

TripleSpec

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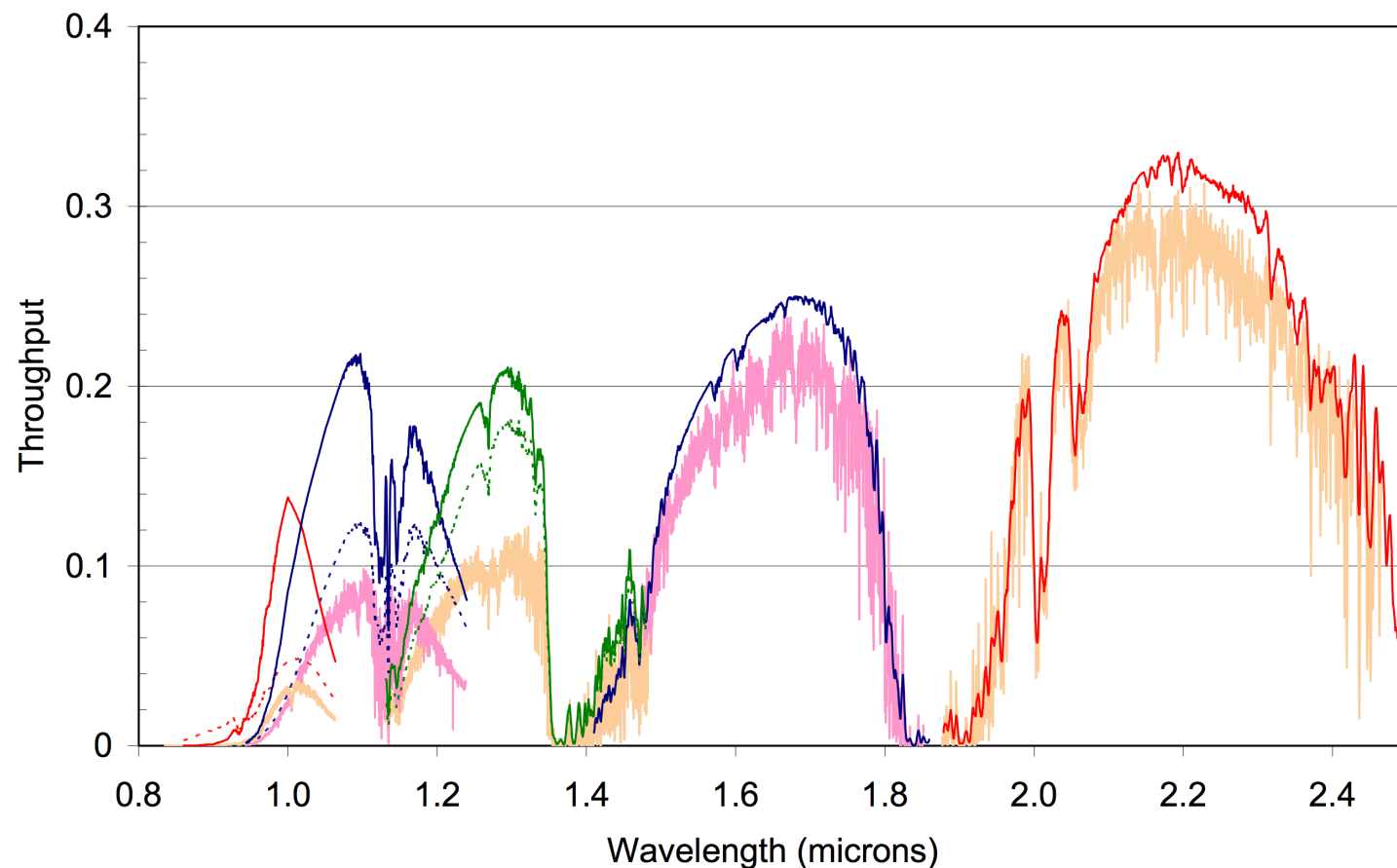
mamajek@jpl.nasa.gov, federico.marocco@jpl.nasa.gov

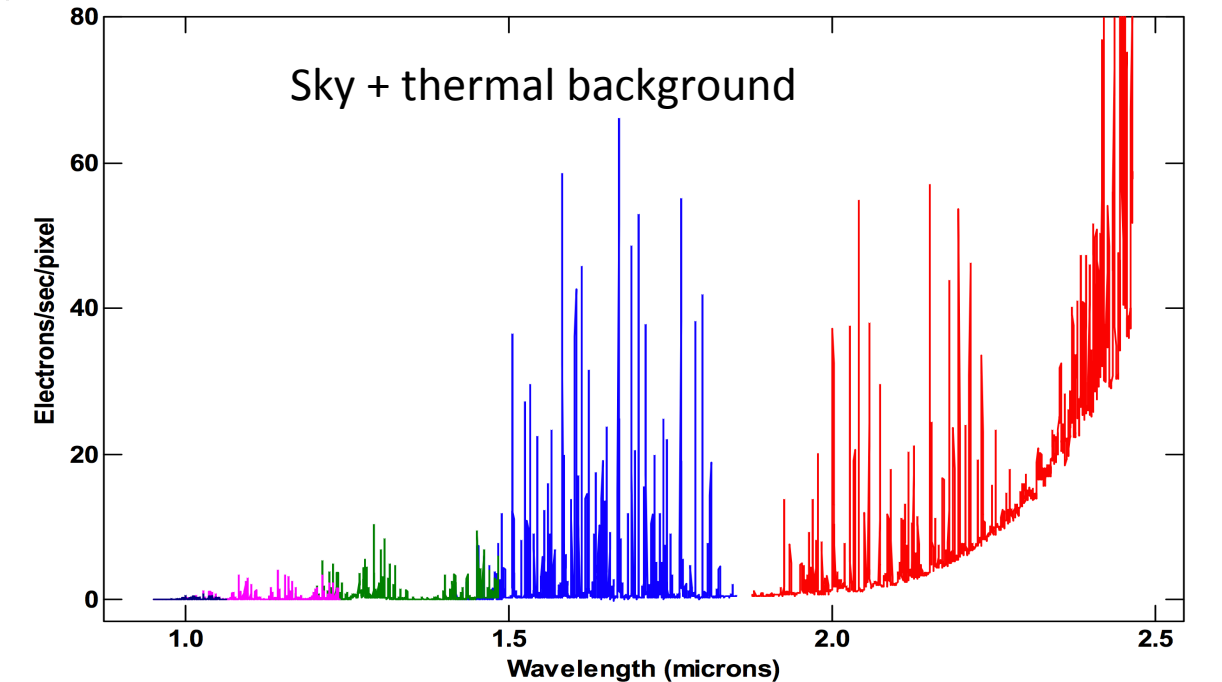
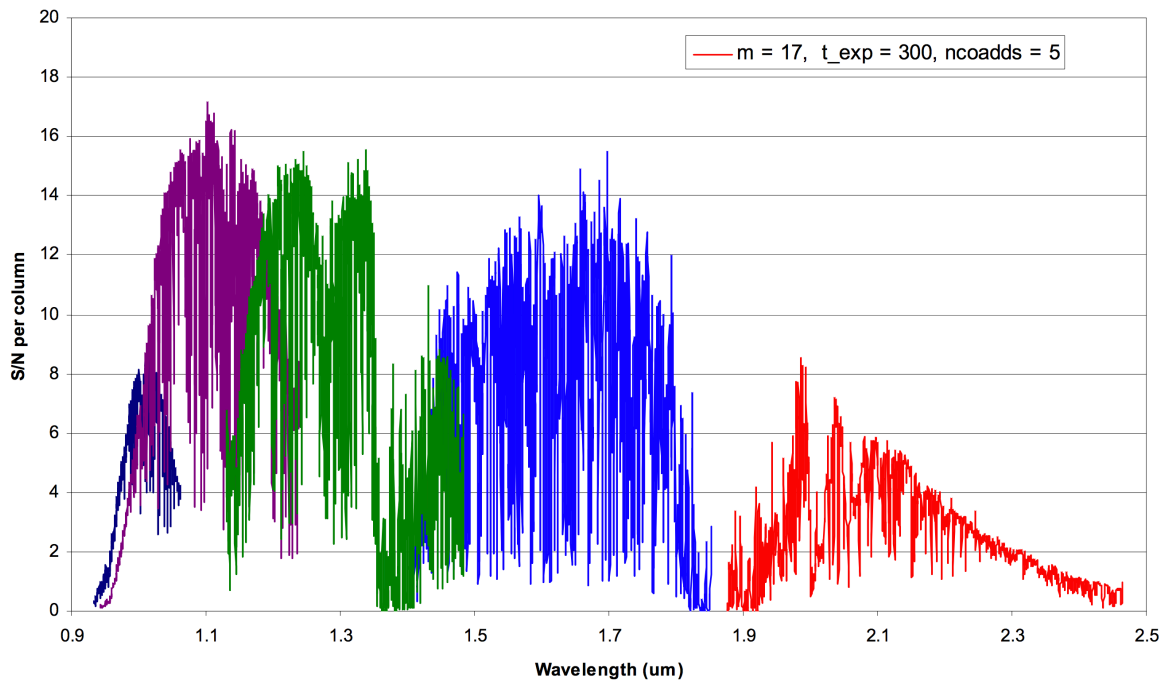
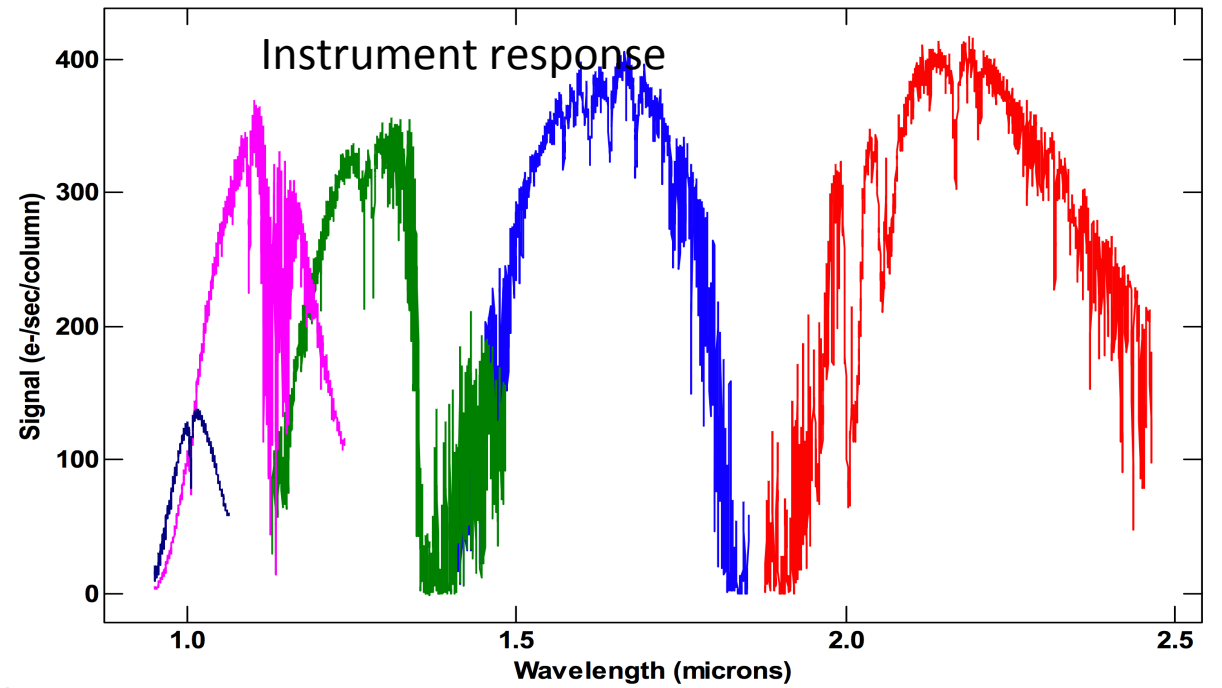
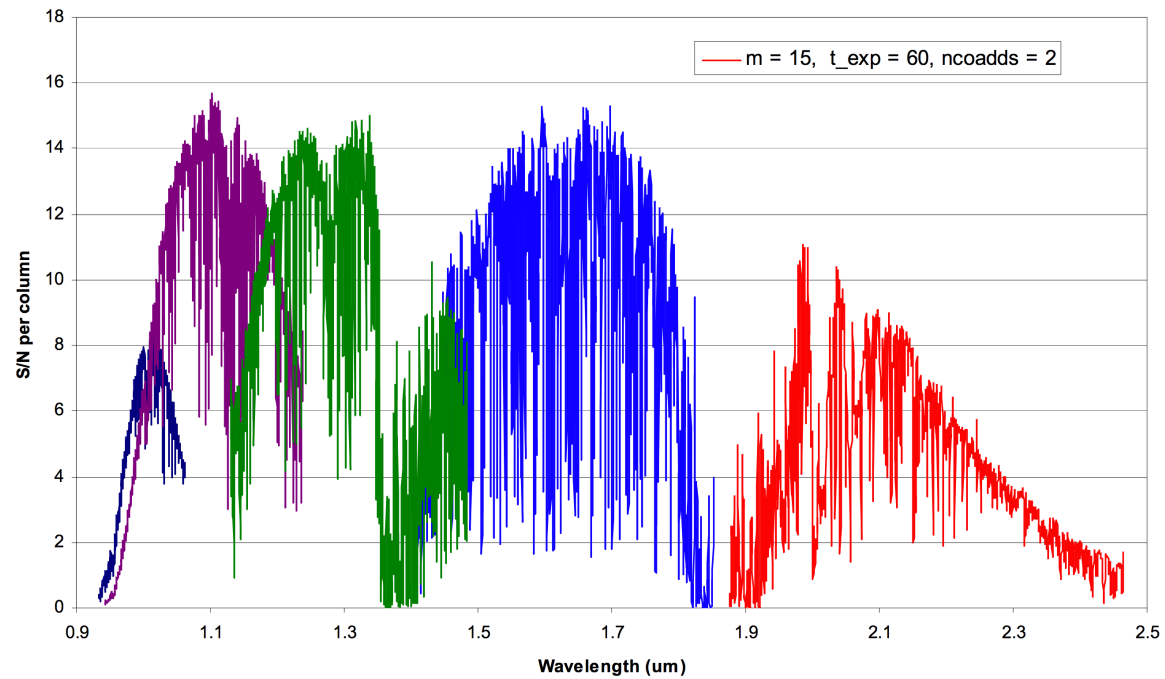
What is TripleSpec?

- TripleSpec is a near-infrared, cross-dispersed spectrograph covering wavelengths from 1 - 2.4 microns simultaneously at a resolution of ~ 2700 .
- It has a 1024×2048 Hawaii-II HgCdTe array, sampling the spectrum with ~ 2.7 pixels per resolution element.
- The entrance slit is $1'' \times 30''$ and the spectrum is spread over five orders in a cross-dispersed design.
- It's an almost identical twin to TripleSpec on APO 3.5-m, NIRES on Keck II, and ARCoIRIS on SOAR 4-m (previously on Blanco 4-m)
- Example topics where TripleSpec used: gravitationally lensed $1.5 < z < 3$ galaxies (e.g. Belli+2013), reddened AGNs (LaMassa+2017), refining stellar parameters (e.g. effective temperature, metallicity) for exoplanet host stars (e.g. Howard+2014, Dressing+2017), exoplanet emission spectra from secondary eclipses (e.g. Zellem+2014), characterizing brown dwarfs (e.g. Loutrel+2011, Montet+2015), spectra of central sources of circumstellar shells/bubbles in Galactic plane (e.g. Flagey+2015). See examples of follow-up of targets from Spitzer, WISE, K2, Chandra, XMM, Gaia, etc.

TripleSpec – Key Characteristics

- Guider/slit viewer field of view:
4.3x4.3 arcmin
- Read noise – $10 e^-$ (down to $3.5 e^-$ with Fowler sampling)
- Time to background limit – $\sim 300s$
- Saturation level – ~ 28000 DN
- Gain – $\sim 3.8 e^-/DN$
- Throughput – 20% in H and K band, 10% in J band
- Flexure – 0.5 pix at 45°





TripleSpec – Observing and data reduction

- Documentation available at Palomar instrumentation site:

<http://www.astro.caltech.edu/palomar/observer/200inchResources/tspecspecs.html>

<http://www.astro.caltech.edu/palomar/observer/200inchResources/tspeccookbook.html>

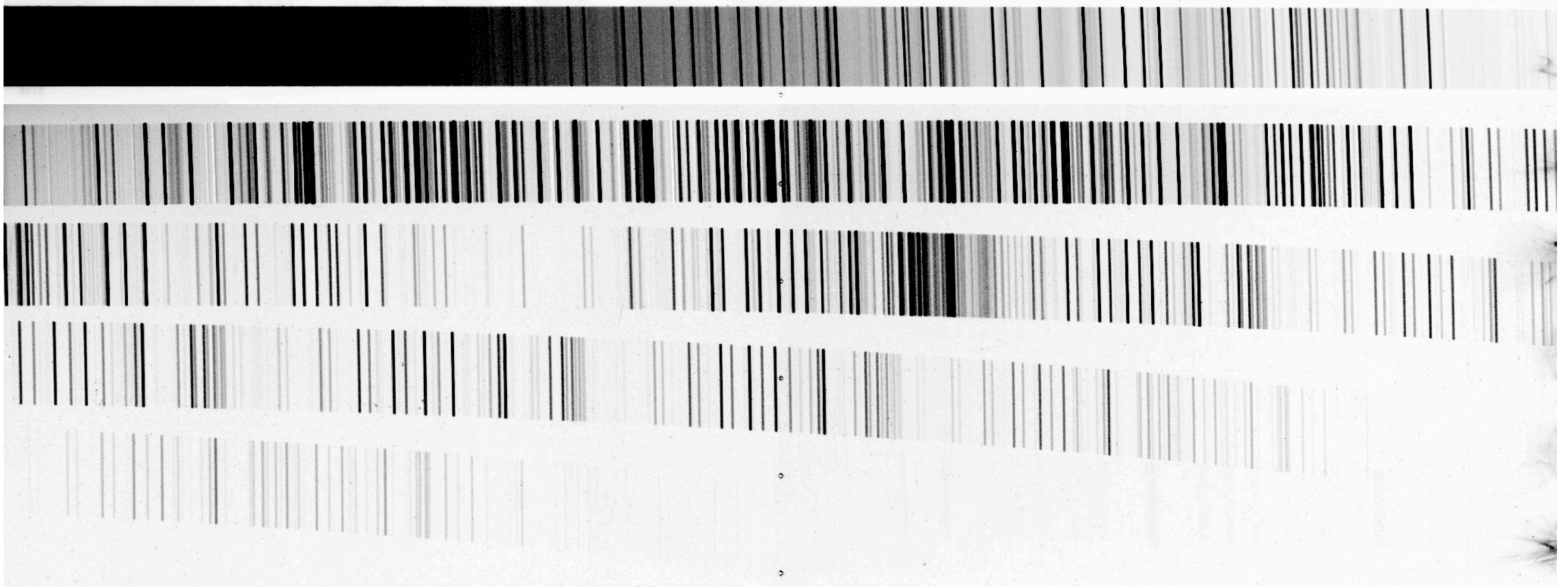
See also Herter et al. 2008, SPIE 7014 (doi: 10.1117/12.789660)

<https://www.spiedigitallibrary.org/conference-proceedings-of-spie/7014/70140X/The-performance-of-TripleSpec-at-Palomar/10.1117/12.789660.short?SSO=1>

- Standard NIR spectroscopy observing. Calibrations (flats + darks) taken in the afternoon. Wavelength calibration done with OH lines (no arcs).
- Data can be reduced using IDL package SpeXtool (written and maintained by M. Cushing, see Cushing, Vacca, Rayner, 2004, PASP, 116, 362 <http://adsabs.harvard.edu/abs/2004PASP..116..362C>)

TripleSpec – Sample Data

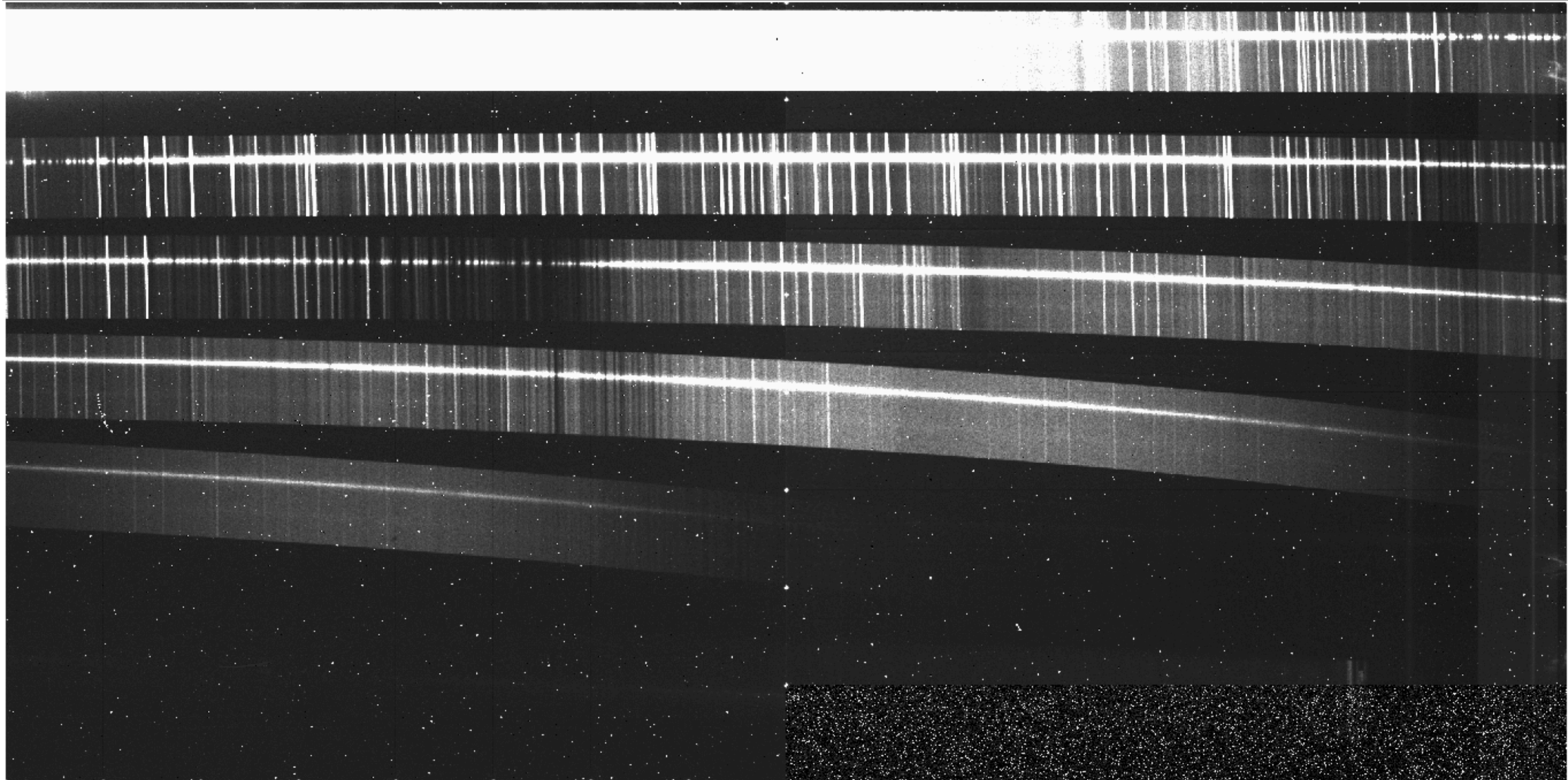
Sky emission – 600s – airmass 1.08



Herter et al. (2008)

TripleSpec – Sample Data

L dwarf – 150s – airmass 1.09

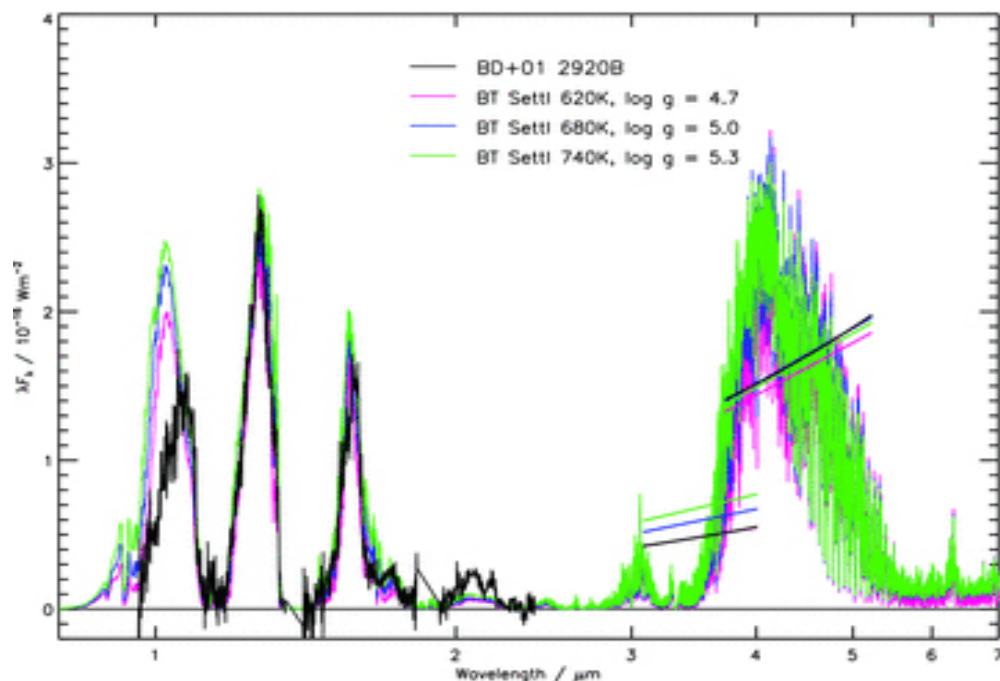


TripleSpec – Follow-up of Gaia L dwarfs

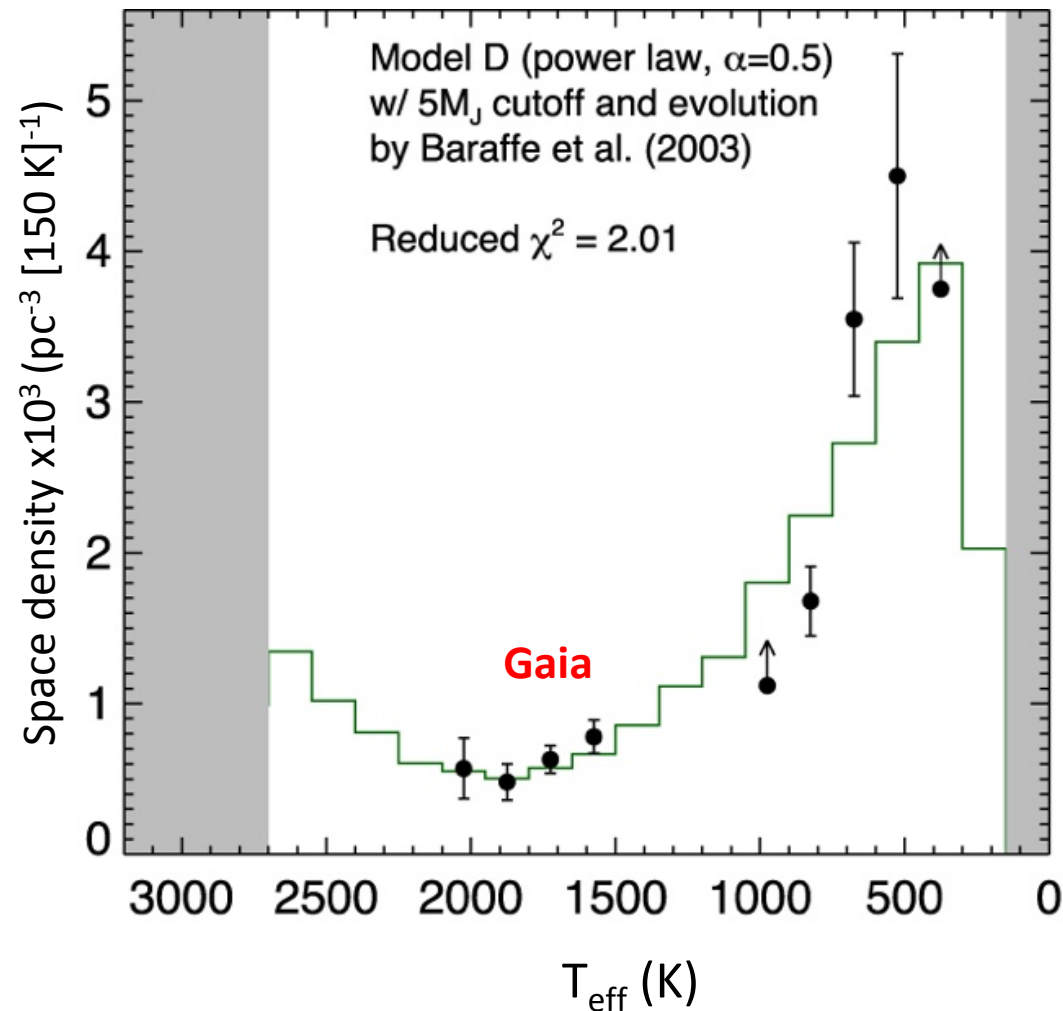
Kirkpatrick et al. 2019

- Goals

- (1) Completing the 30pc volume census
- (2) Identifying and characterizing benchmark systems

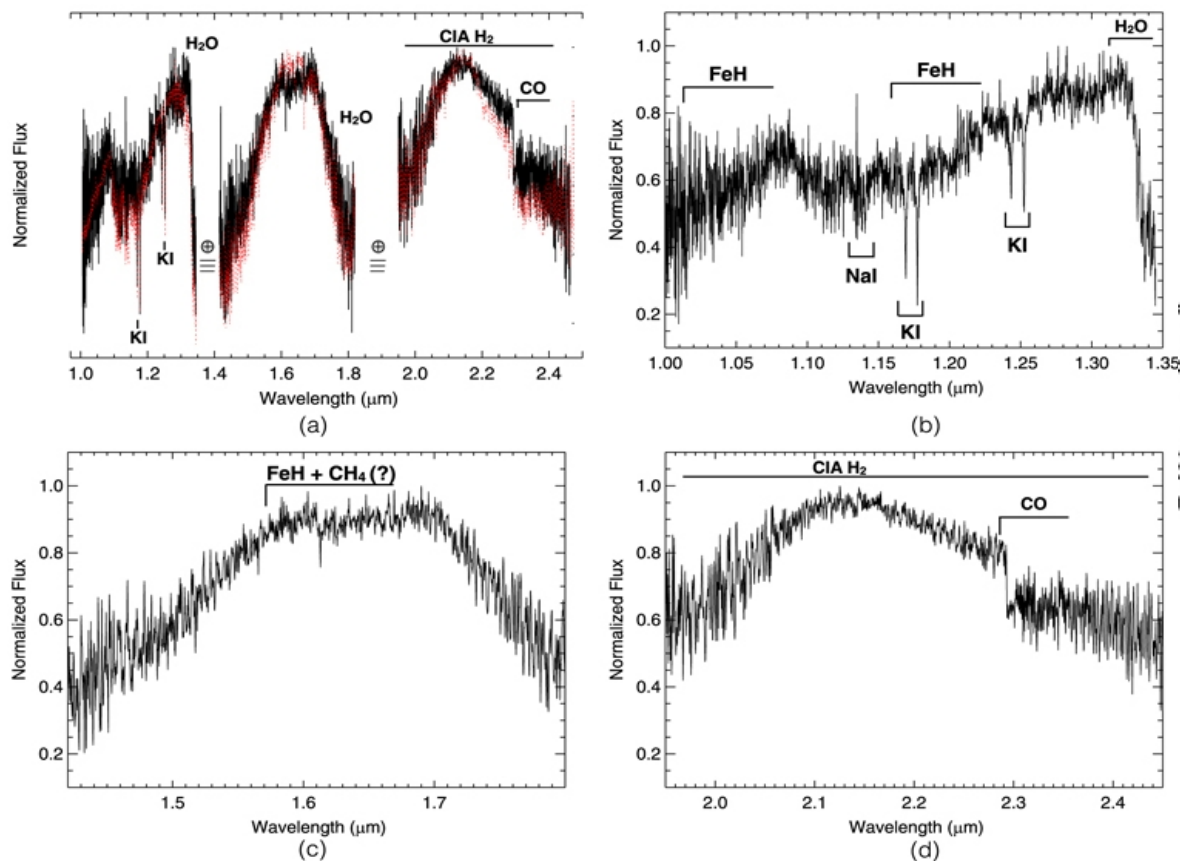


Pinfield et al. (2012)

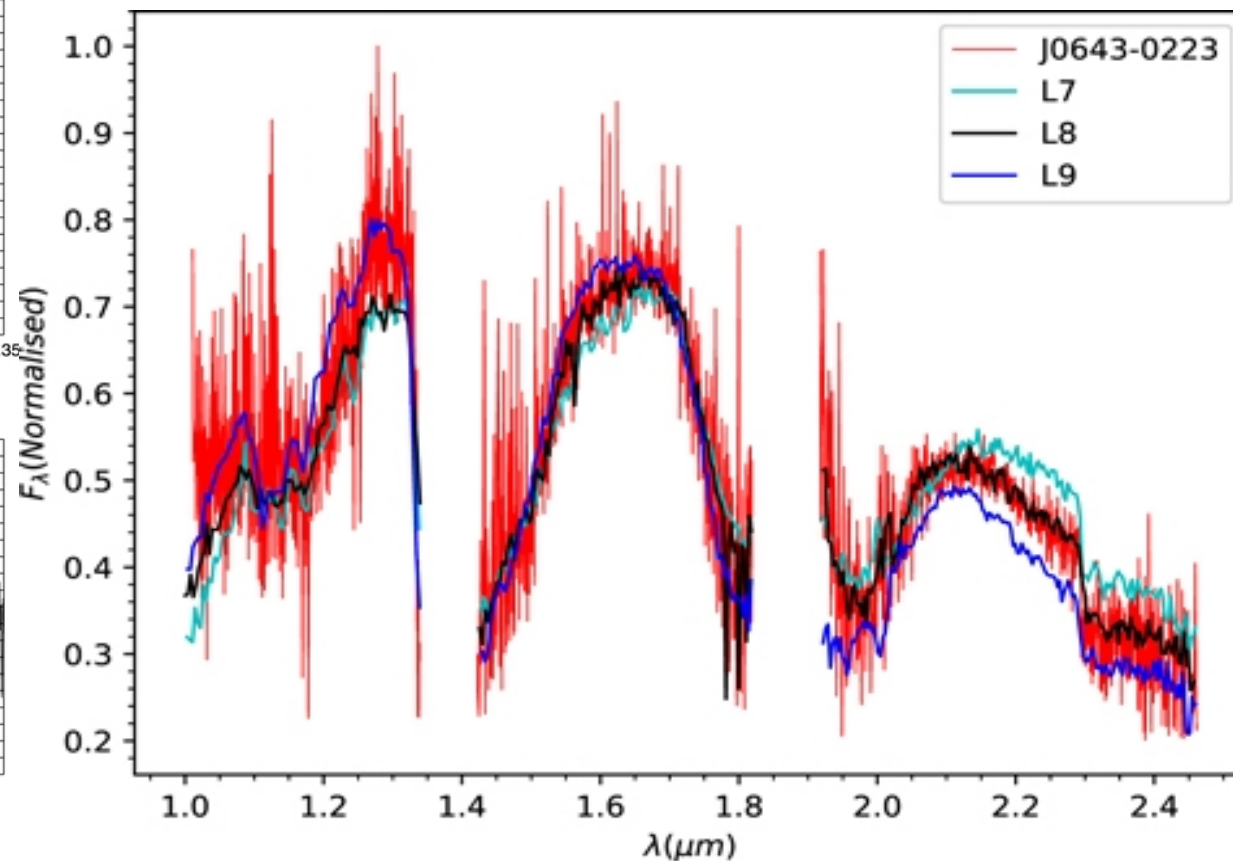


Completing the 30pc census

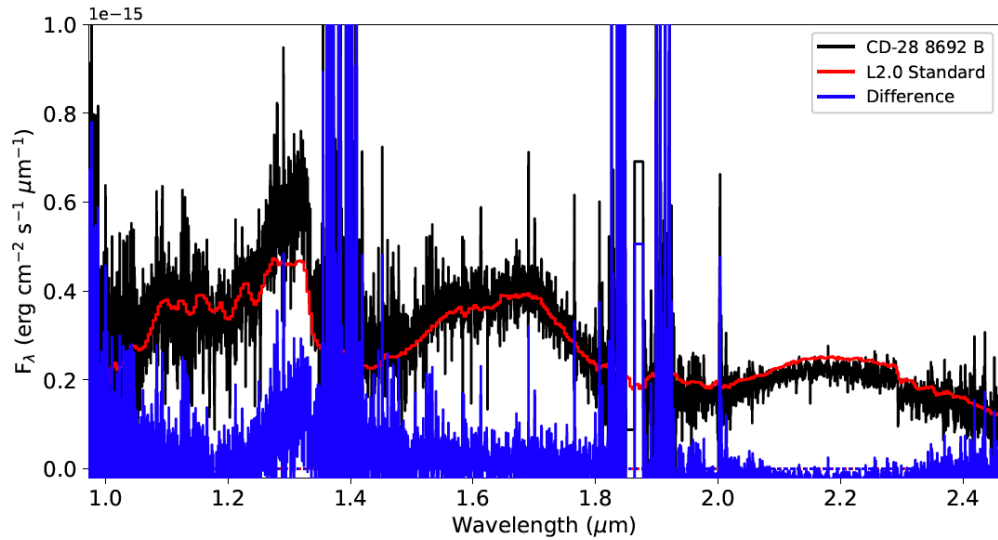
New L7 at 11pc hiding in Galactic Plane – Faherty et al. (2018)



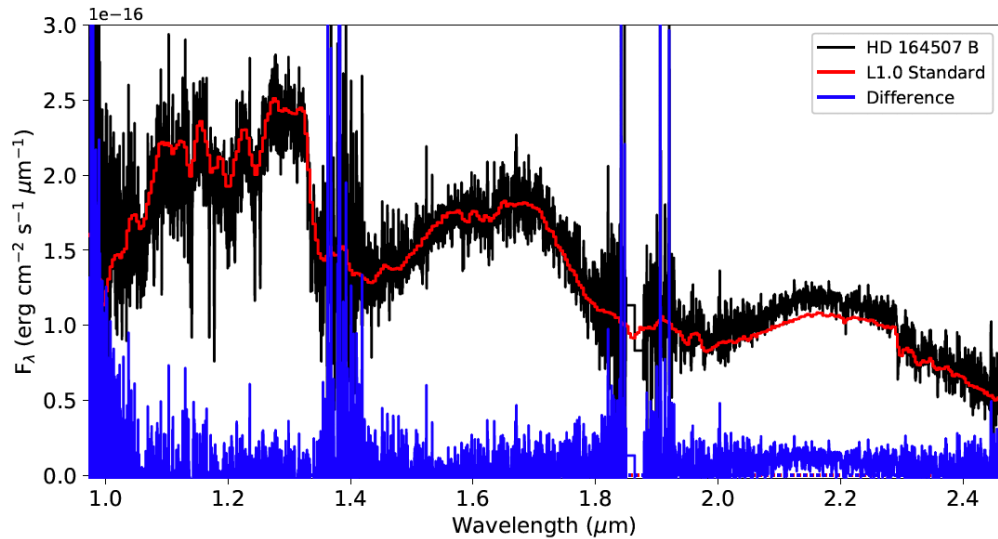
New thick disk L8 at 14pc – Mamajek et al. (2018)



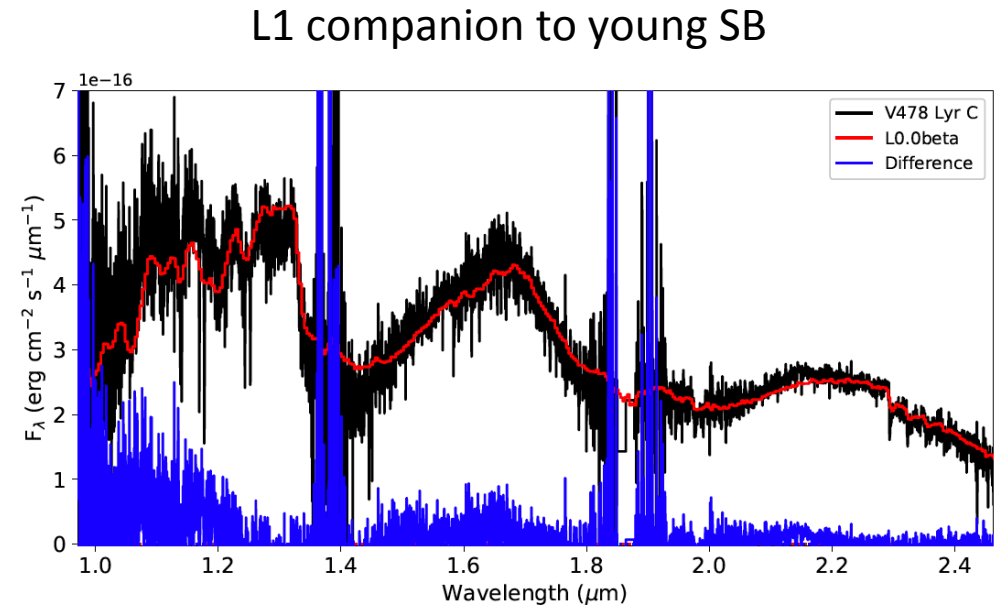
Benchmark systems



L2 companion to
metal poor K5V



L1 companion to
metal rich G5IV



L1 companion to young SB

Marocco et al. (in prep.)