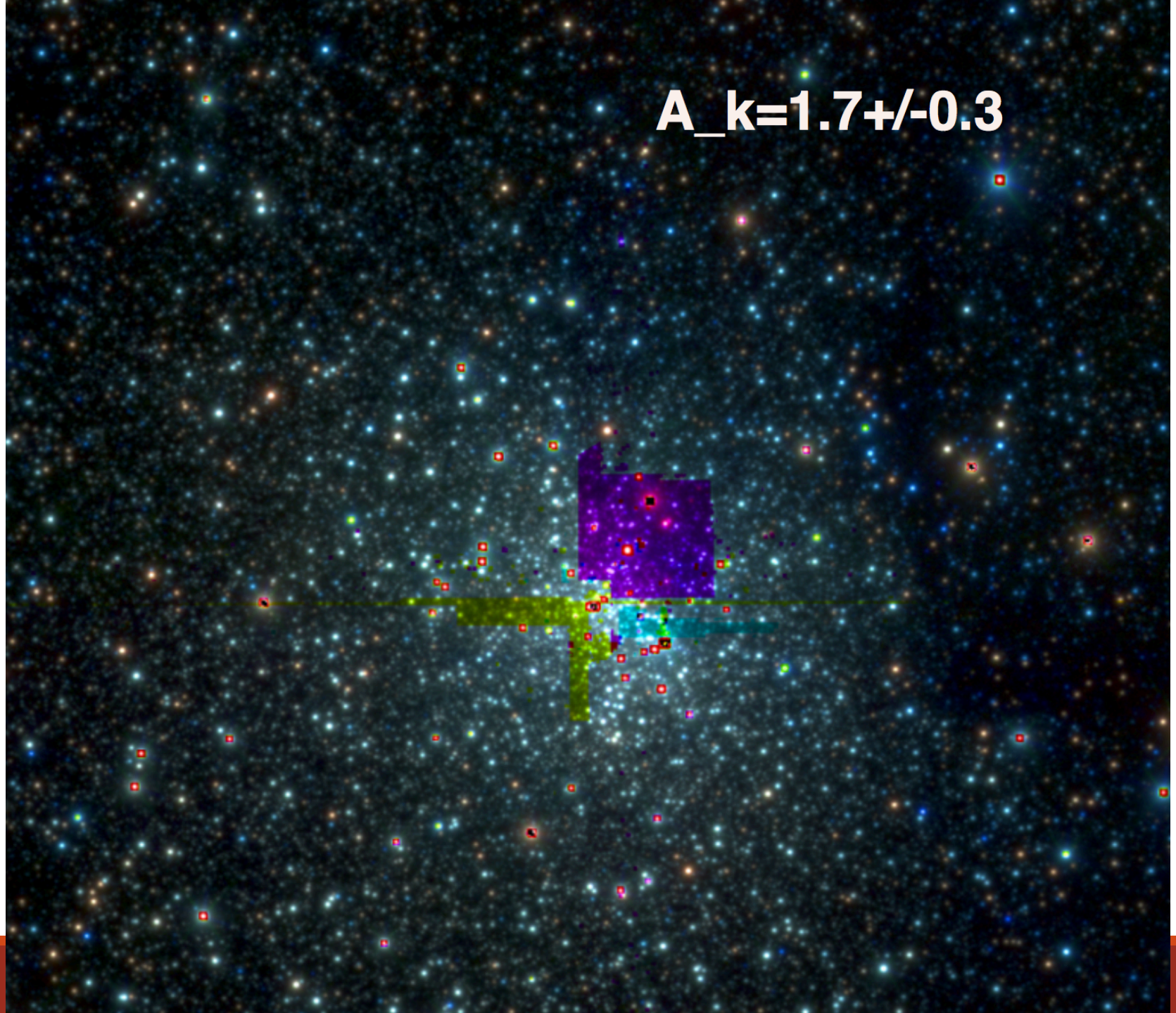
Age?

- Greater than 3 Gyr (Kobulnicky+05)
- Old (Ivanov+05)
- Between 400-800 Myr (Davies+11)
- > 1 Gyr (Davidge+16): Subaru/Raven

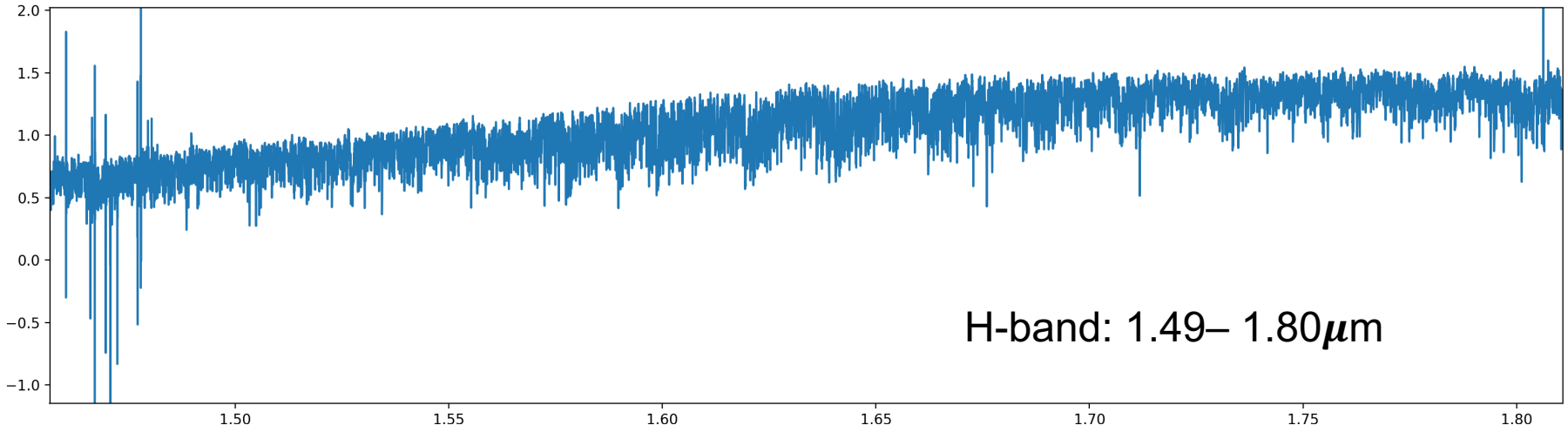
Metallicity?

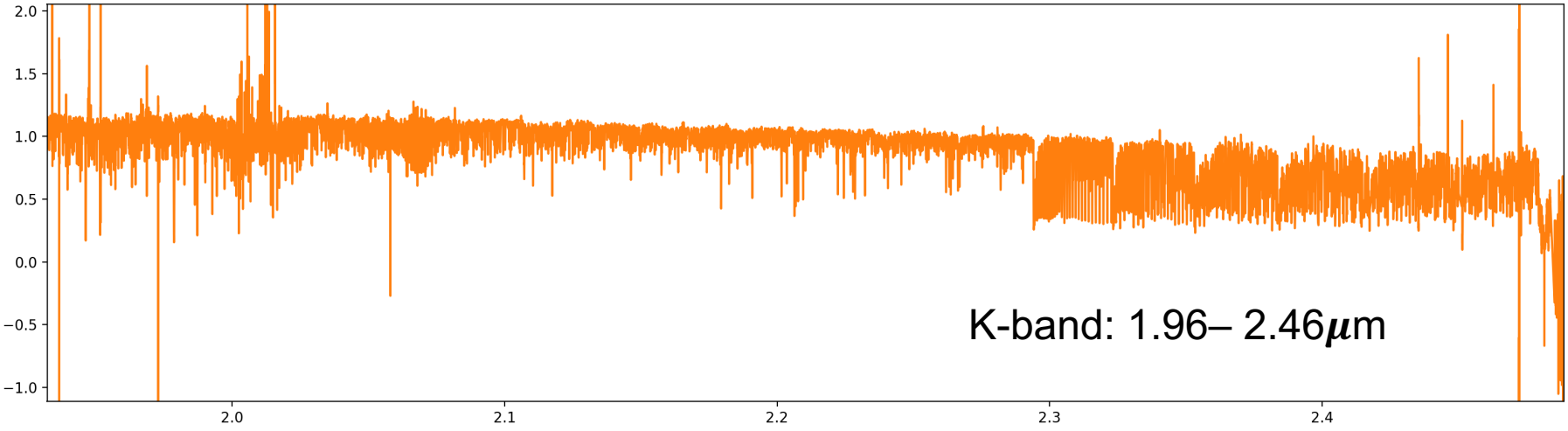
- [Fe/H] ~ -1.5 (Ivanov+05)




A_k=1.7+/-0.3

GLIMPSE-C01-1: K= 7.74mag, 200s, S/N=100-200





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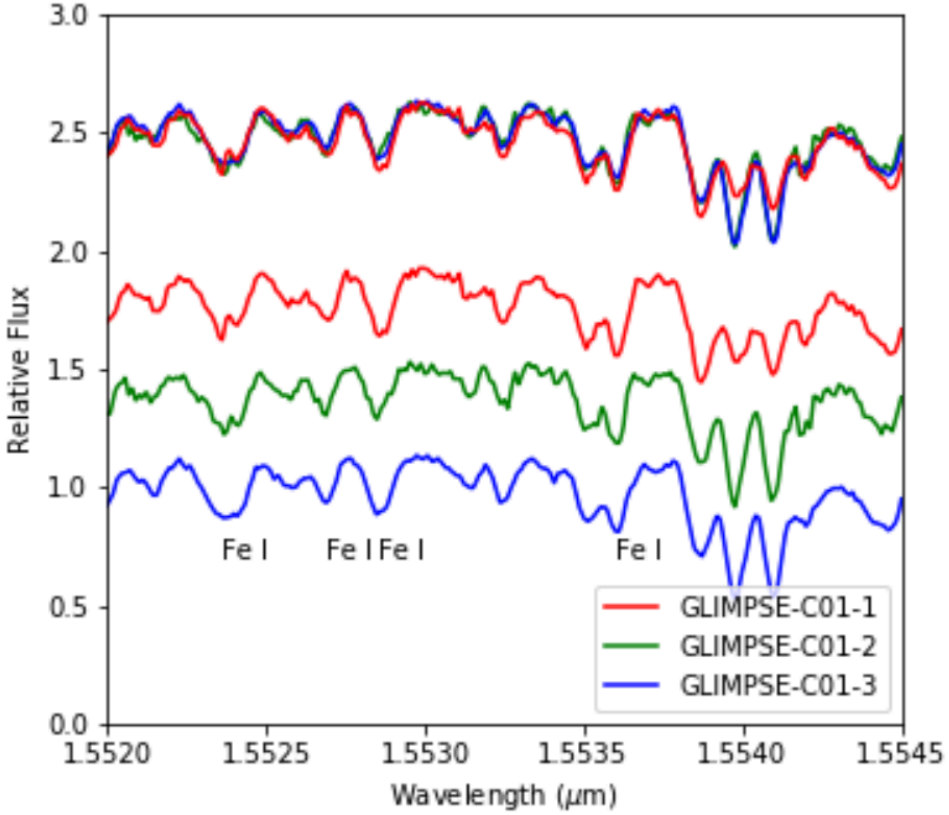
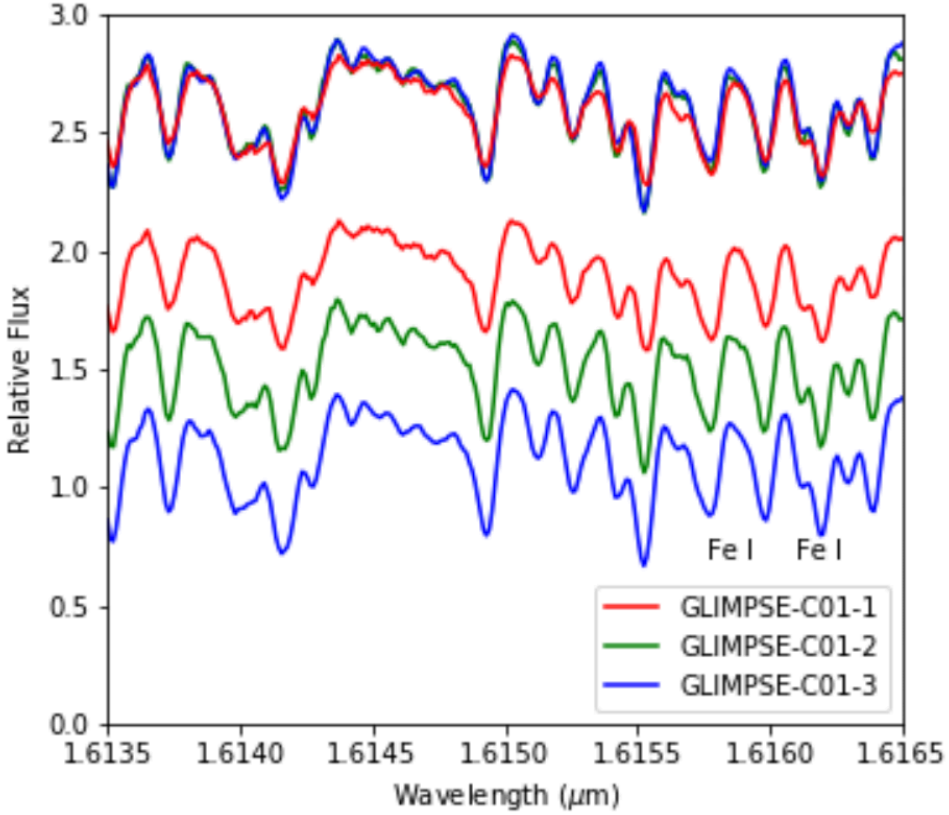
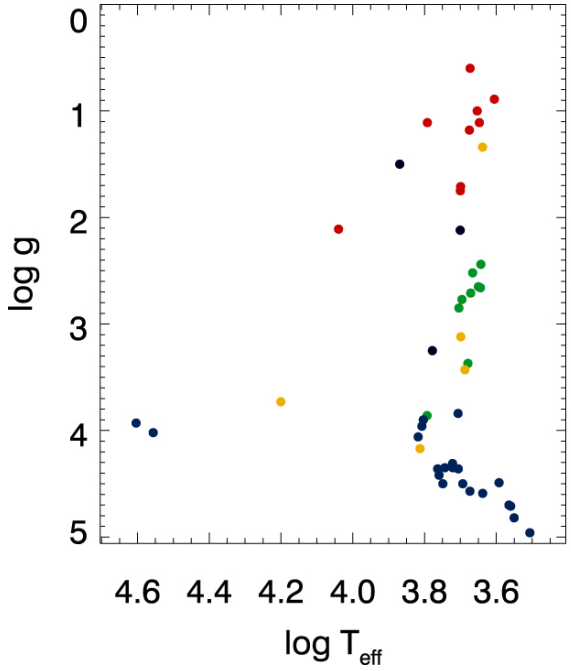
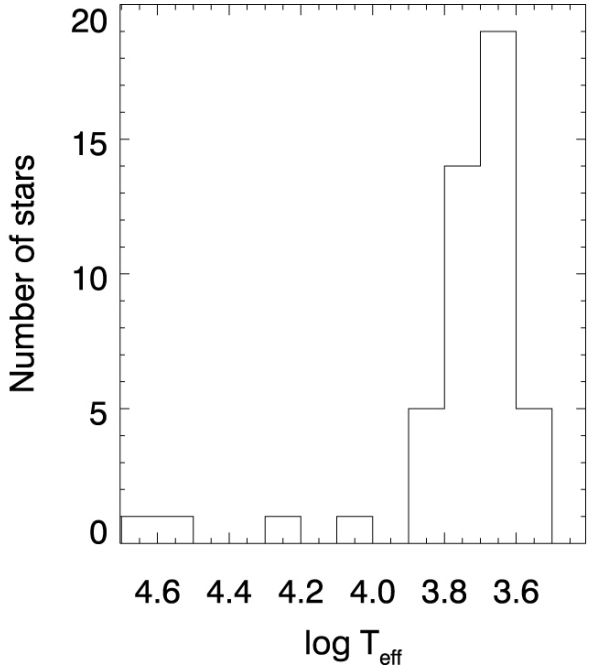
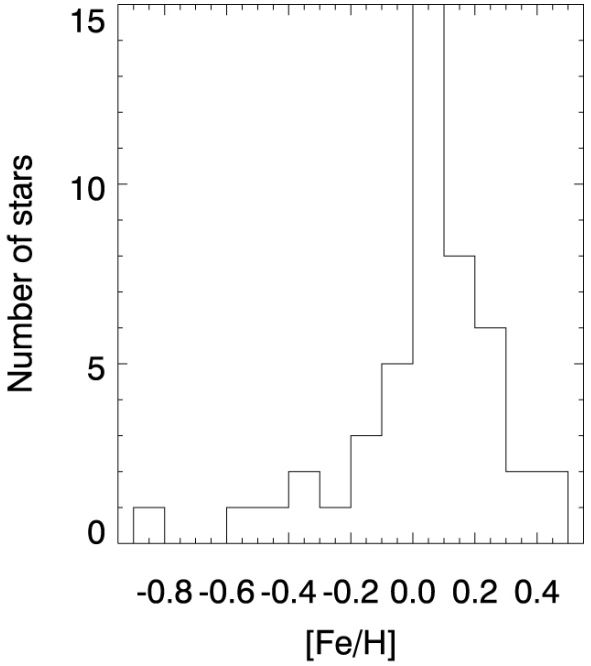


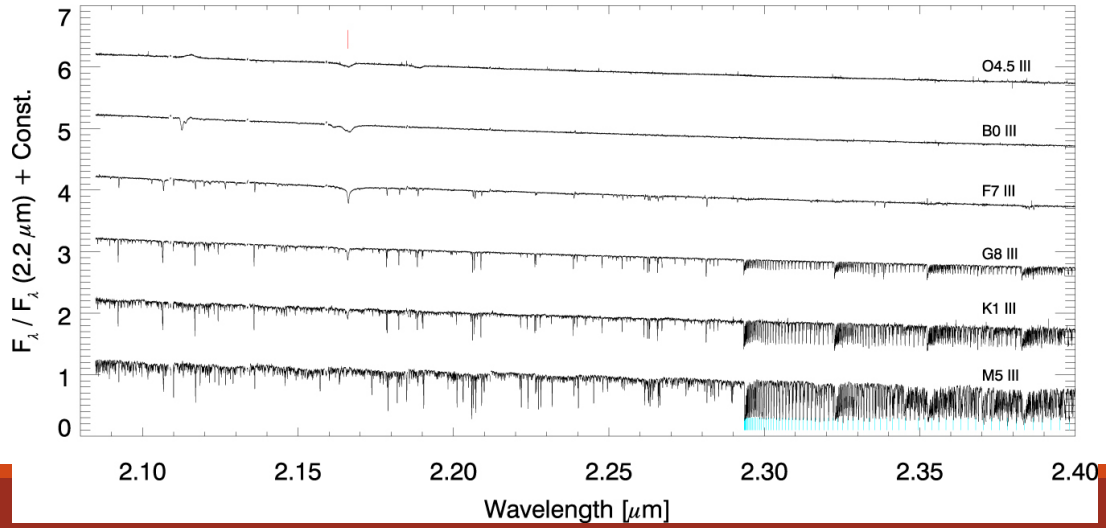


IGRINS spectral library - Park et al. 2018







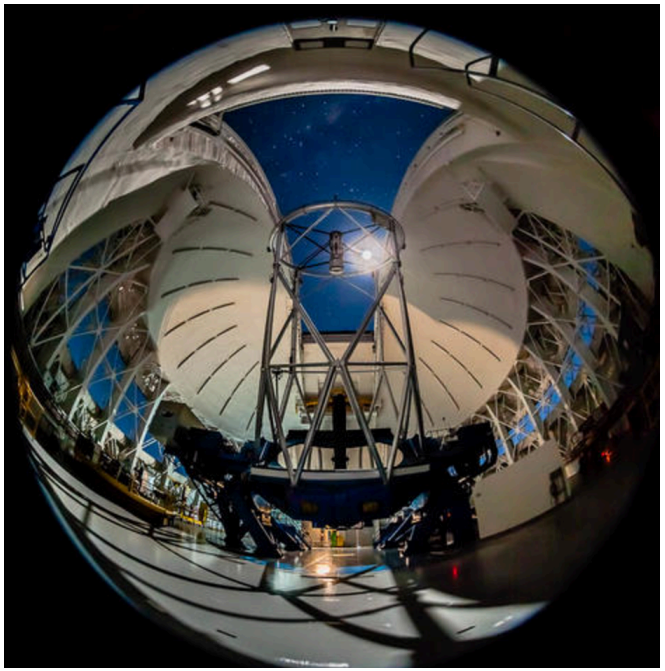


84 stars observed in S/N >200

- Flux calibrated
- Telluric absorption corrected
- Equivalent widths provided
- http://starformation.khu.ac.kr/IGRINS_spectral_library

Status of IGRINS

- Completed 3 observing runs at Gemini-South (50 nights) in 2018A
  - All data reduced and distributed to the PIs
- Currently being used at Lowell-DCT till April 2019
- The next visit to Gemini is undecided. Hopefully coming back in 2020A.
- IGRINS-2 (name TBD) for Gemini is being planned at KASI.



GEMINI OBSERVATORY

Thank you!
¡Gracias!
Obrigada!
고맙습니다!

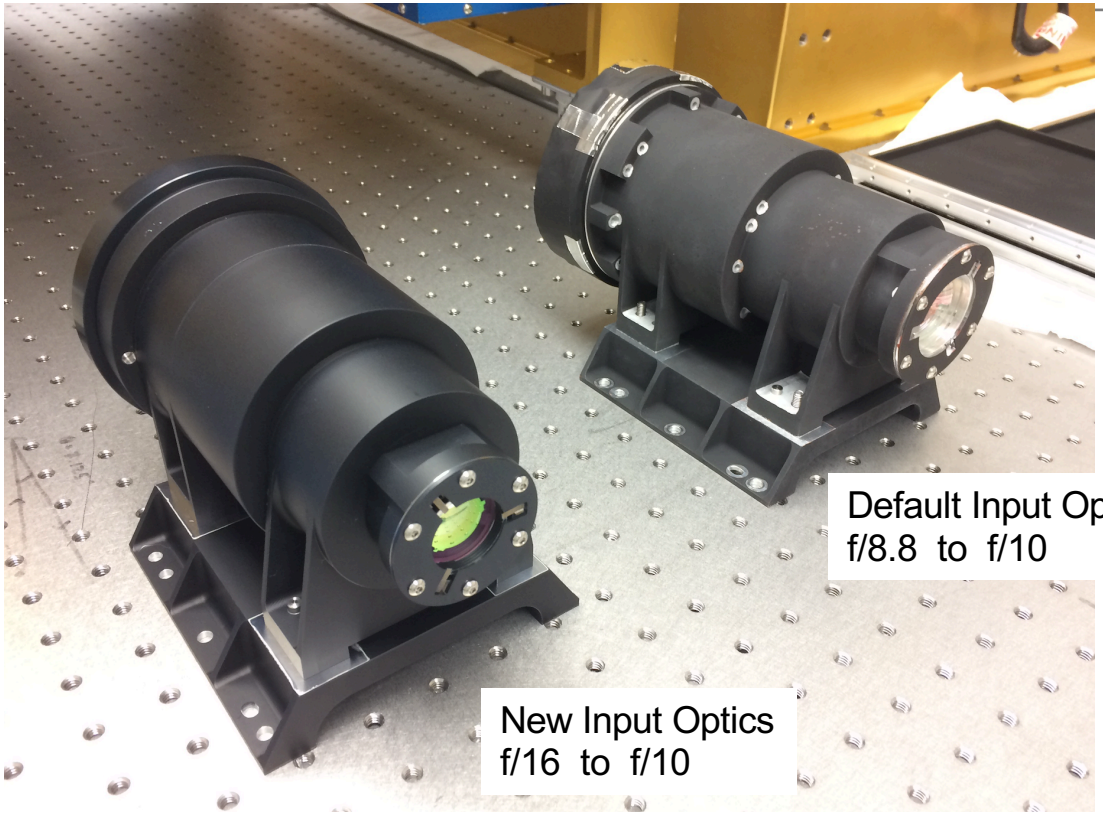
QUESTIONS?

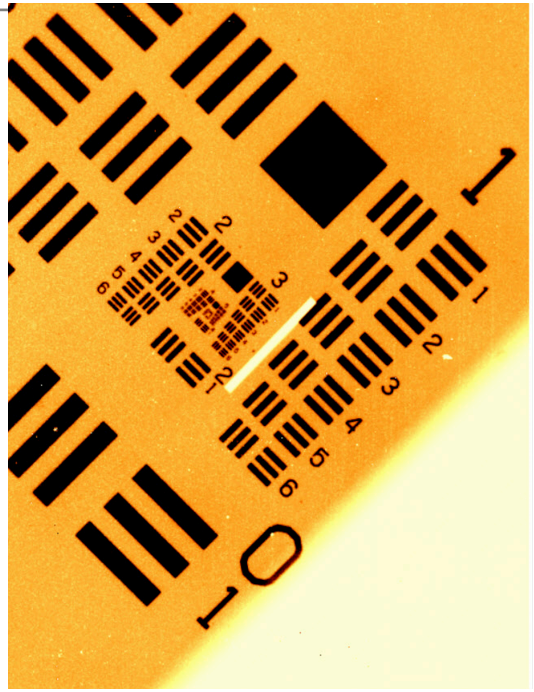
¿PREGUNTAS?

QUESTÕES?

질문?

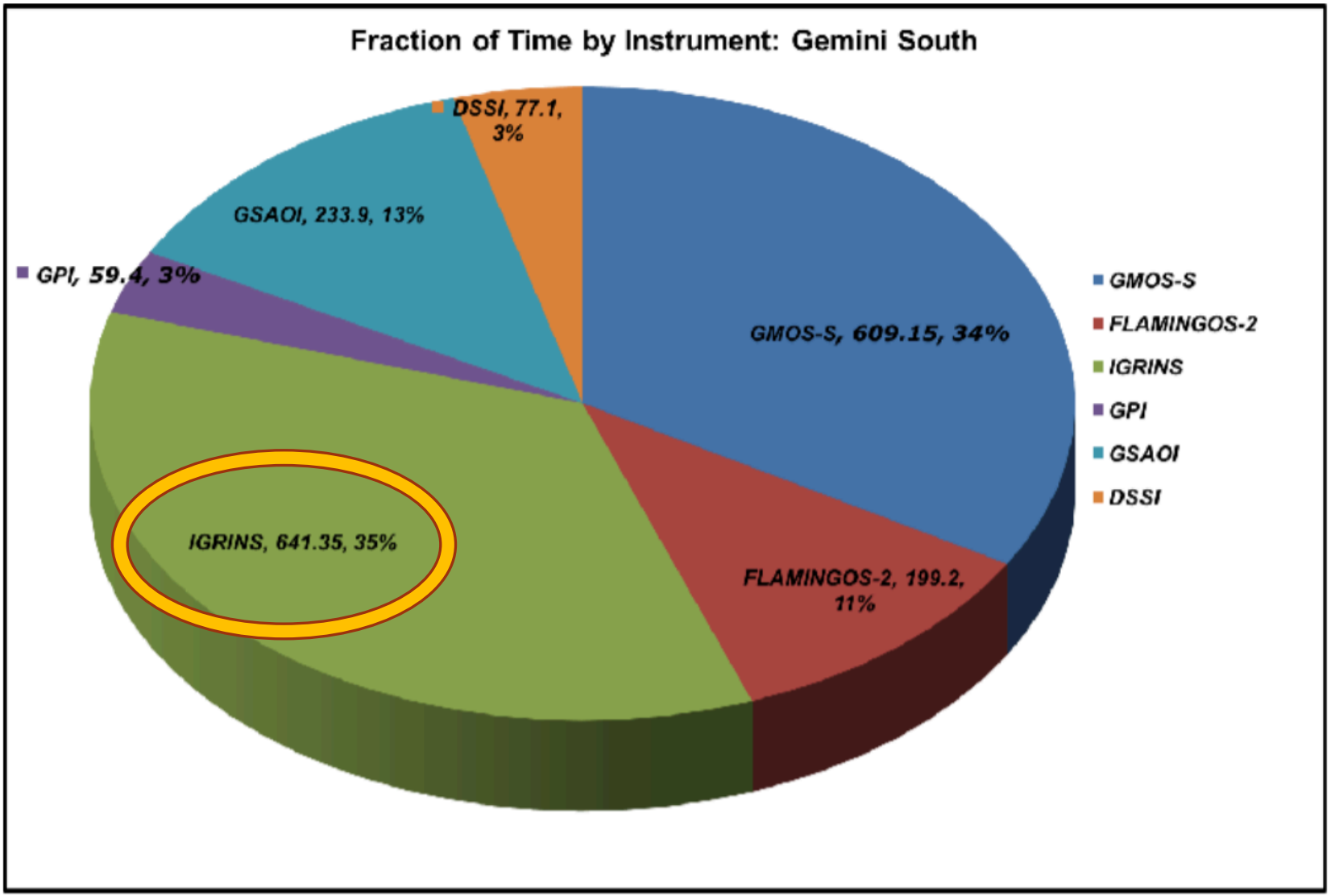
Preparing IGRINS for Gemini South





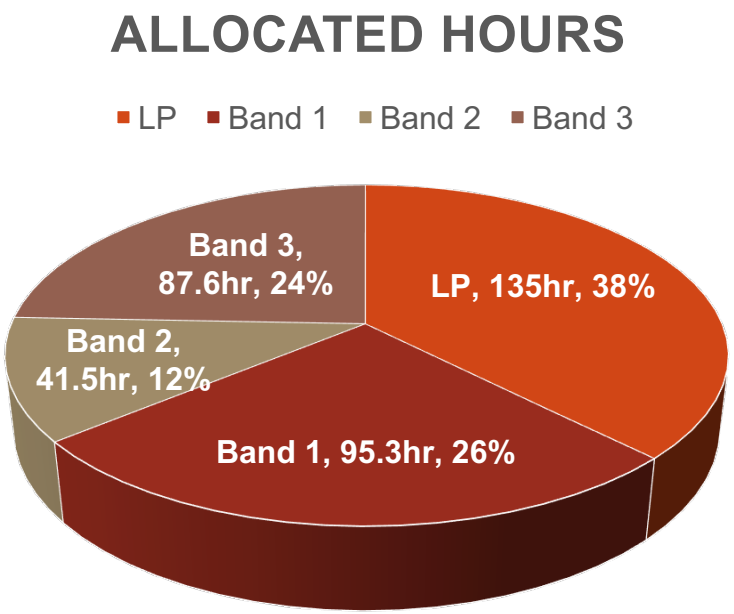
Pixel Limited Angular Resolution

Gemini 2018A time request



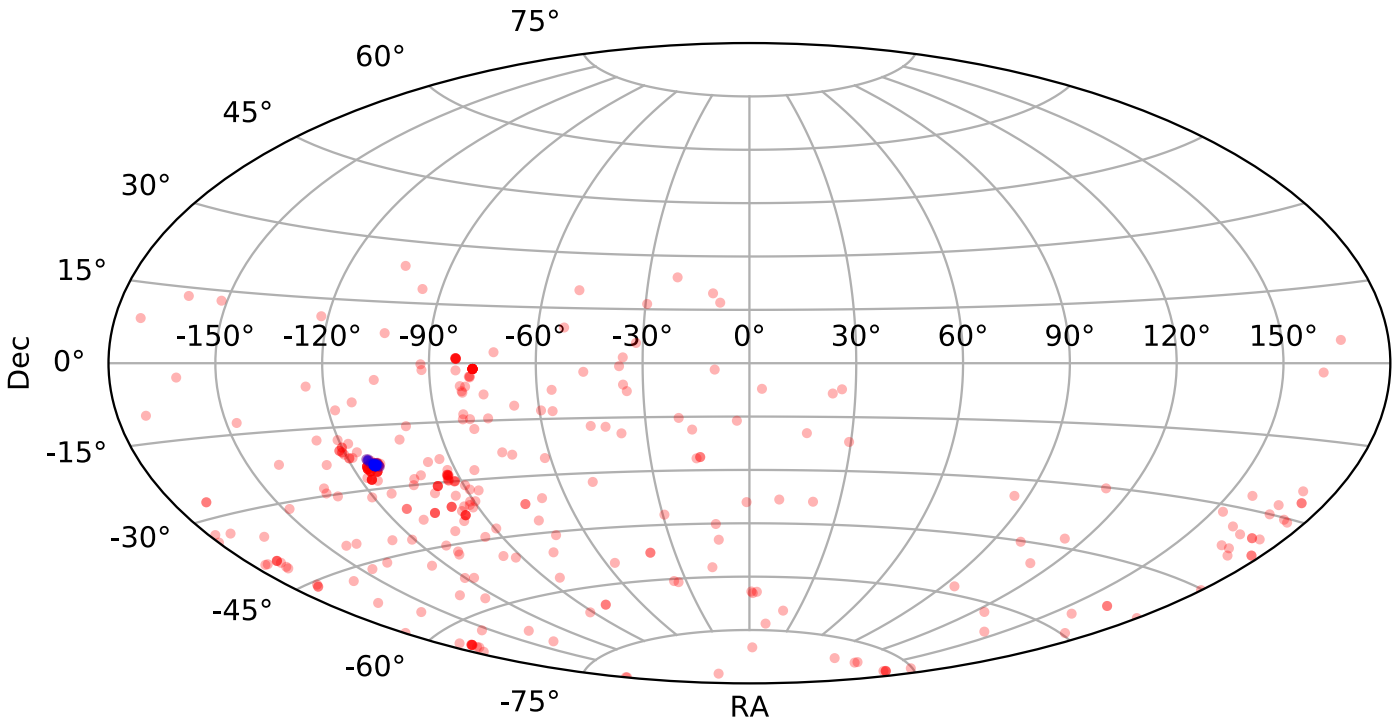
2018A IGRINS programs

- Total 21 programs approved (Total of 359.4 hrs)
  - 1 LP and 20 Queue programs
  - 7 Band 4 programs to fill up the gaps in the queue



IGRINS Targets

- Red circles: all targets (total 449; Band 4 targets included)
- Blue dots: 98 targets in LP-17



2018A IGRINS programs

- Total 21 programs approved
  - 1 LP, 20 regular queue programs
  - 7 Band 4 programs to fill up the gaps in the queue
- 14 (+ 3 B4) programs are complete!!
  - 76% completion of Band 1 programs (LP not included)
  - Followed by 88% of B2, 92.5% of B3