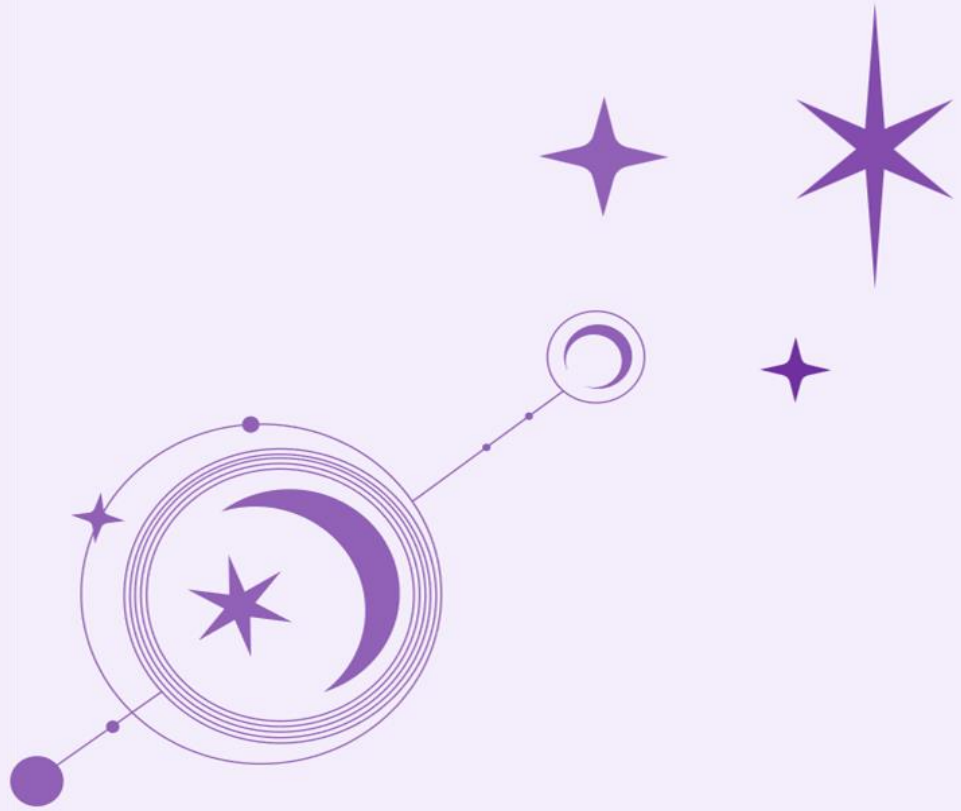
SPECTROSCOPIC CLASSIFICATION OF 50 GAIA ULTRACOOL DWARFS

GEMMA CHENG

OVERVIEW

- Background material
- Observations
- Data reduction
- Spectral classification
- Plots!
- Interesting objects
- Future work



WHAT ARE UCDS?

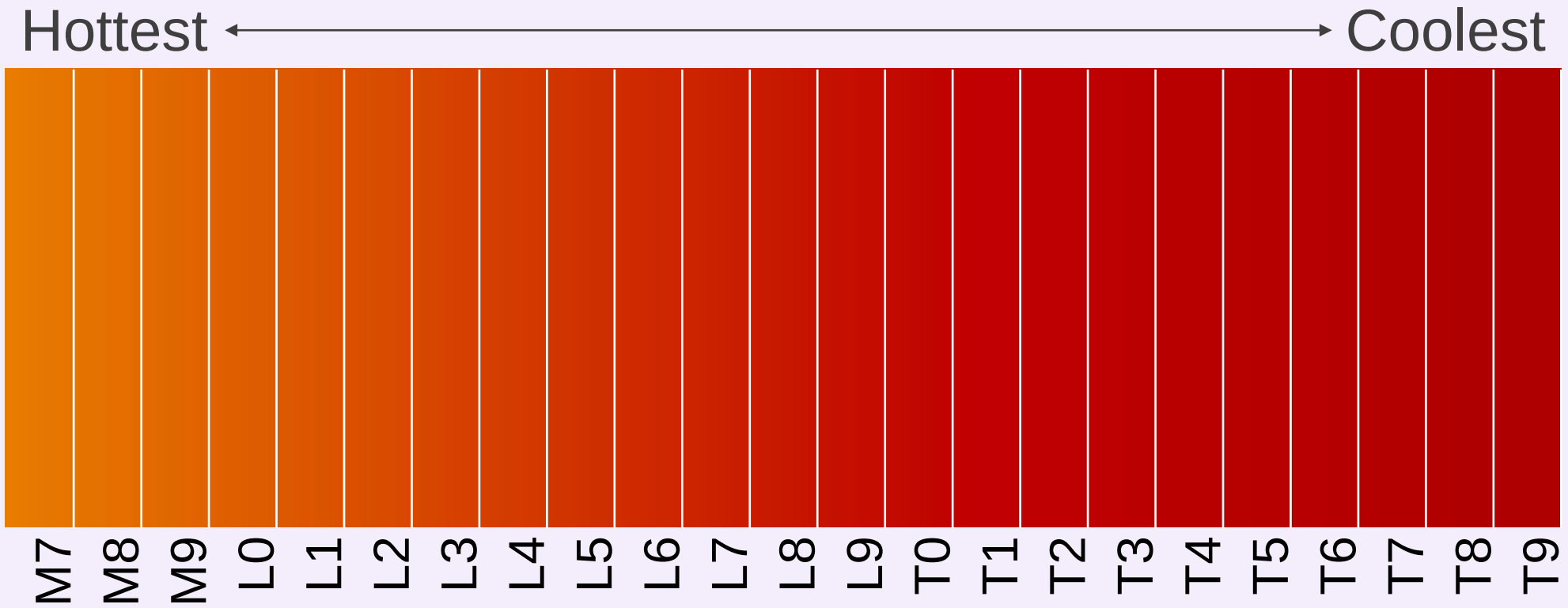
- Sub-stellar objects – no fusion of hydrogen
- Straddle boundary between planets and stars
- Spectral types later than M7

Jones & Steele, 2001

SPECTRAL TYPES

Morgan, Keenan & Kellman, 1943

SPECTRAL TYPES



Morgan, Keenan & Kellman, 1943

CANDIDATE SELECTION

- Targets are all from *Gaia* DR2 and cross-matched with a number of catalogues of known UCDs
- Full master list has 8000+ objects
- 59 targets selected for this work, depending on visibility on observing nights

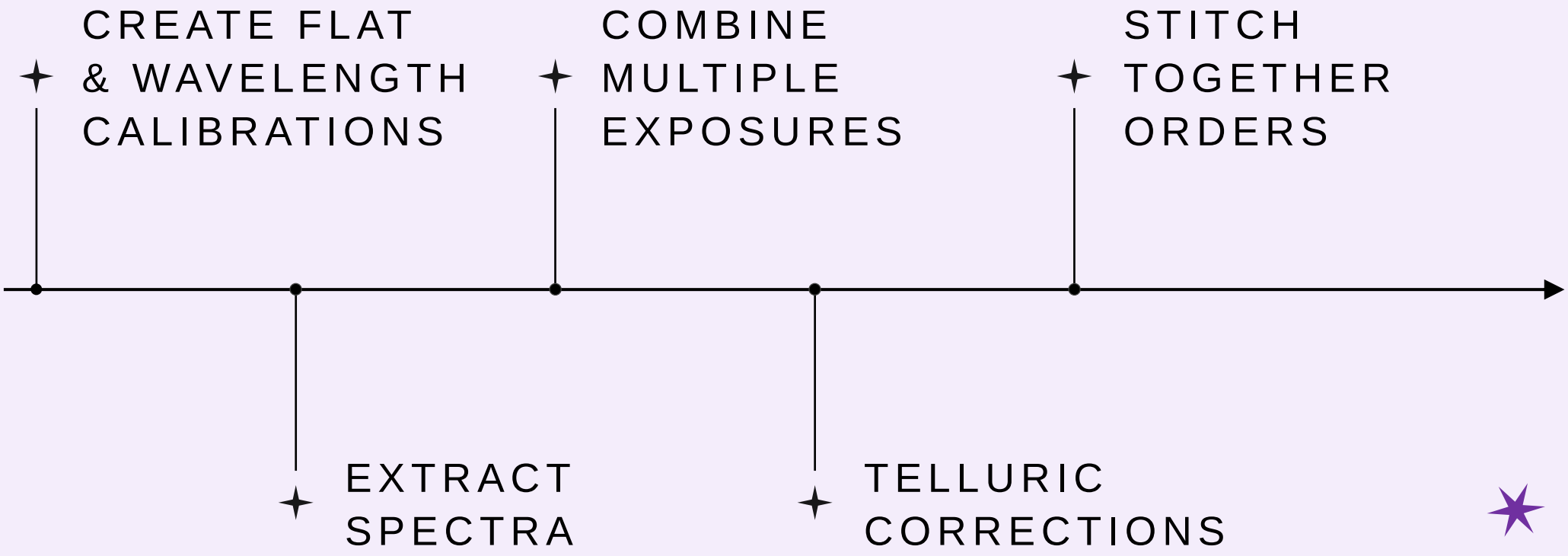
Smart et al., 2017 • Smart et al., 2019 • Marocco et al., 2020

OBSERVATIONS

- 2 instruments used for observations – ARCoIRIS and SpeX
- 13 observations with ARCoIRIS
  - Cross-dispersed spectrograph (R~3000, λ=0.8-2.4μm)
- 37 observations with SpeX
  - 7 with prism configuration (R~200, λ=0.70-2.52μm)
  - 30 with SXD grating (R~2000, λ=0.70-2.55μm)

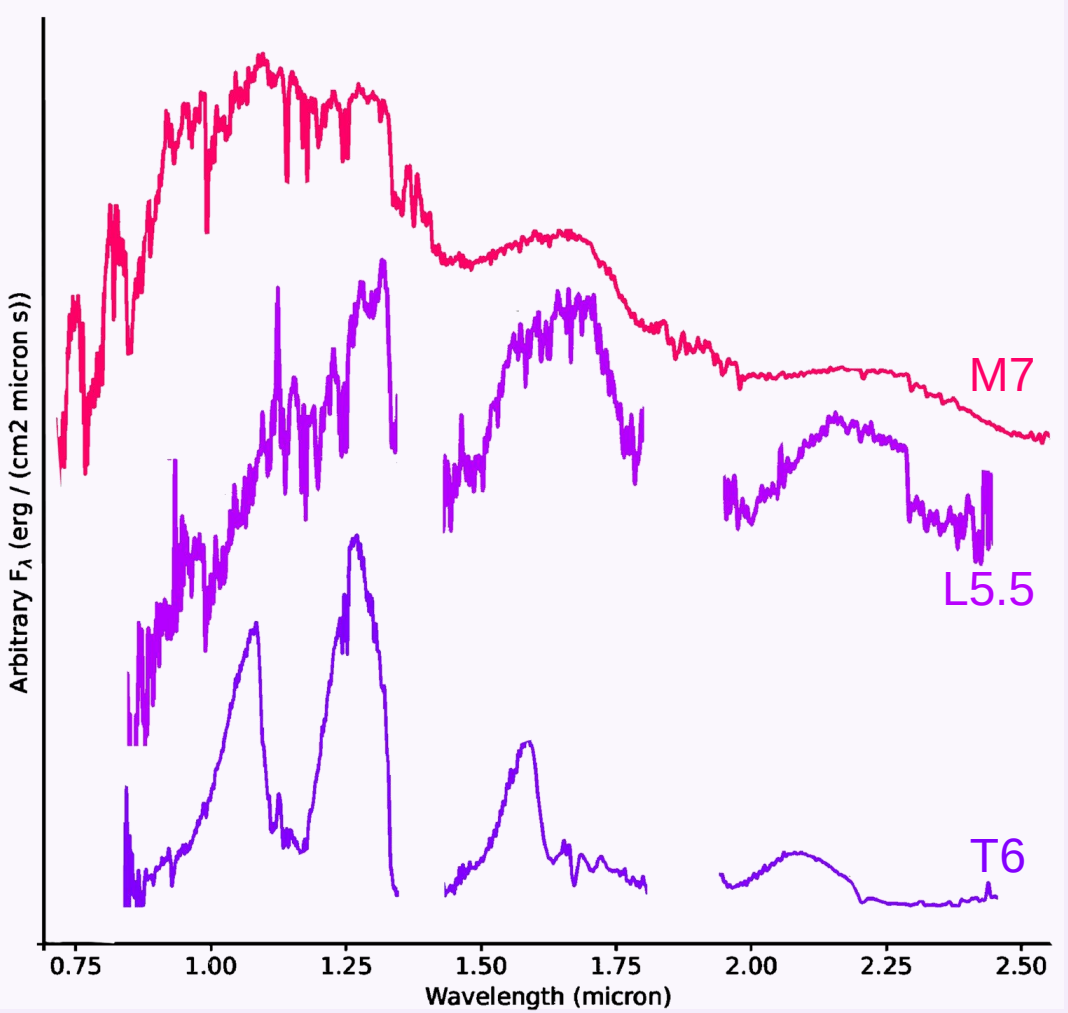
James et al, 2015 • Rayner et al., 2003

DATA REDUCTION



SPECTRAL CLASSIFICATION

- Spectral type correlates with what the spectrum looks like
- Spectroscopic classification uses spectral shape and features



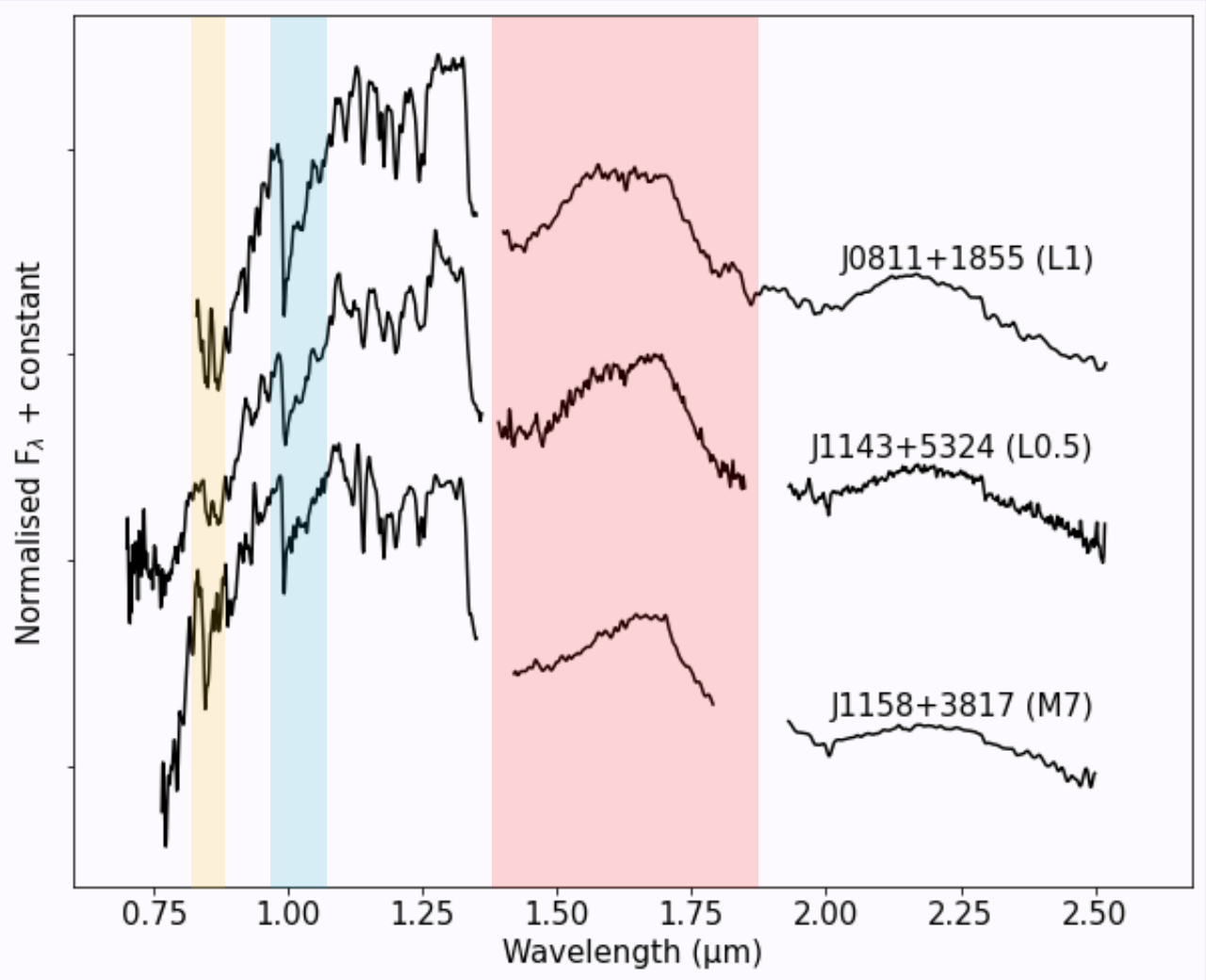
SPECTRAL CLASSIFICATION

- Python module `Splat` used to spectroscopically classify each object
- Classify by standard – compare spectrum with standard
  - Whole spectrum vs Kirkpatrick (*J*-band only) classification
- Photometric classification using *2MASS* and *WISE*
- Comparison with published spectral types
- 25 M-types, 23 L-types, 2 T-types

Burgasser et al. 2017 • Skrzypek et al., 2015

PLOTS!

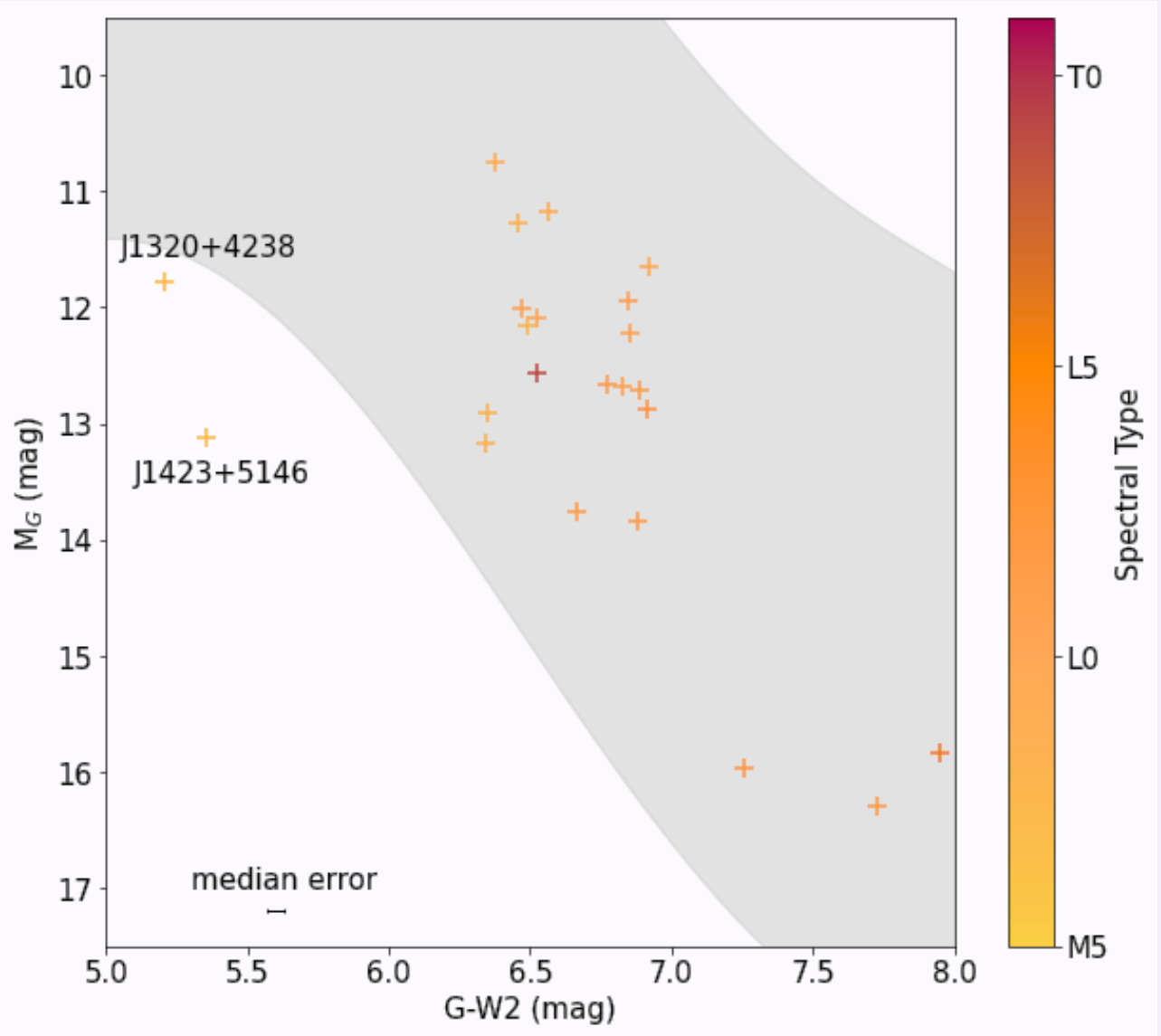
- Spectral plots
  - Look for anything that looks interesting or out of sequence
  - Signs of low gravity
    - Triangular *H*-band
    - Strong FeH and TiO features



Allers & Liu, 2013 • Almendros-Abad et al., 2022

PLOTS!

- Colour-magnitude plots
  - Shaded area is locus around template made using Gagné list of UCDs
  - Most objects within shaded region



Gagné, 2014

YOUNG, DISC, BINARY?

Spectral Type	Young	Disc	Binary
M-type	1	4	4
L-type	7	6	3
T-type	0	0	1
Total	**8**	**10**	**8**

FUTURE WORK...

- Calculate temperatures for each candidate
- Calculate radial velocities for SXD data

IN SUMMARY...

- Find candidates in *Gaia* DR2 and cross-match with known UCDs
- Observations with ARCoIRIS and SpeX
- Data reduced in order for spectral types to be classified
- Classified 25 M-types, 23 L-types and 2 T-types
- Spectral and colour-magnitude plots to find interesting objects
- Use spectra and other published parameters to identify possible young, disc or binary objects
- Future work: calculate temperatures and radial velocities

THANK YOU ☺

GEMMA CHENG • G.J.CHENG@HERTS.AC.UK