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Spectral characterization of newly detected young substellar binaries

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<https://www.aanda.org/articles/aa/pdf/2019/07/aa35319-19.pdf>

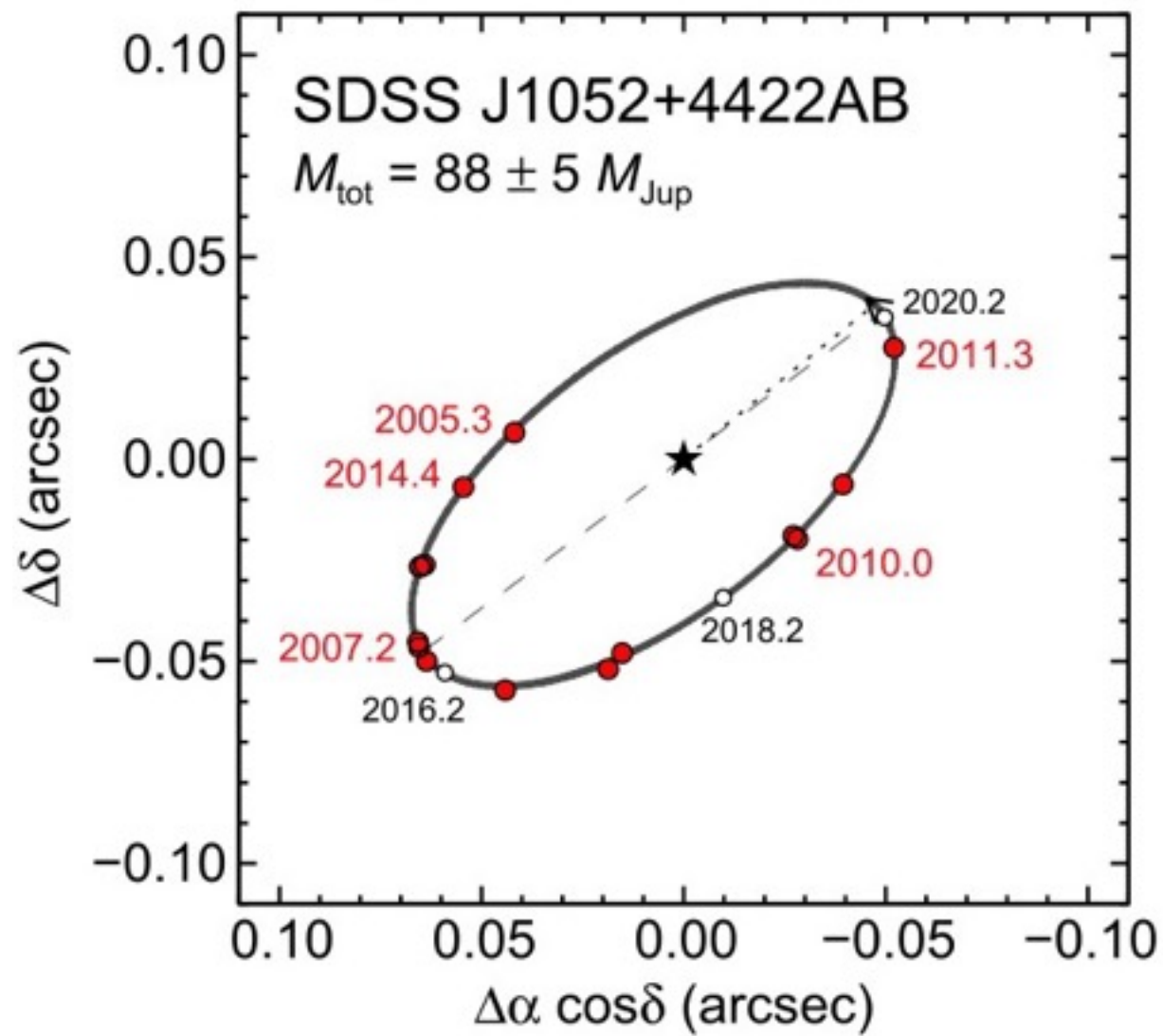
+ Markus Janson¹, Rubén Asensio-Torres¹, and Rainer Köhler^{2,3}

¹ Stockholm University, Stockholm, Sweden

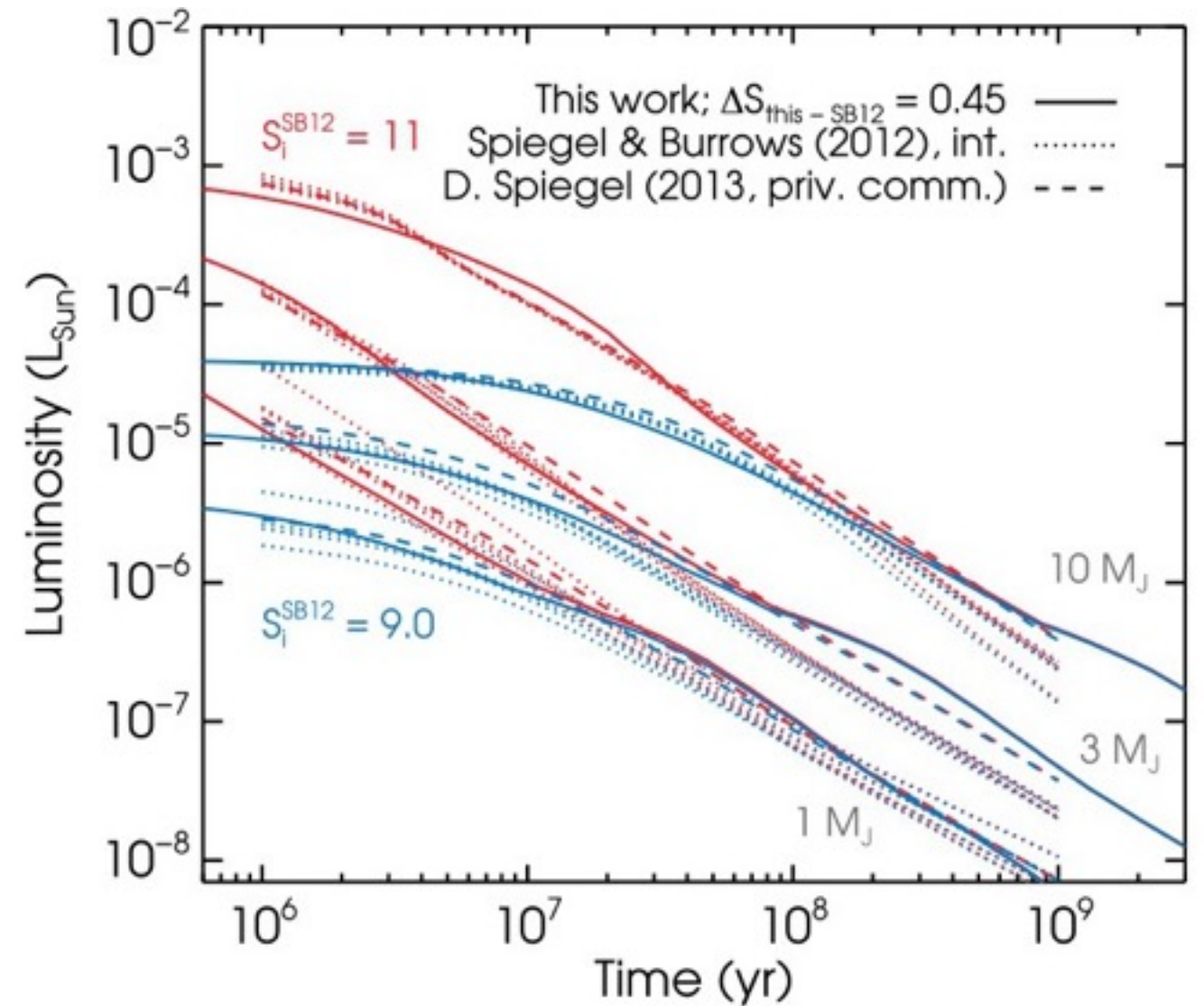
² Sterrewacht Leiden, Netherlands

³ University of Vienna, Vienna, Austria

Background

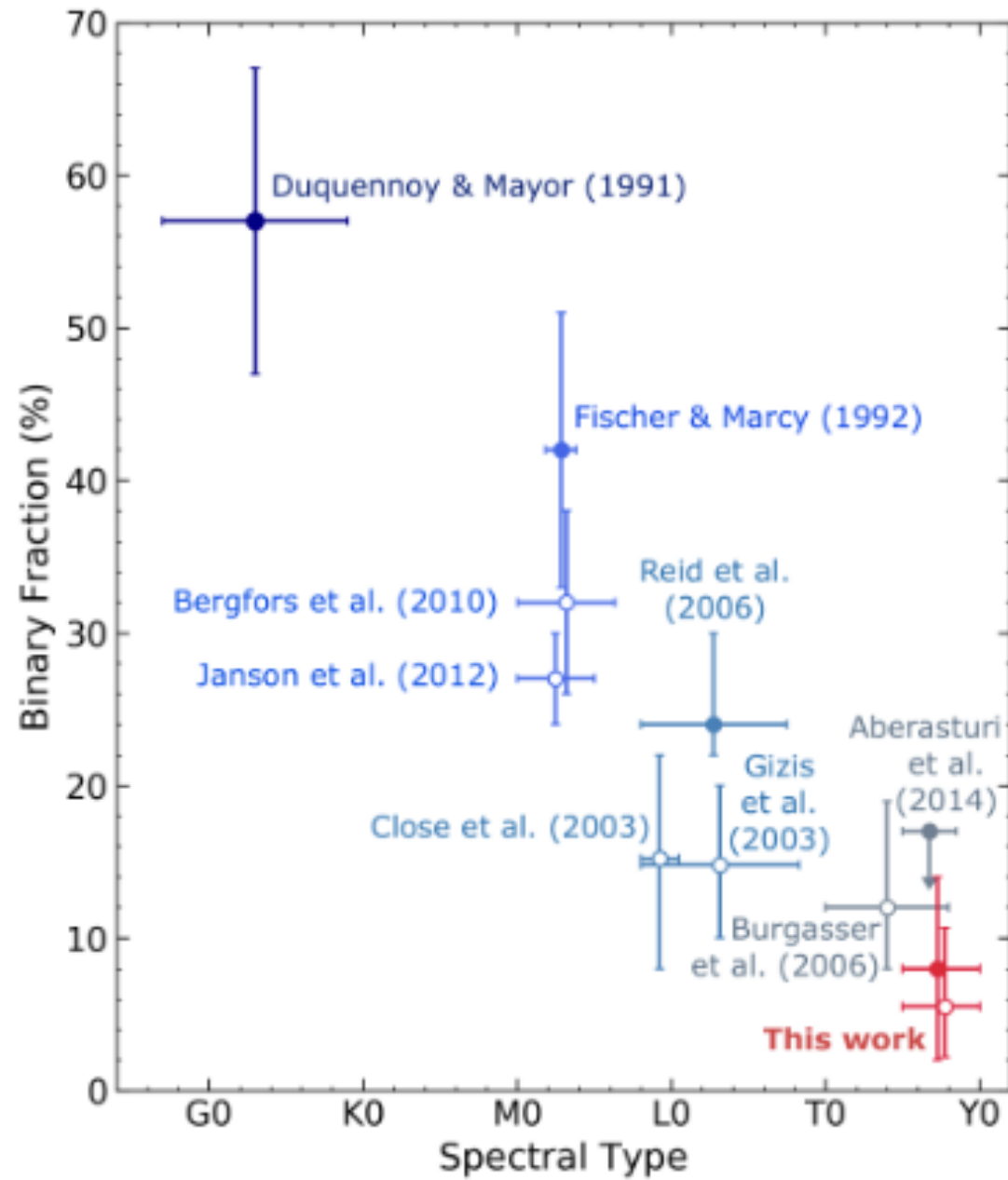


Credit: Dupuy et al. (2015)

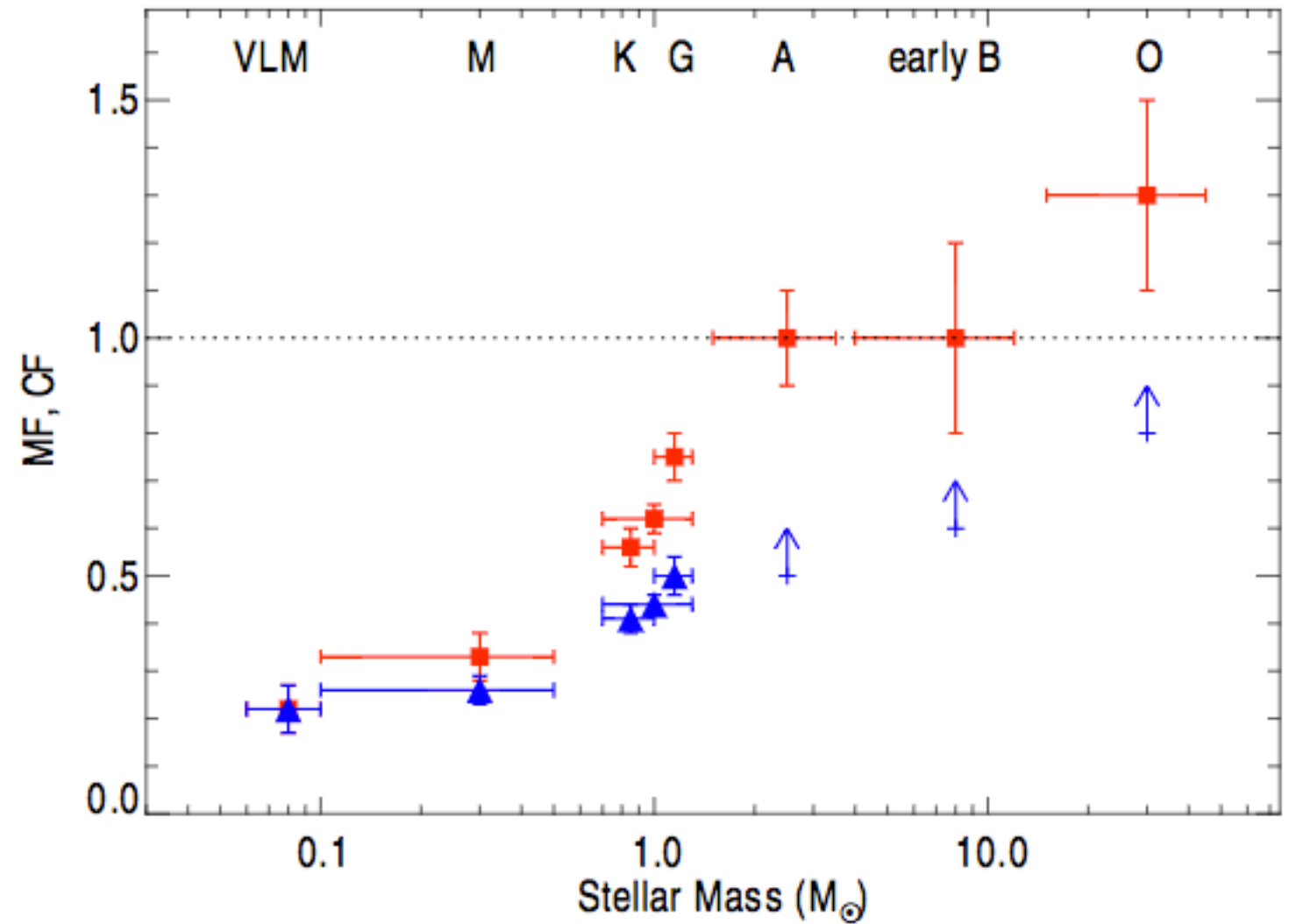


Credit: Marleau & Cumming (2014)

Multiplicity

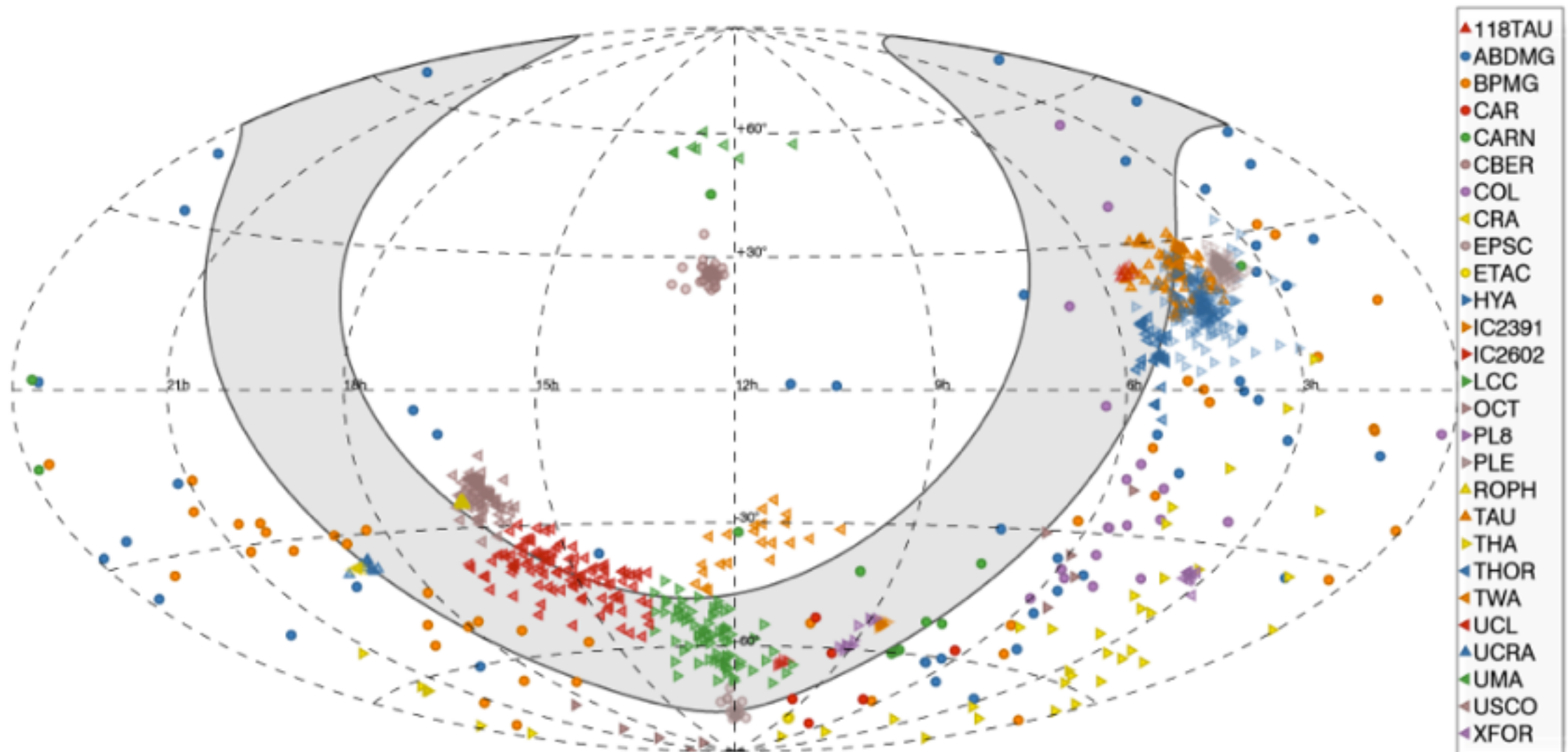


Credit: Fontanive et al. (2018)



Credit: Duchêne & Kraus (2013)

Young Moving Groups



Credit: Gagné et al. (2018)

SINFONI - Spectrograph for **I**Ntegral **F**ield **O**bservations in the **N**ear **I**nfrared

Field of View: 0.8'' x 0.8''

Spatial Scale: 12.5 x 25 mas

Band: H+K

Resolving power: $R = 1500$

Laser Guide Star Adaptive Optics

Wavelength slices: ~ 2000

Wavelength range: 1.457 - 2.457 μm

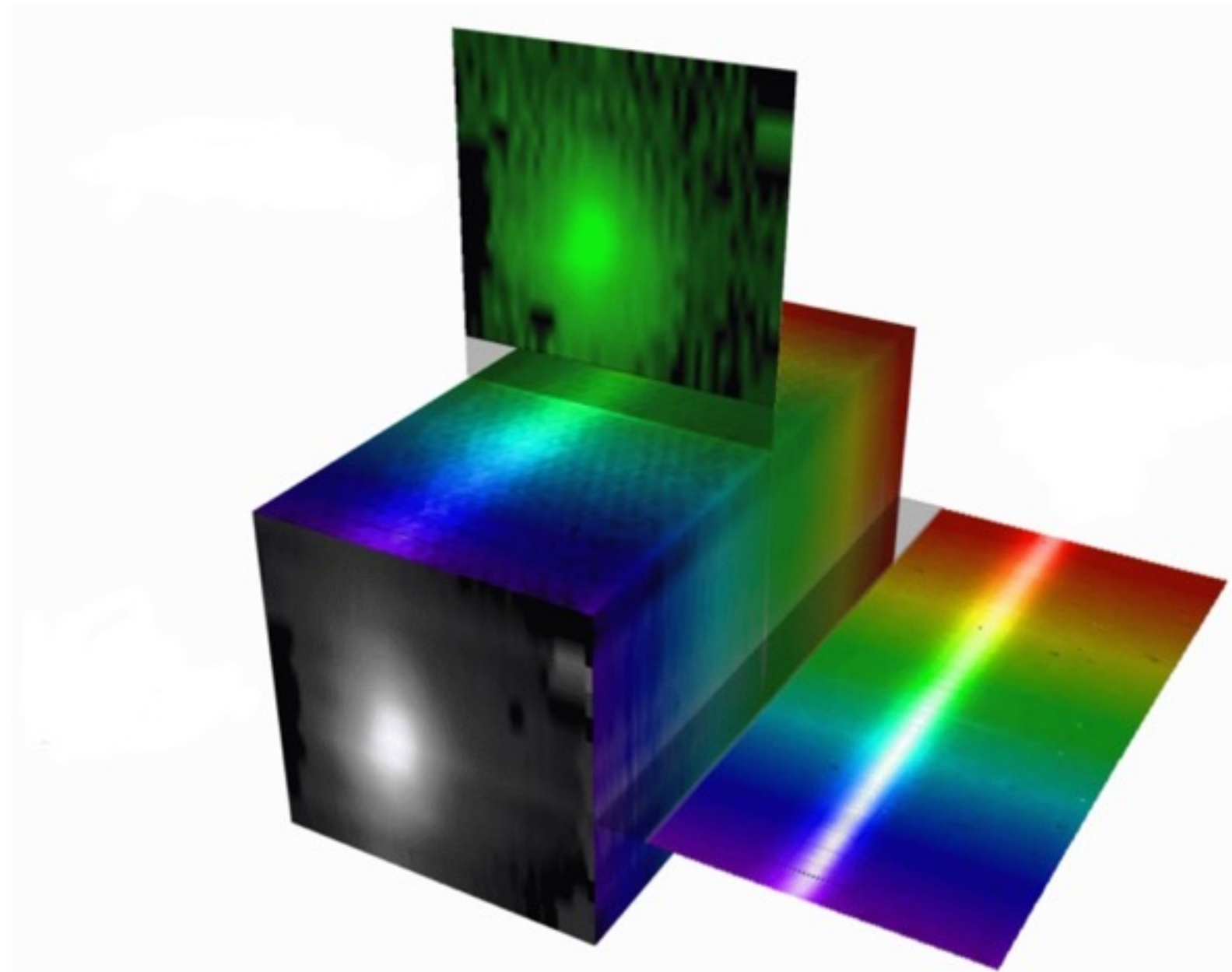
Our observations

Full sample: 22 sources

Observed: 14 sources

Usable: 7 sources

Binaries: 3 candidates

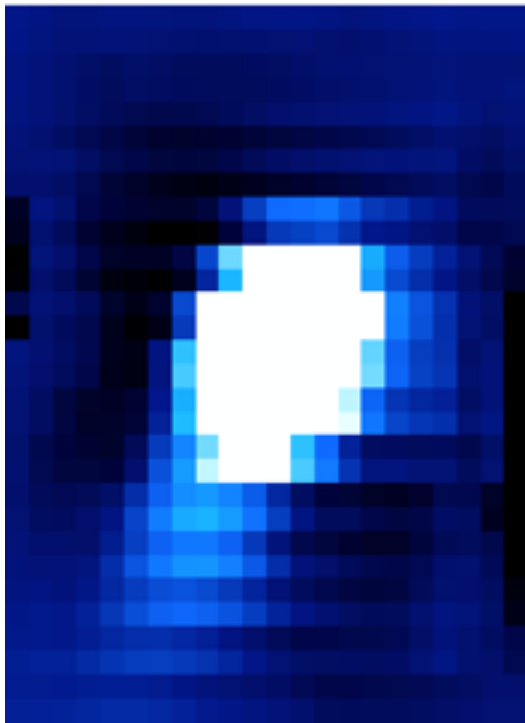


Credit: Stephen Todd (ROE) and Douglas Pierce-Price (JAC)

Binary candidates

2M1510

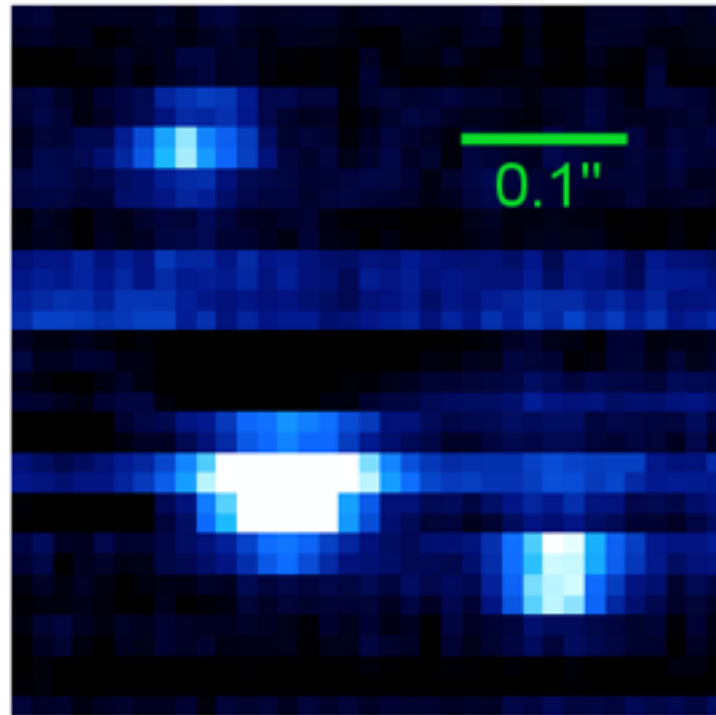
2MASS J15104786-2818174



$H = 12.11 \pm 0.03$ mag
YMG = Argus
Age = 30 - 50 Myr

2M1547

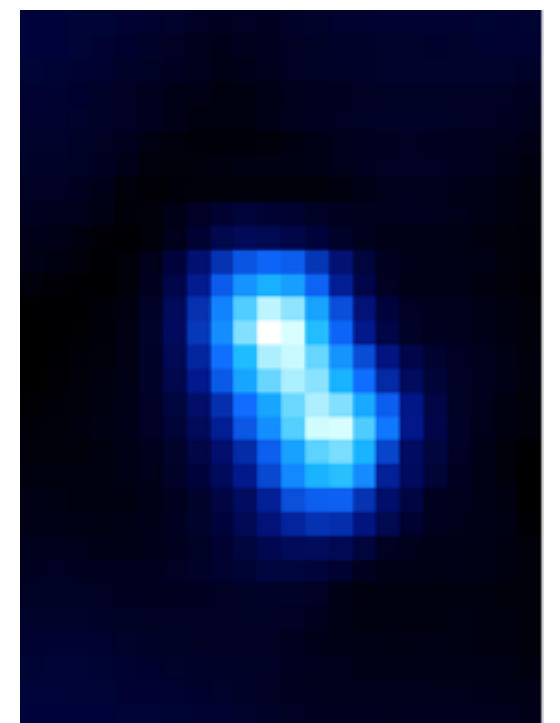
2MASS J15474719-2423493



$H = 13.27 \pm 0.03$ mag
YMG = Young Field
Age = 30 - 50 Myr

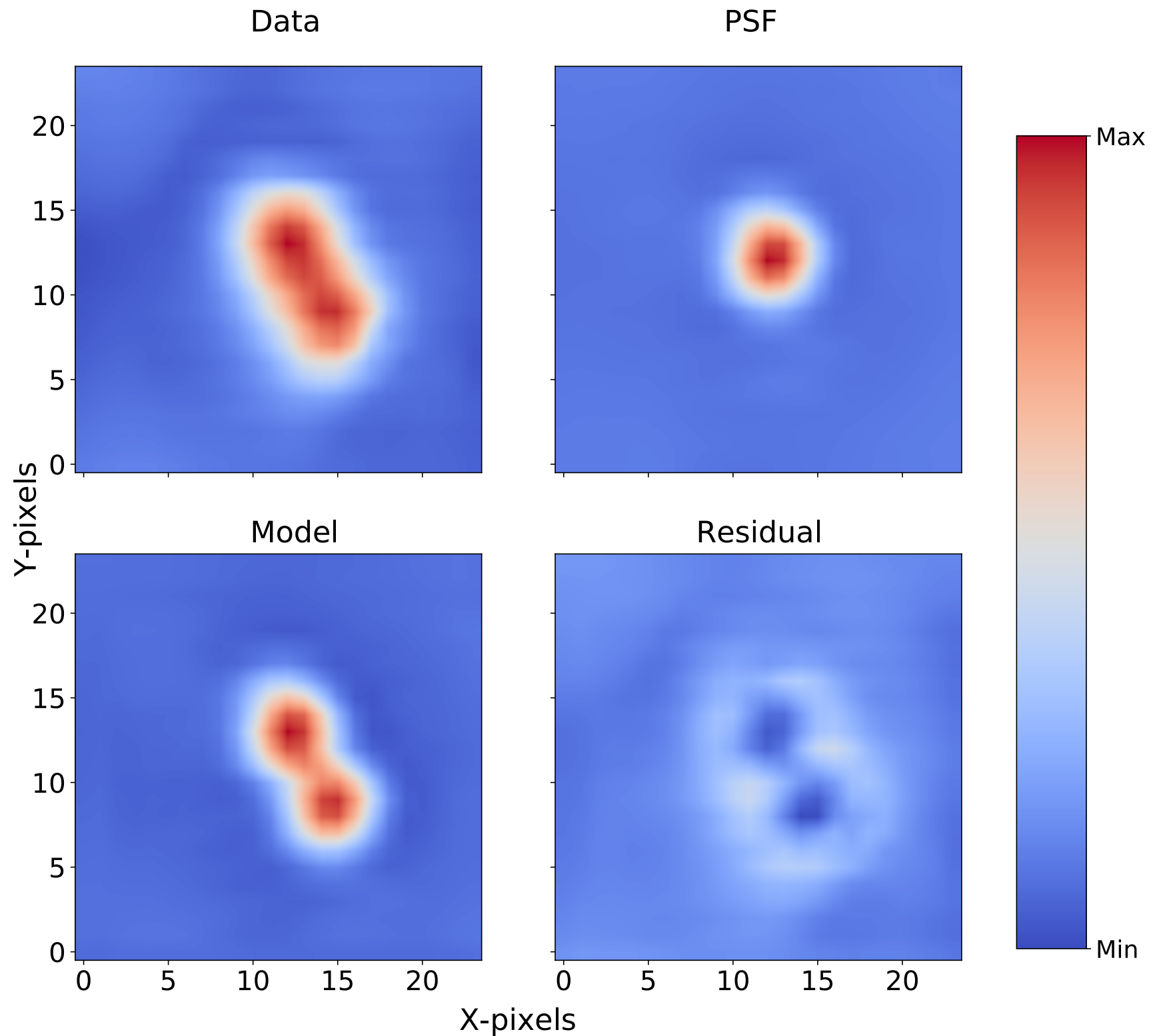
2M2202

2MASS J22025794-5605087



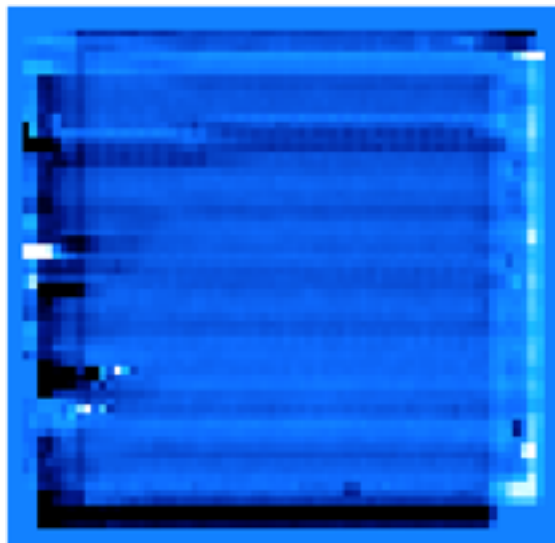
$H = 13.62 \pm 0.04$ mag
YMG = ABDMG
Age = 120 - 200 Myr

Astrometry

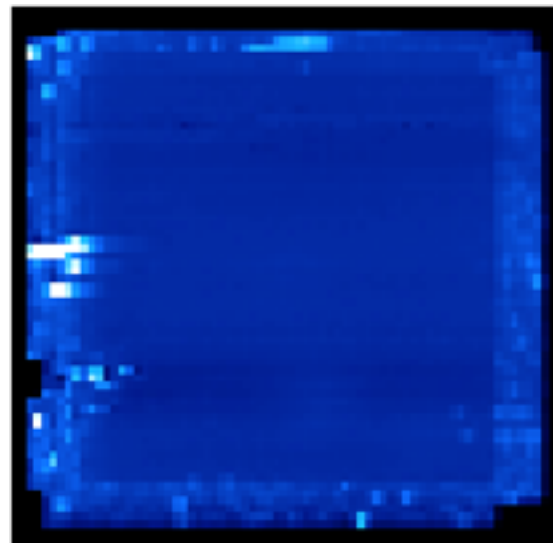


2M1547 - Special case

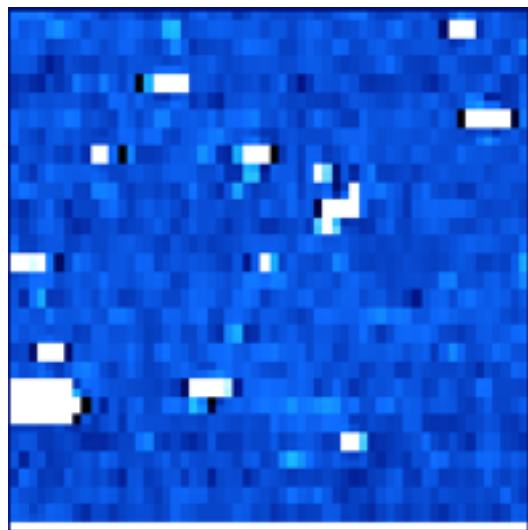
2M1547 collapsed



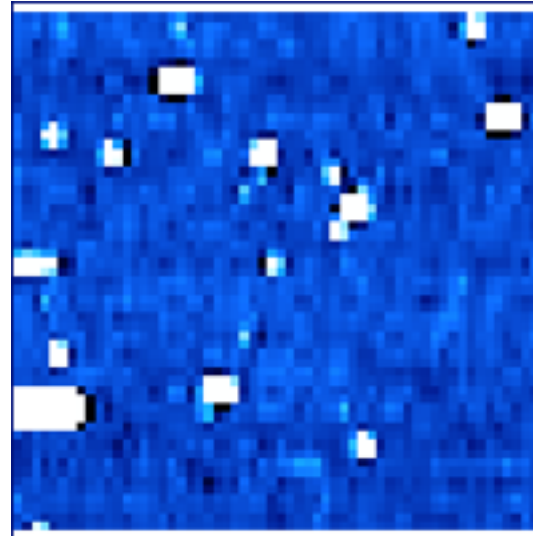
2M1547 collapsed
(no sky subtraction)



2M1547 single slice
(no sky subtraction)

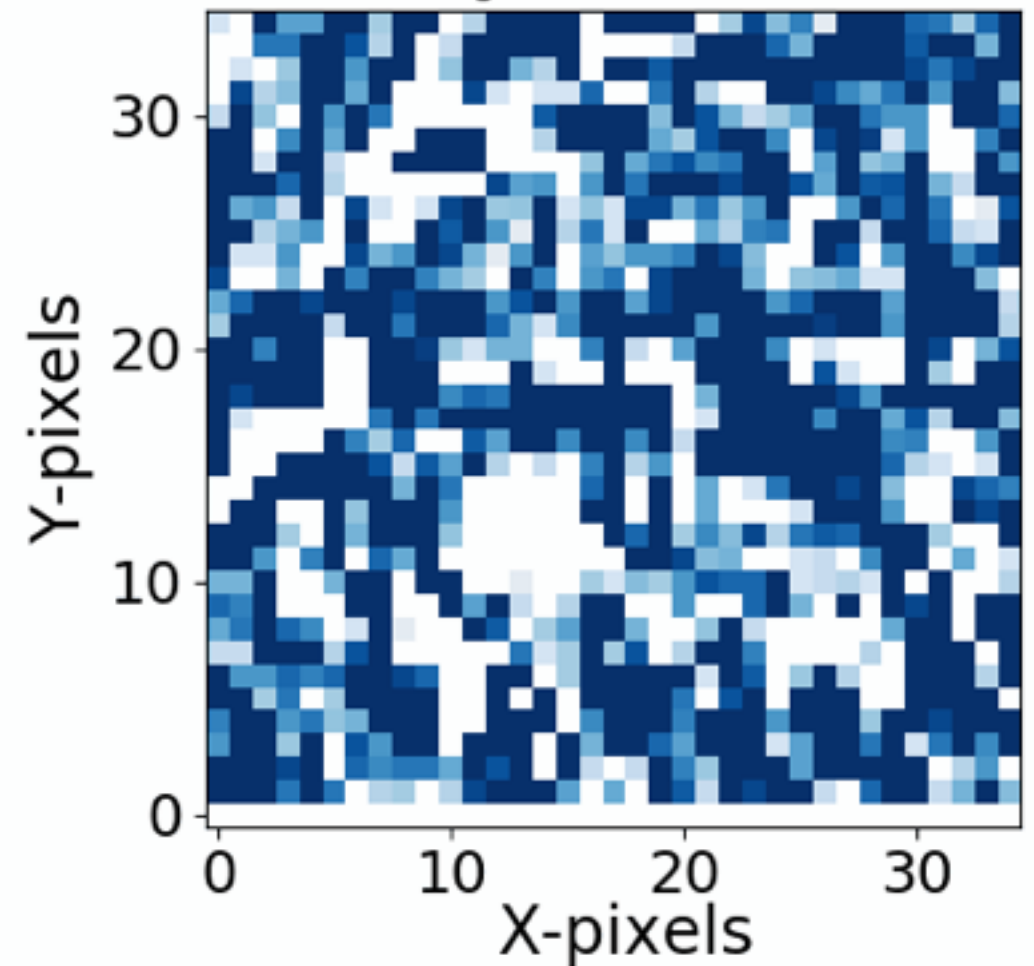


2M1425 single slice
(no sky subtraction)

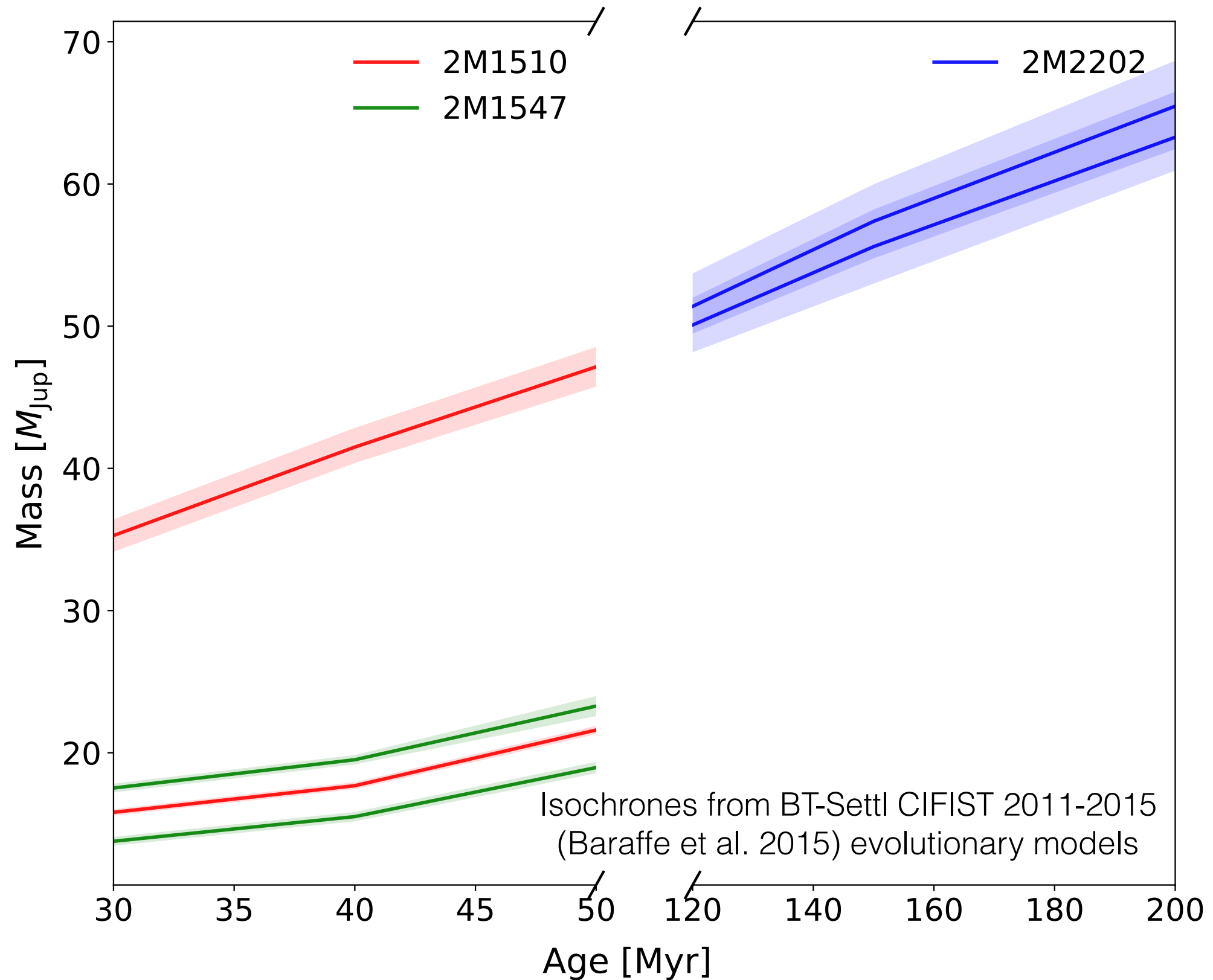


2M1547 - 2M1425

Wavelength slices combined: 1

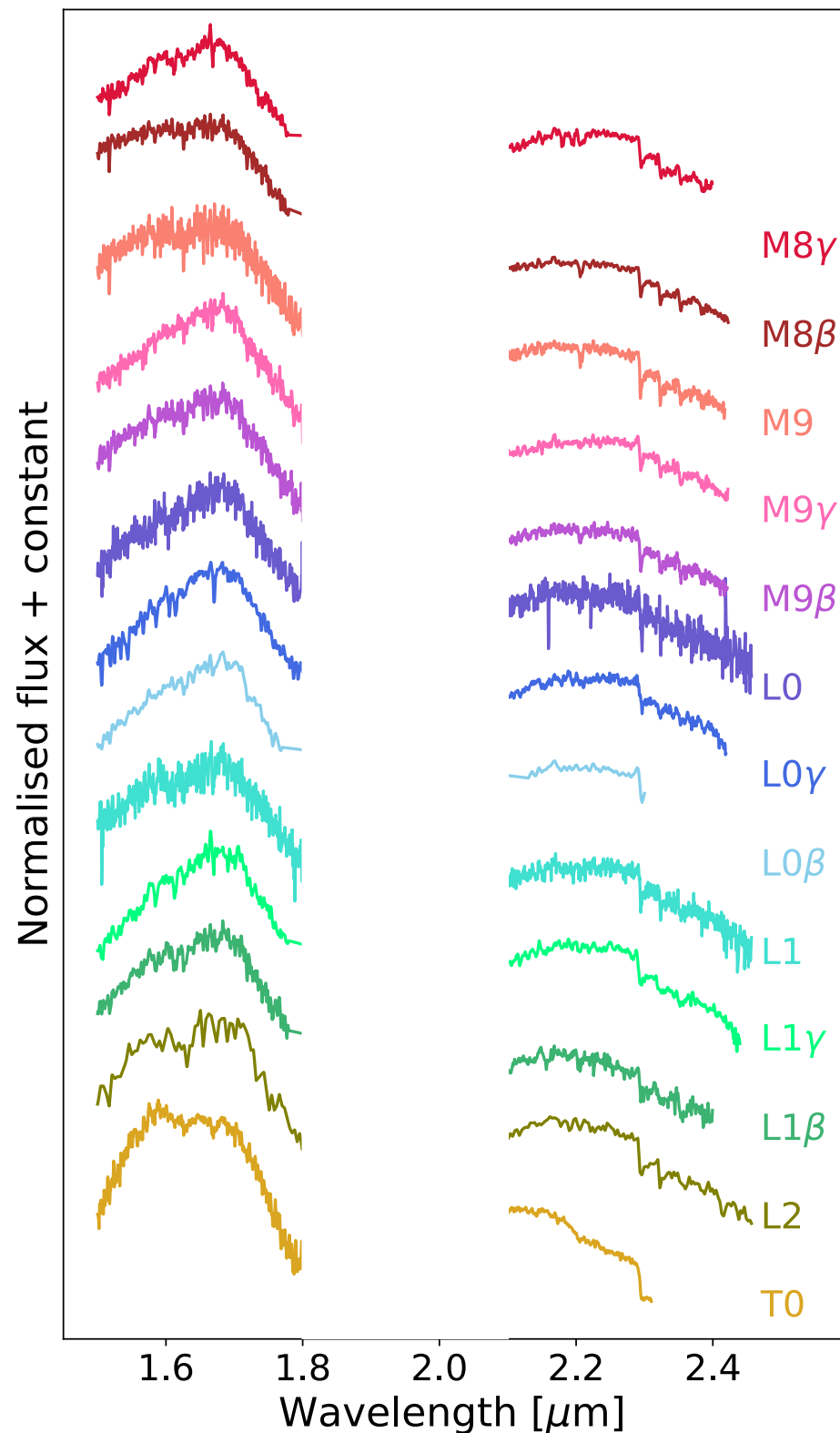


Photometry

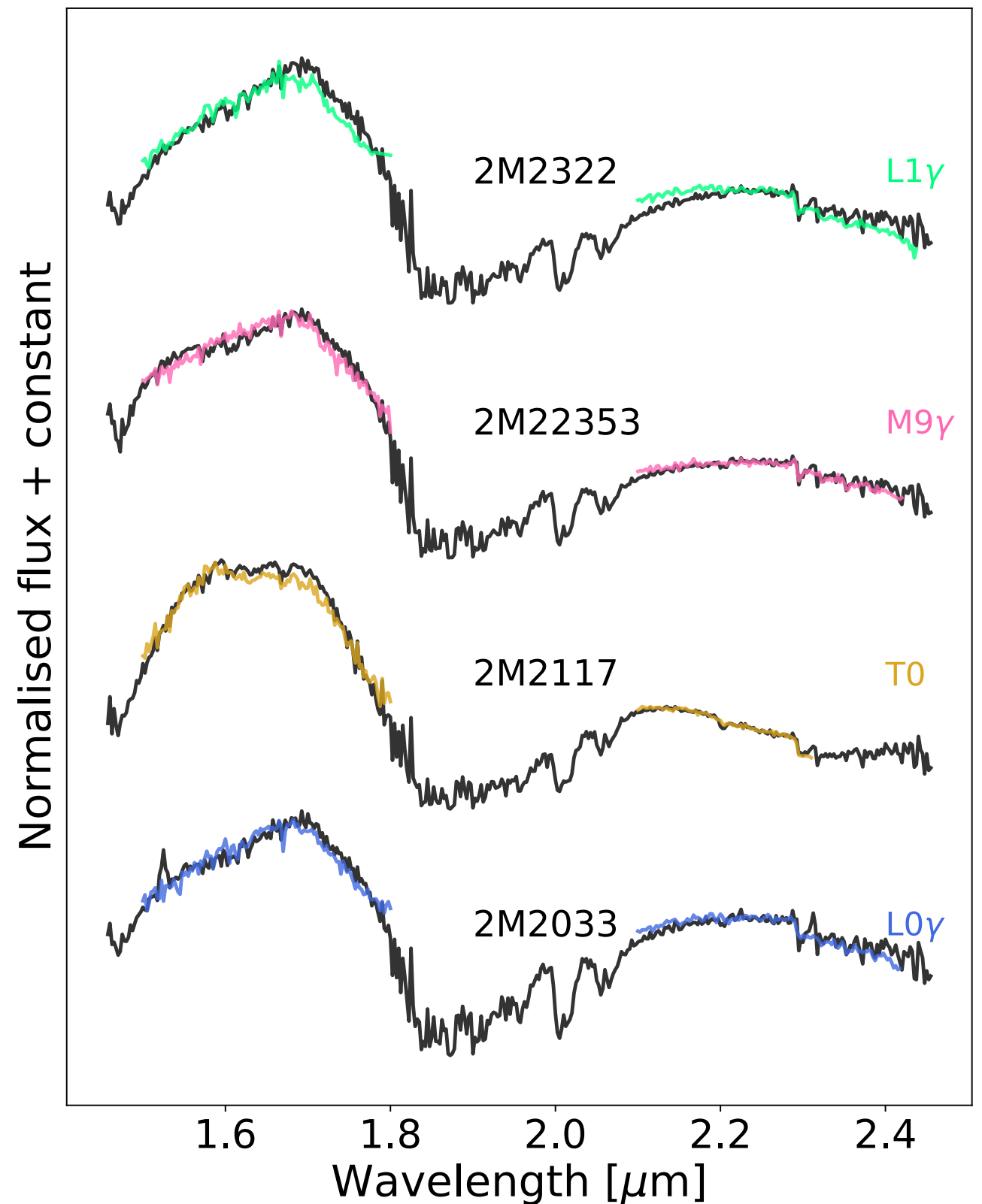


Spectral analysis

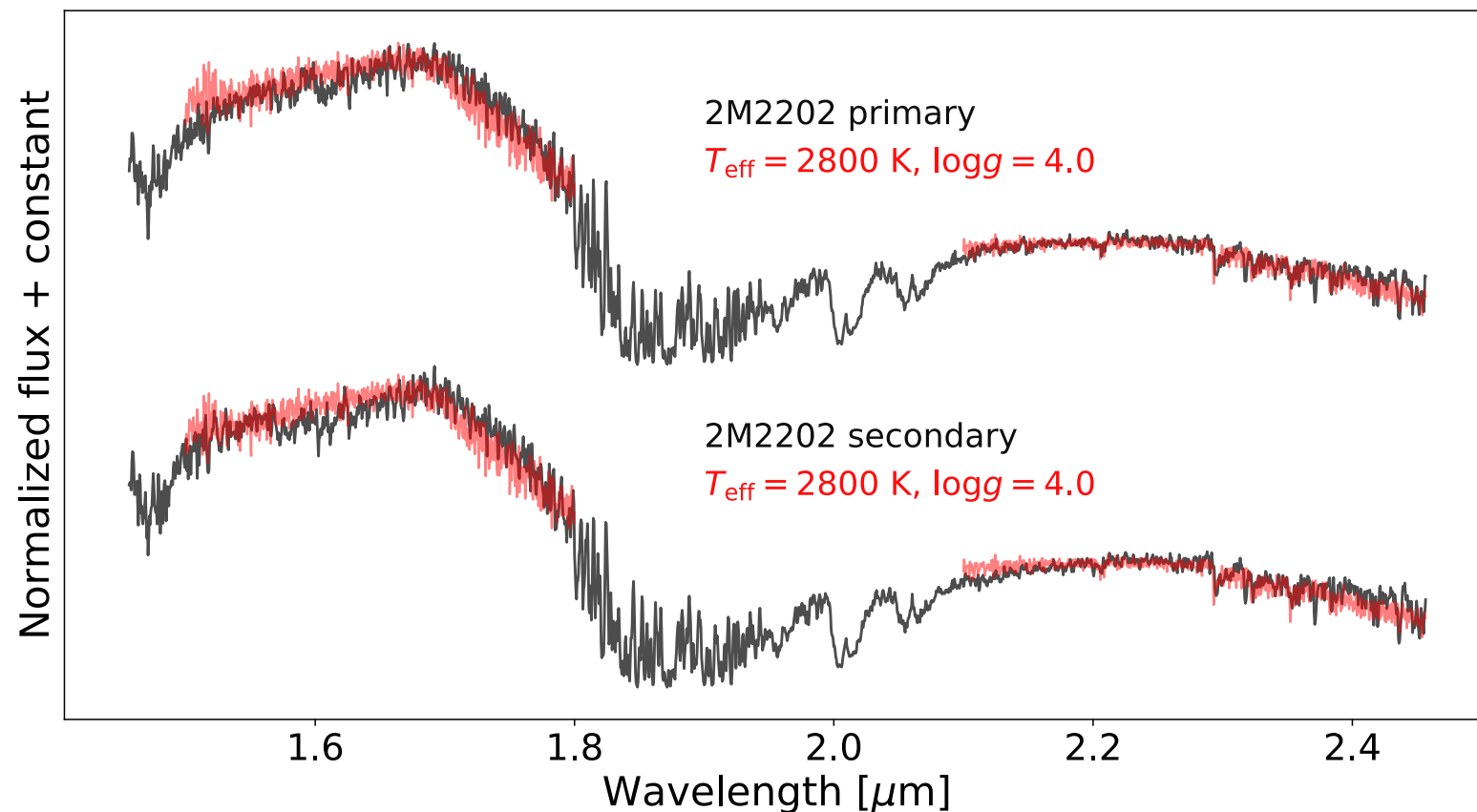
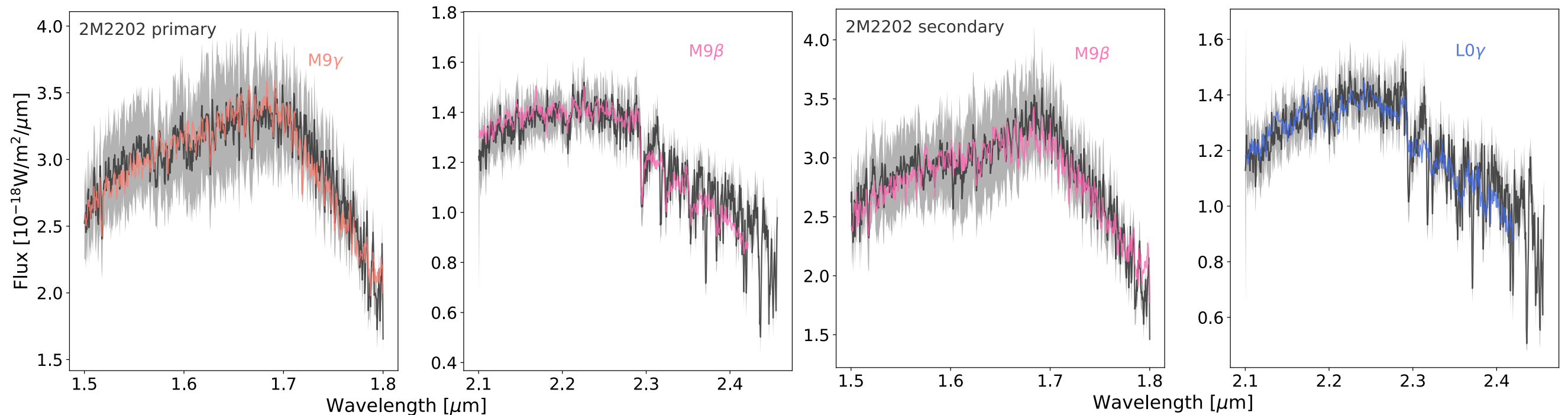
Spectral templates



Single or unresolved sources



2M2202 - Spectral fits



2M2202 primary
Spectral type: M9 $\gamma/\beta \pm 1$
Mass: $\approx 57 M_{\text{Jup}}$

2M2202 secondary
Spectral type: M9 $\gamma/\beta \pm 1$
Mass: $\approx 56 M_{\text{Jup}}$

Physical separation: $\approx 4.8 \text{ AU}$
Predicted period: $\approx 34 \text{ years}$

Conclusions

- We observed 7 young brown dwarfs systems, discovering 3 substellar binary candidates.
- Follow-up observations are suggested to confirm binarity.
- Our small statistical sample show implications for a higher multiplicity frequency compared to the older field population of brown dwarfs.
- We obtain (partly) resolved spectra for the binary candidates.
- Continued astrometric monitoring of the detected binary candidates will yield potential benchmarks to test against evolutionary models.

<https://arxiv.org/abs/1906.05871>