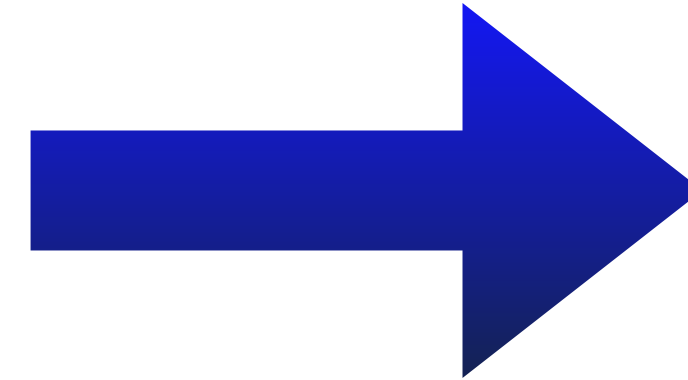




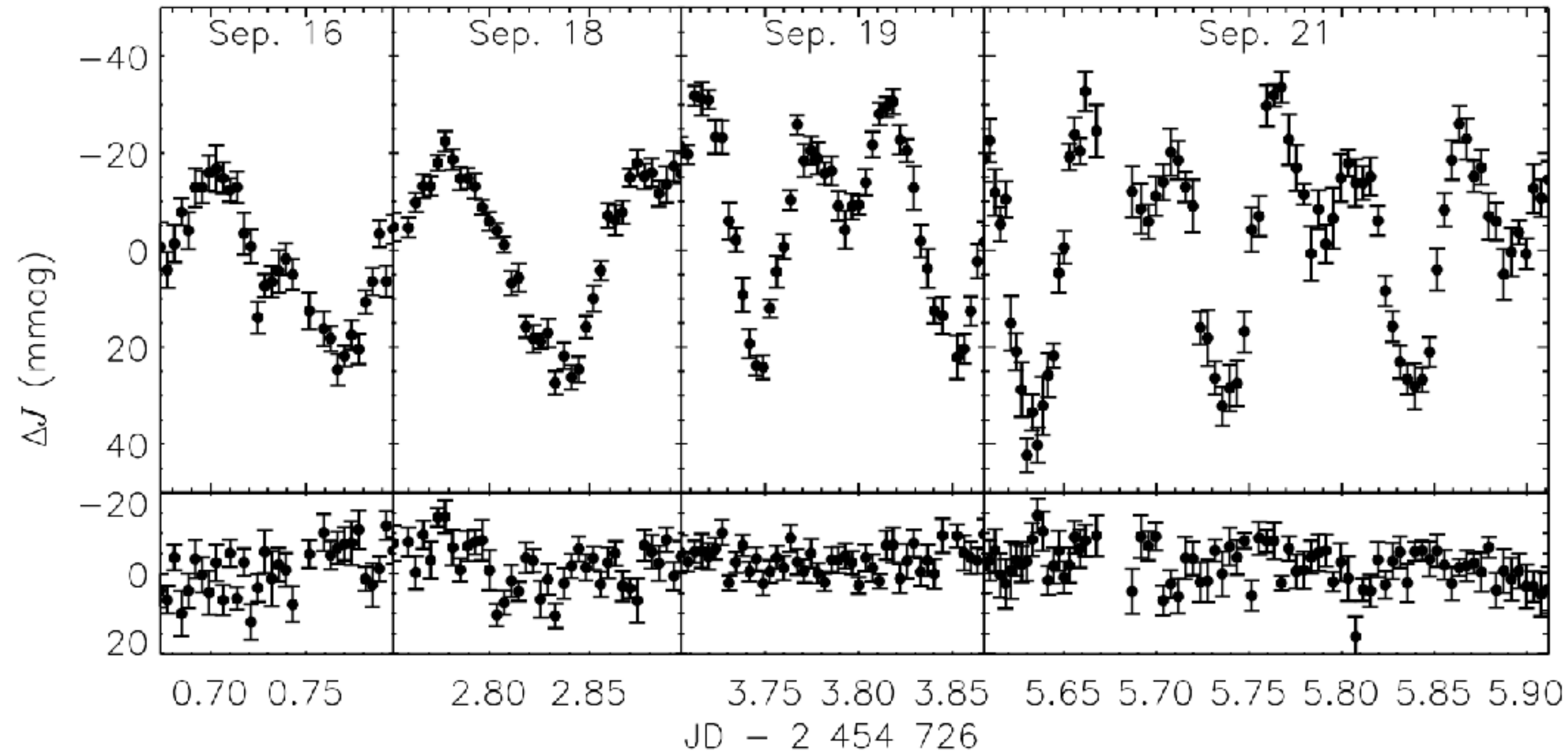
Weather Patterns on Exoplanet Analogues: A Survey for Variability in Low-Gravity Brown Dwarfs

Johanna M. Vos, Beth A. Biller, Mariangela Bonavita,
Simon Eriksson, Michael C. Liu, William M. J. Best,
Stanimir Metchev, Jacqueline Radigan, Katelyn N. Allers,
Markus Janson, Esther Buenzli, Trent J. Dupuy, Mickaël
Bonnefoy, Elena Manjavacas, Wolfgang Brandner, Ian
Crossfield, Niall Deacon, Thomas Henning, Derek Homeier,
Taisiya Kopytova and Joshua Schlieder

Atmospheric Features
+
Rapid Rotation

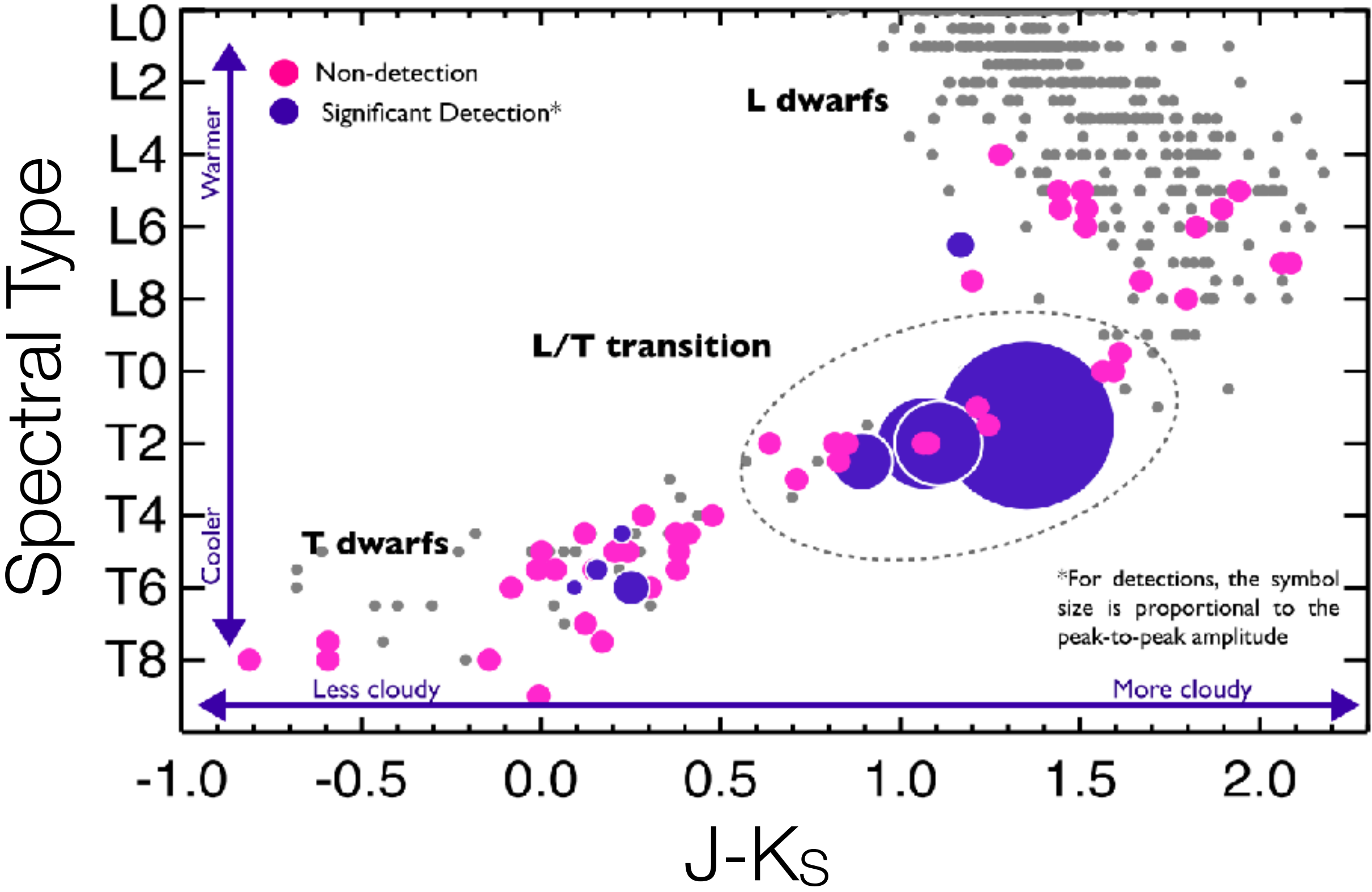


Photometric Variability

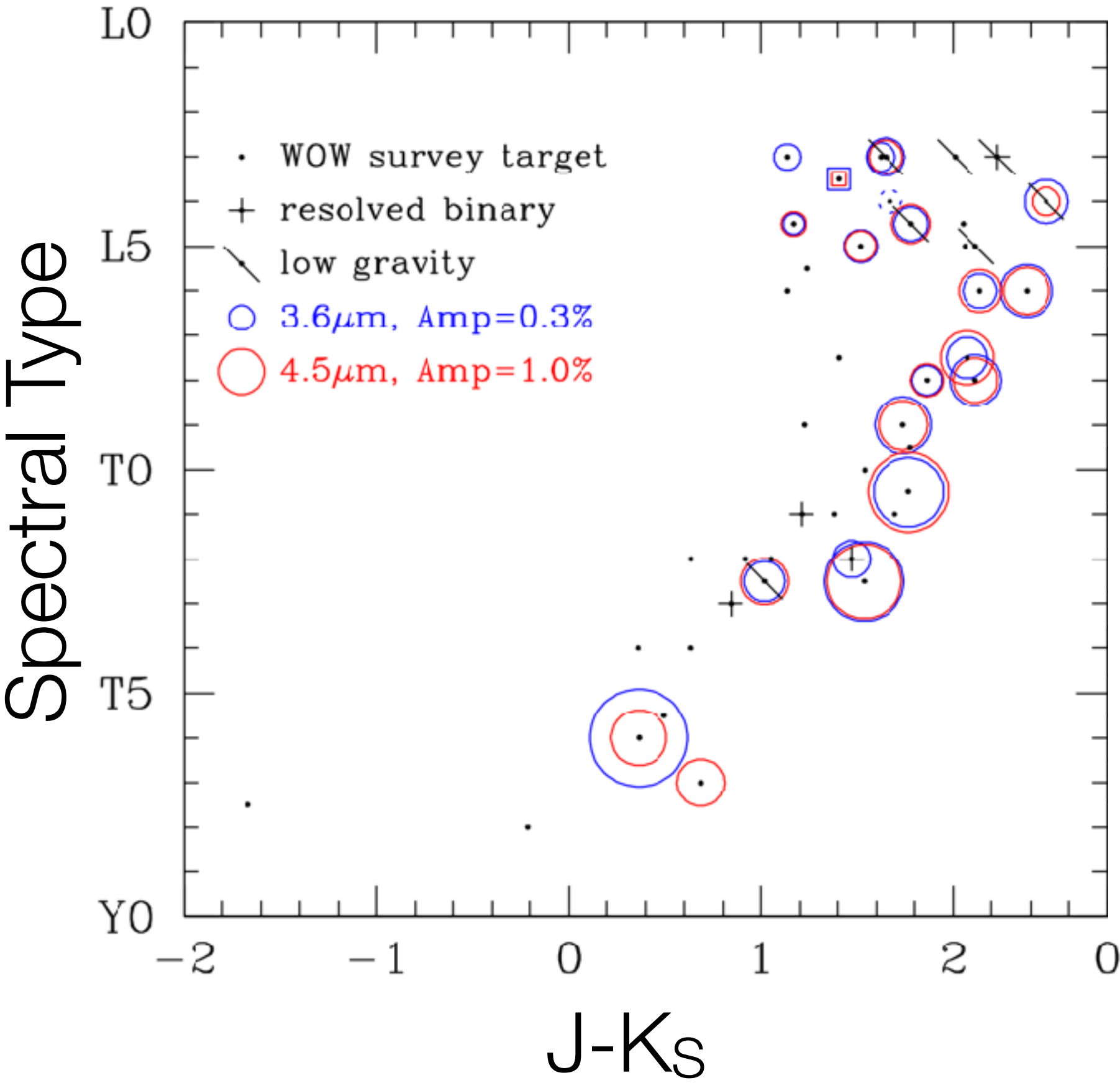


SIMP 0136
Artigau et al. 2009

Brown Dwarf Variability Surveys

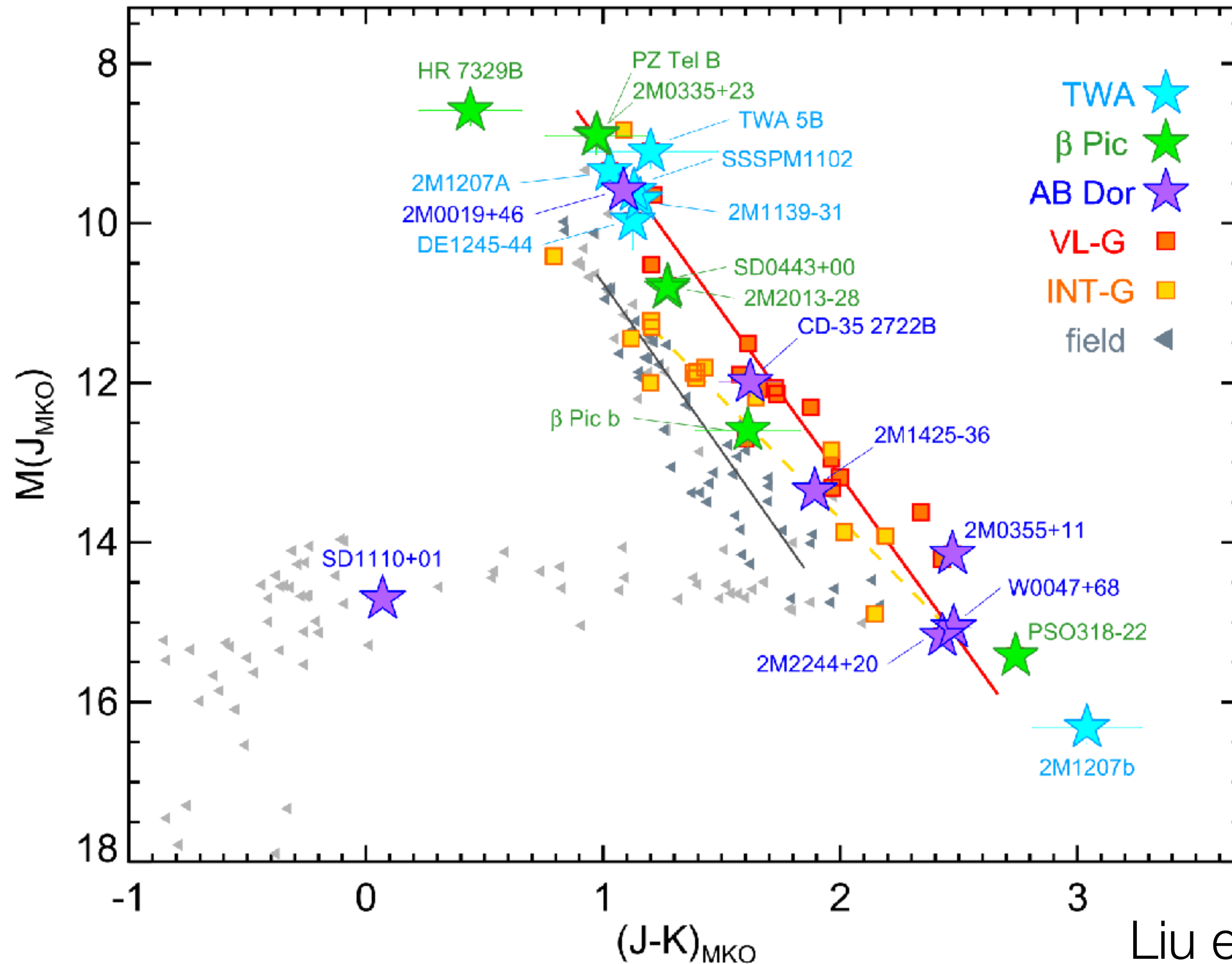


Radigan et al. 2014



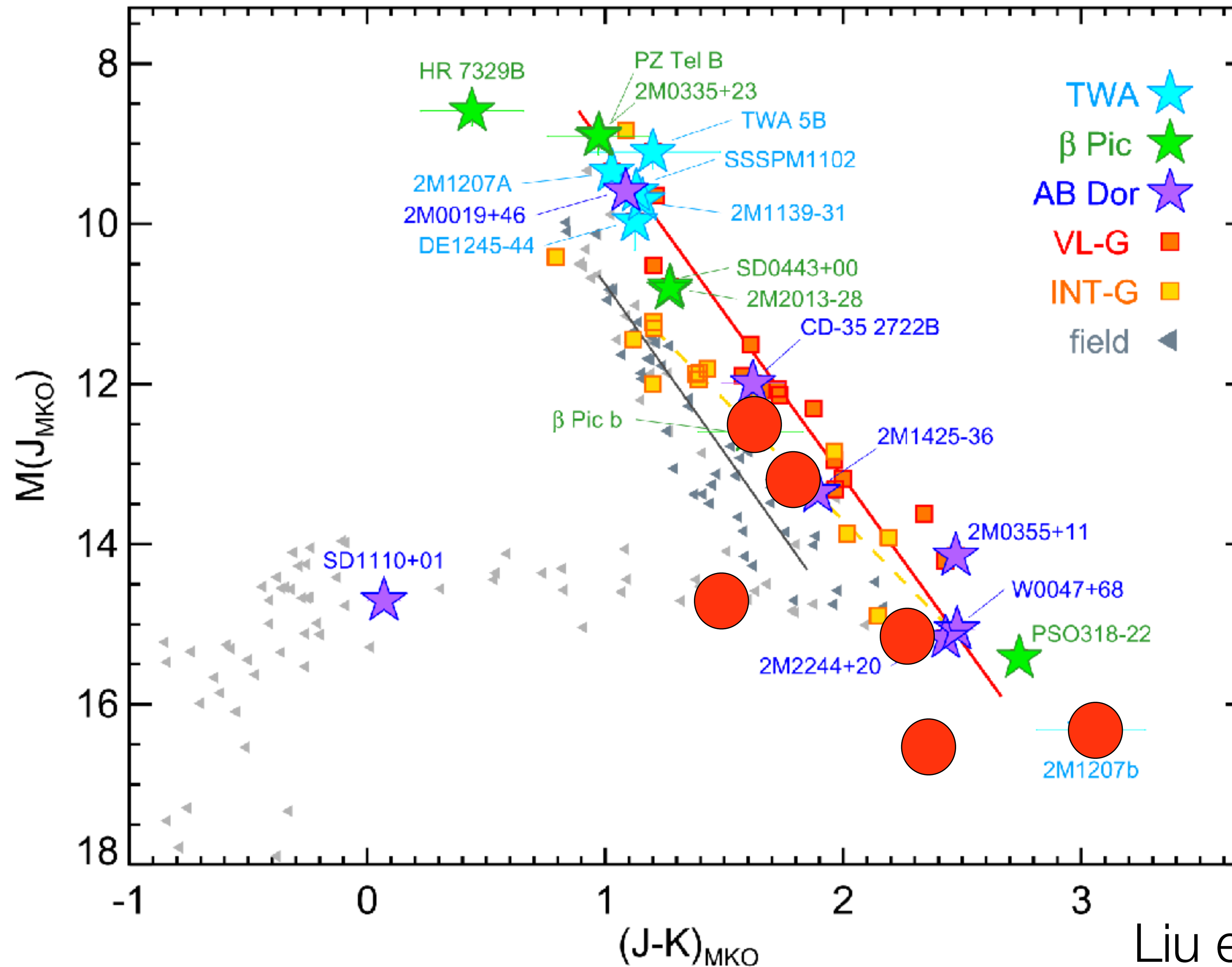
Metchev et al. 2015

Low-gravity brown dwarfs resemble the directly-imaged planets



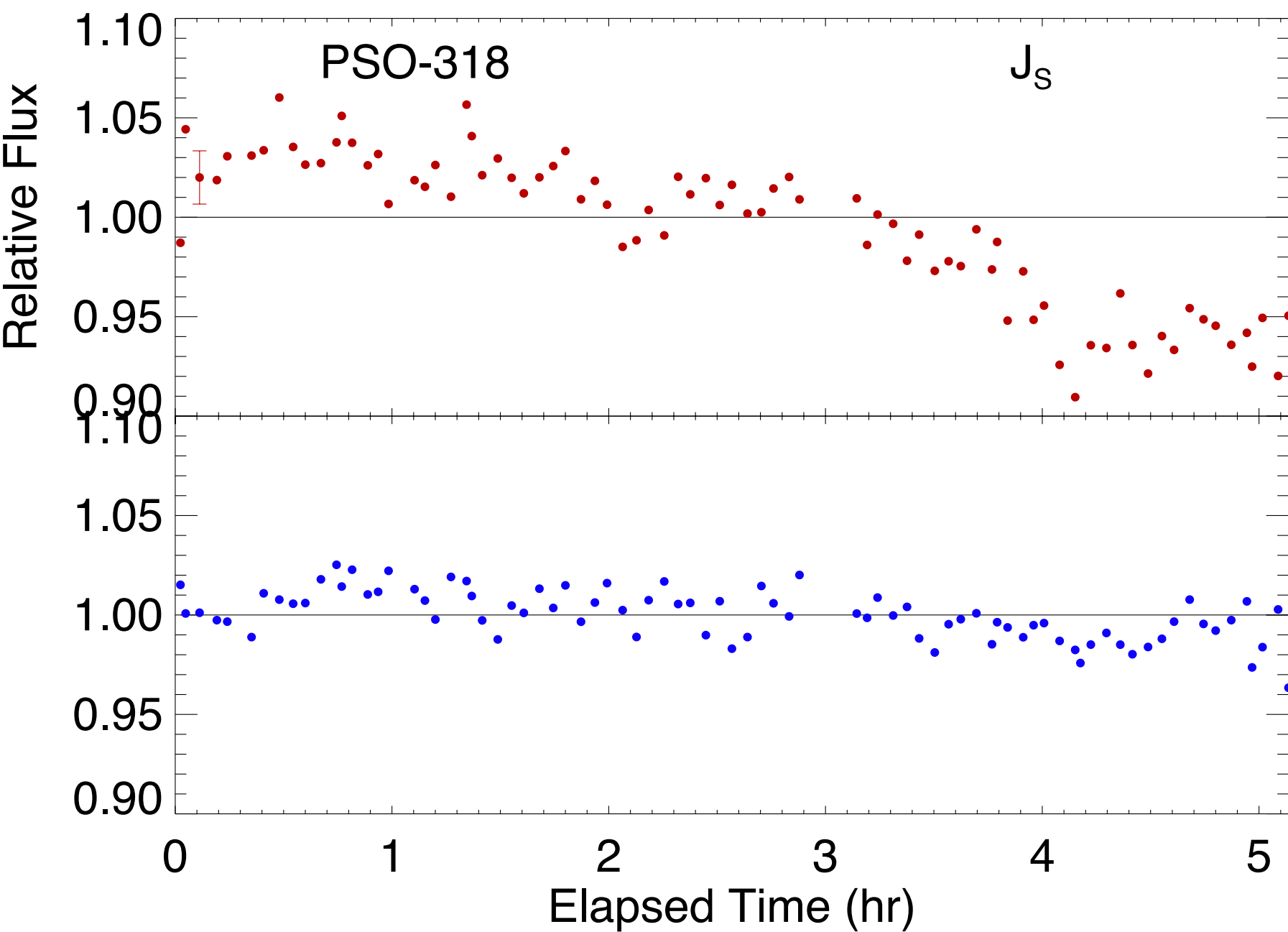
Liu et al. 2016

Low-gravity brown dwarfs resemble the directly-imaged planets



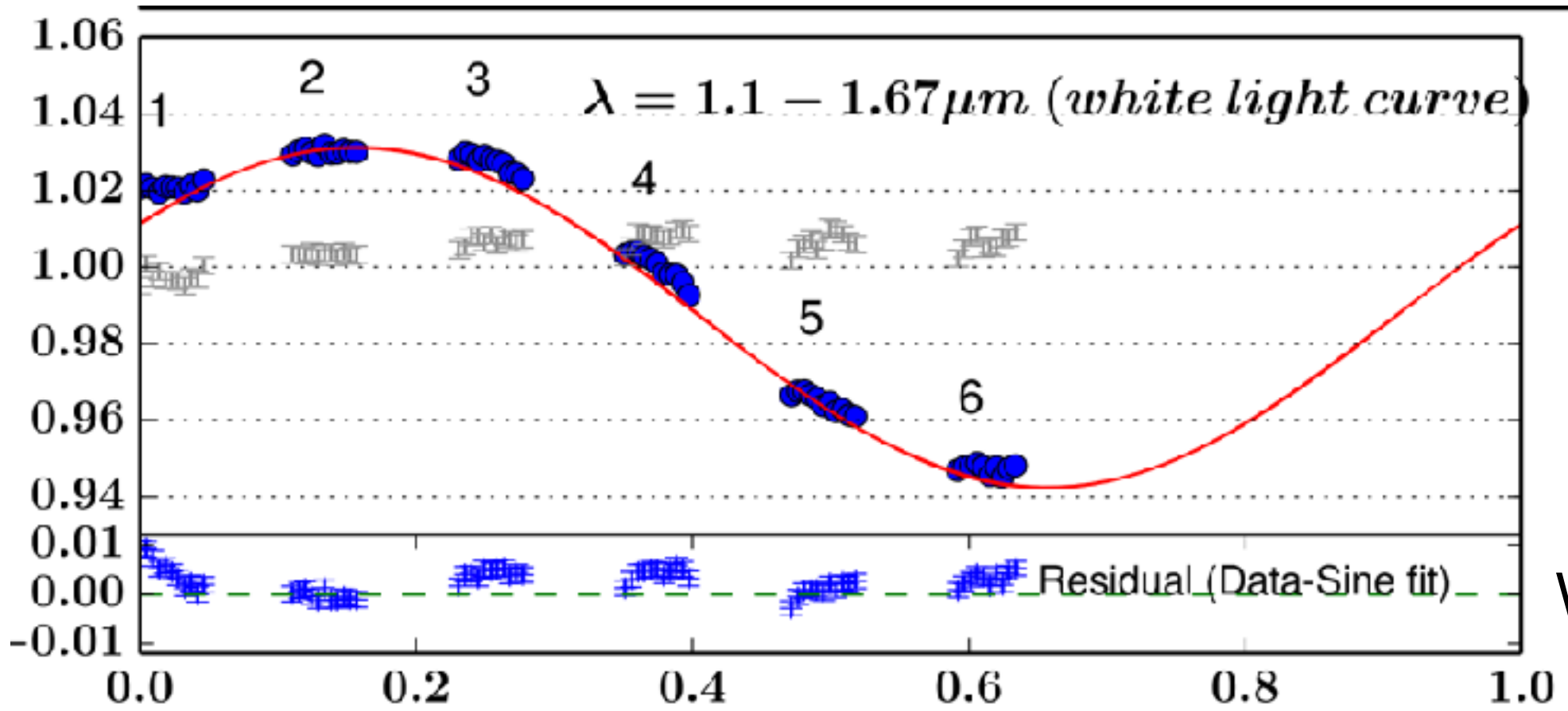
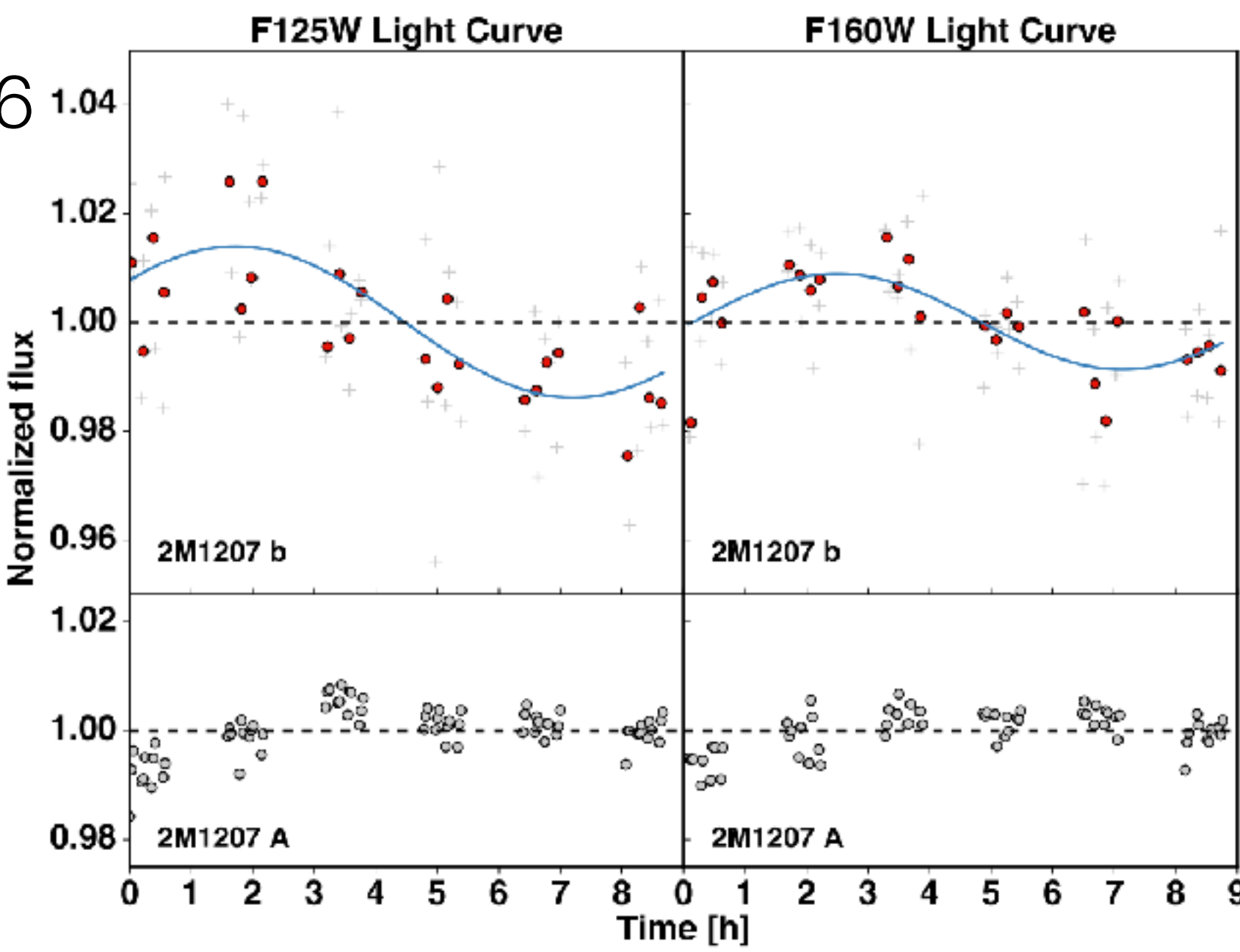
Liu et al. 2016

Variability searches on low-gravity objects



PSO-318 (L7.5); Biller, Vos et al. 2015

2M1207b (L5); Zhou et al. 2016



W0047 (L7); Lew et al. 2016

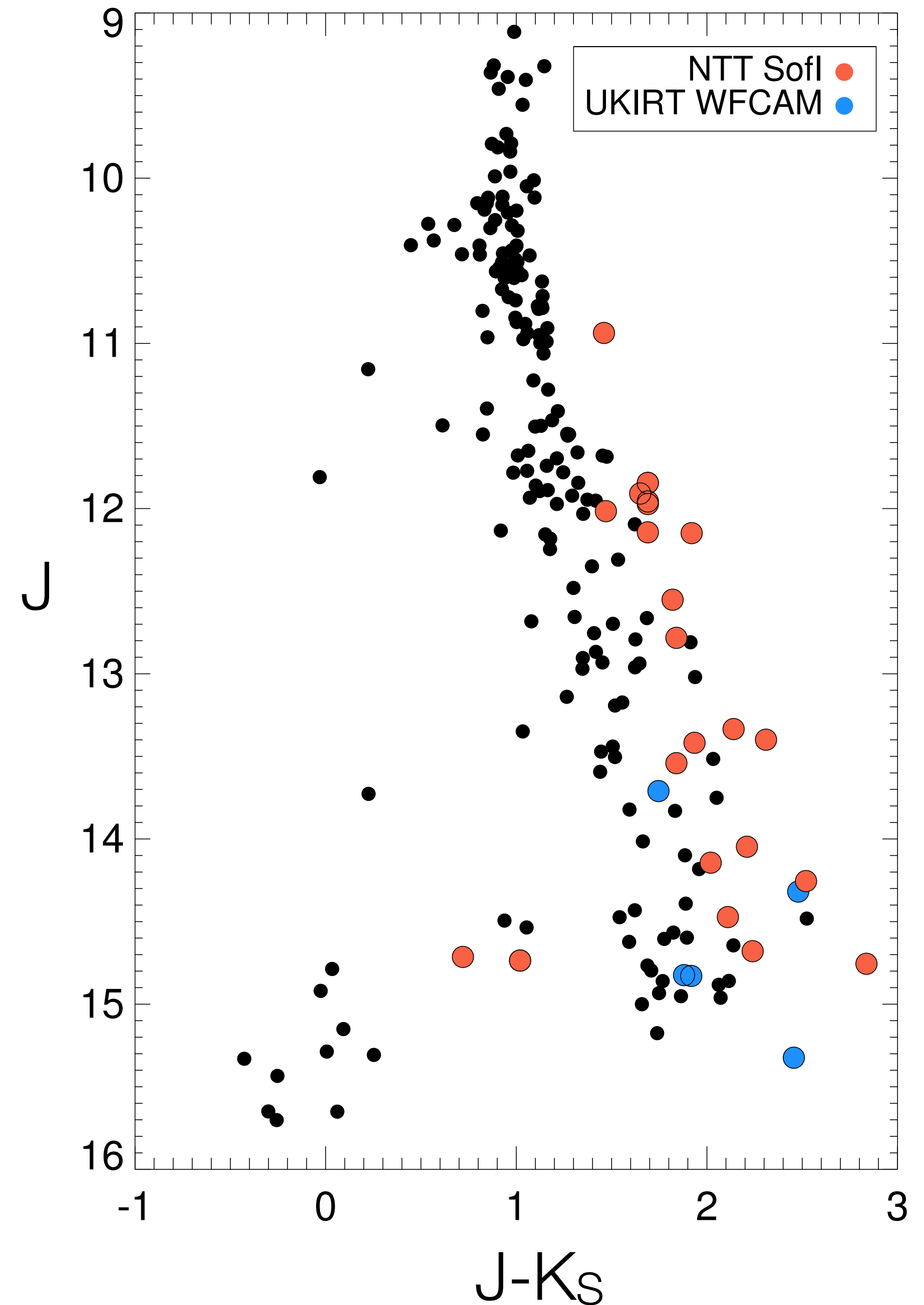
Variability Survey in Low-gravity Objects

Ground-based survey for photometric variability in low-gravity objects using:

- NTT/Sofl J_s -band
- UKIRT/WFCAM J-band

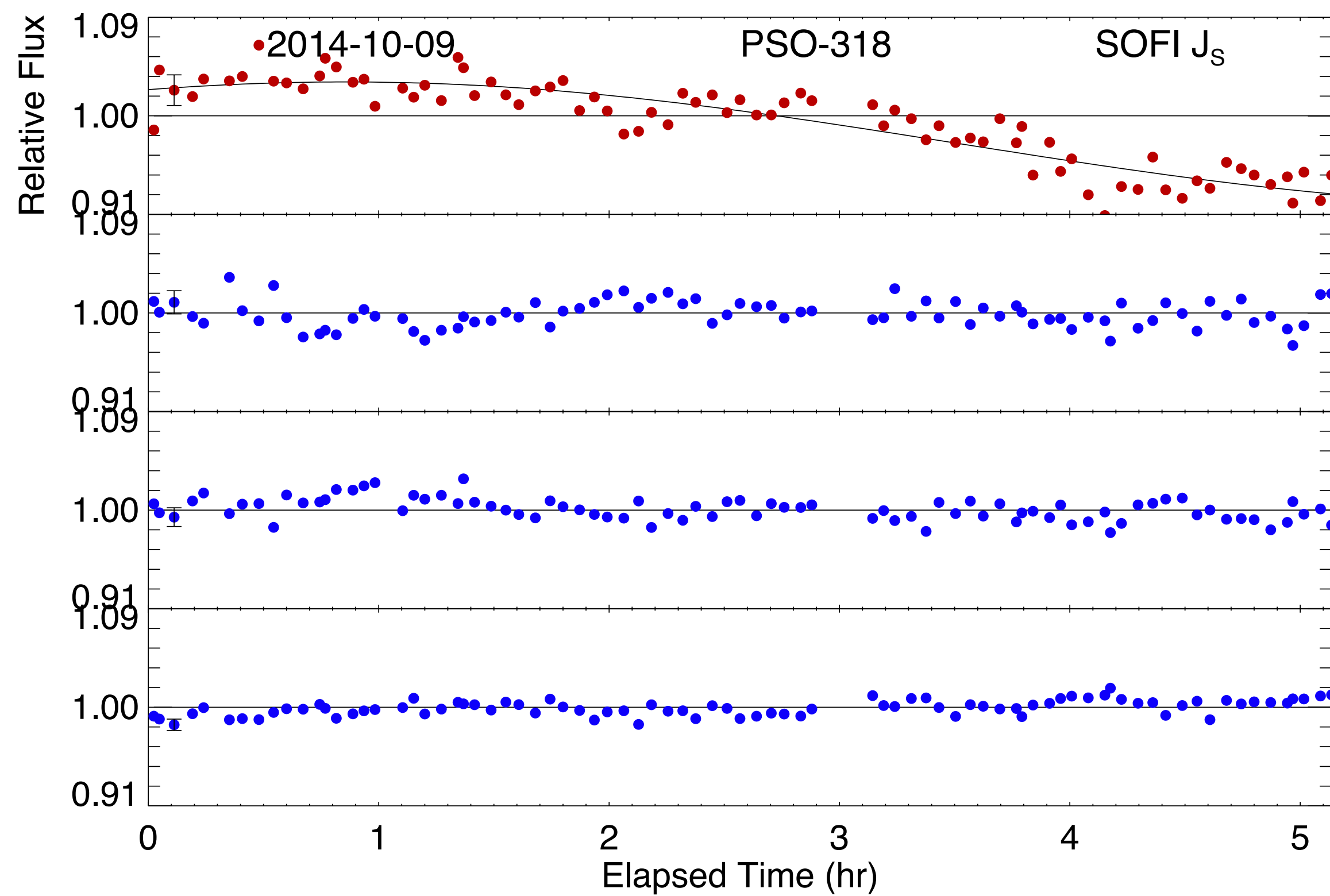
30 objects that are high-likelihood members of young moving groups and/or show signs of low-gravity in their spectra.

3-5 hours observations



Lightcurve Analysis: PSO-318

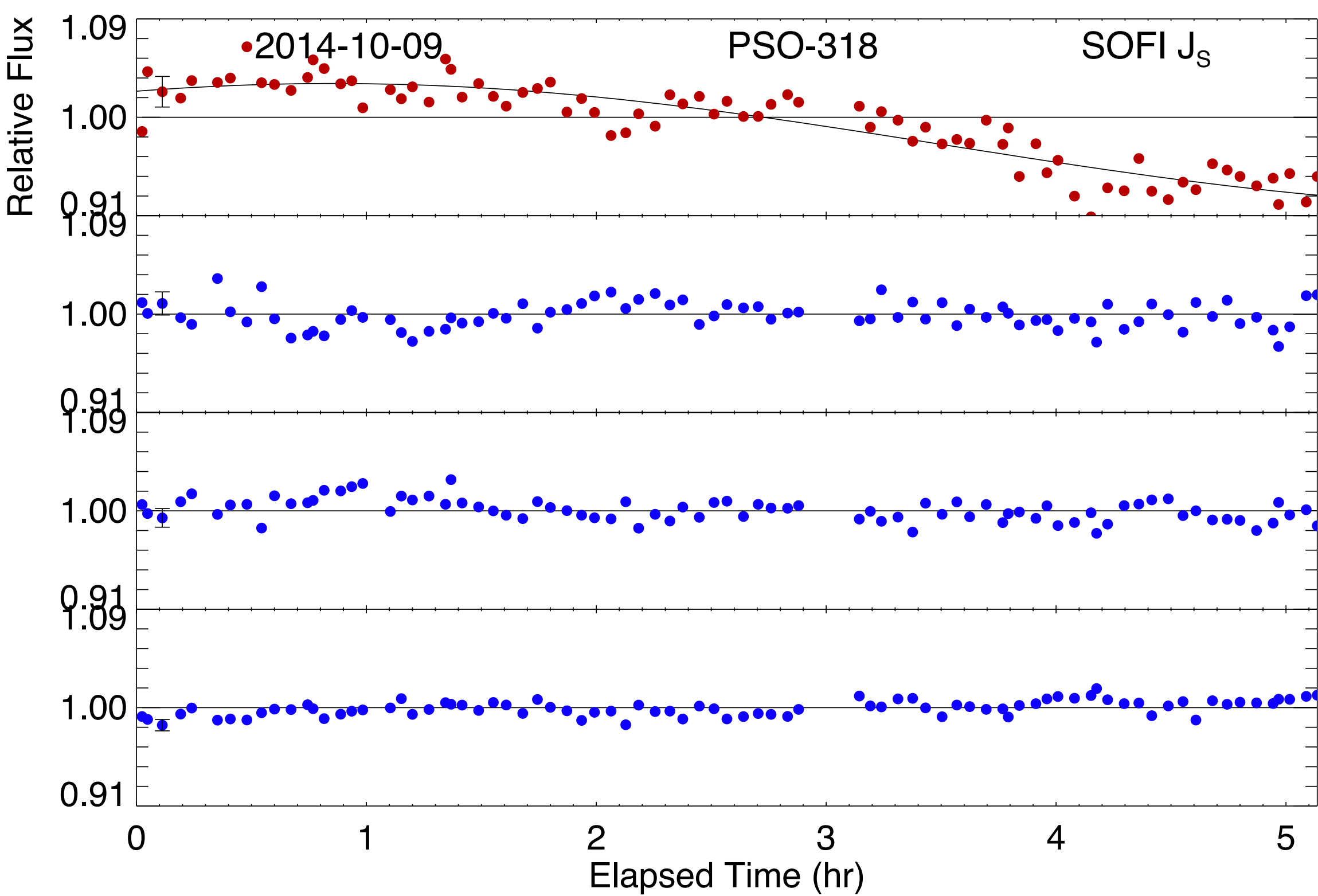
L7.5, 8.3 M_{Jup} object



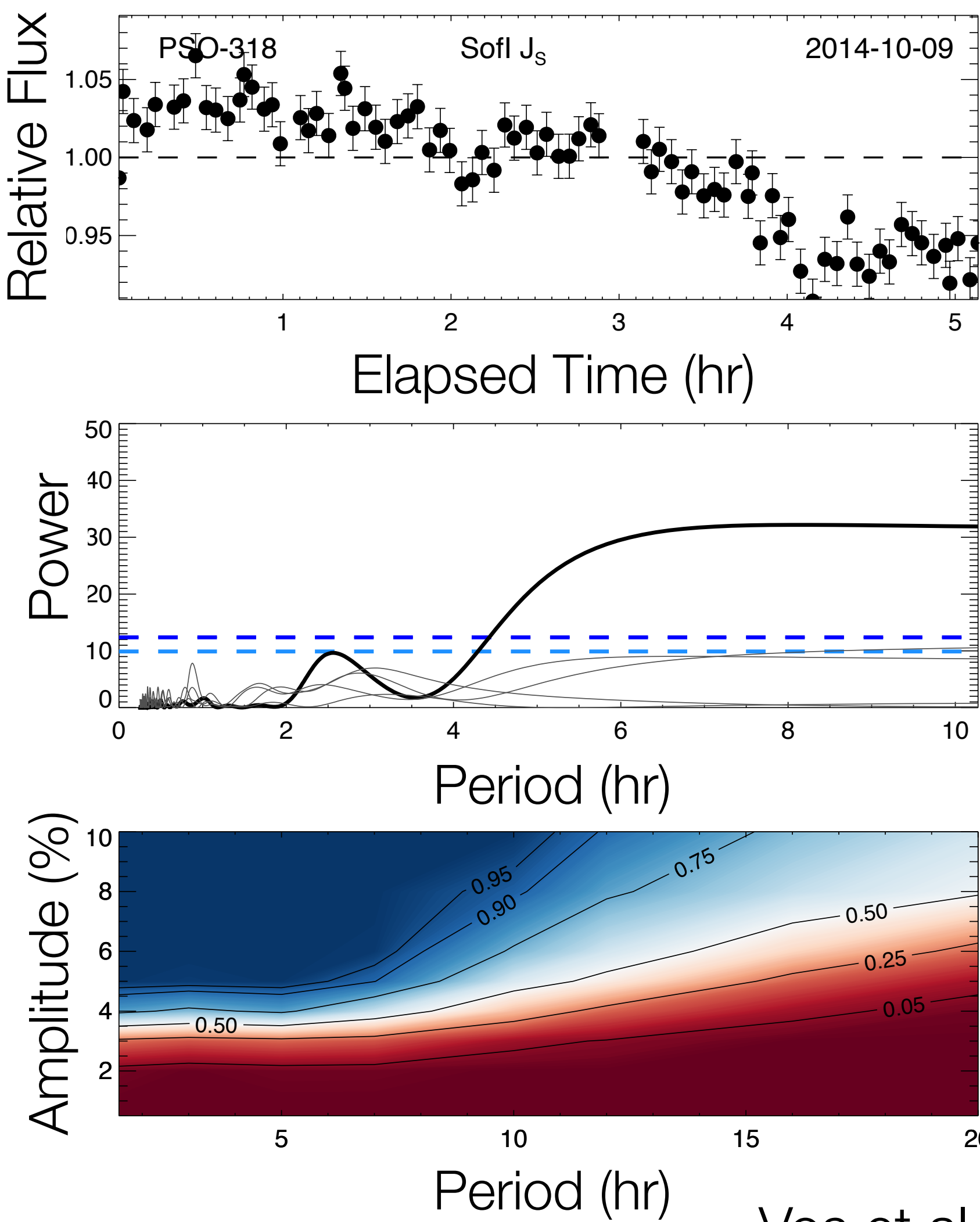
Biller, Vos et al. 2015
Vos et al, submitted

Lightcurve Analysis: PSO-318

L7.5, 8.3 M_{Jup} object



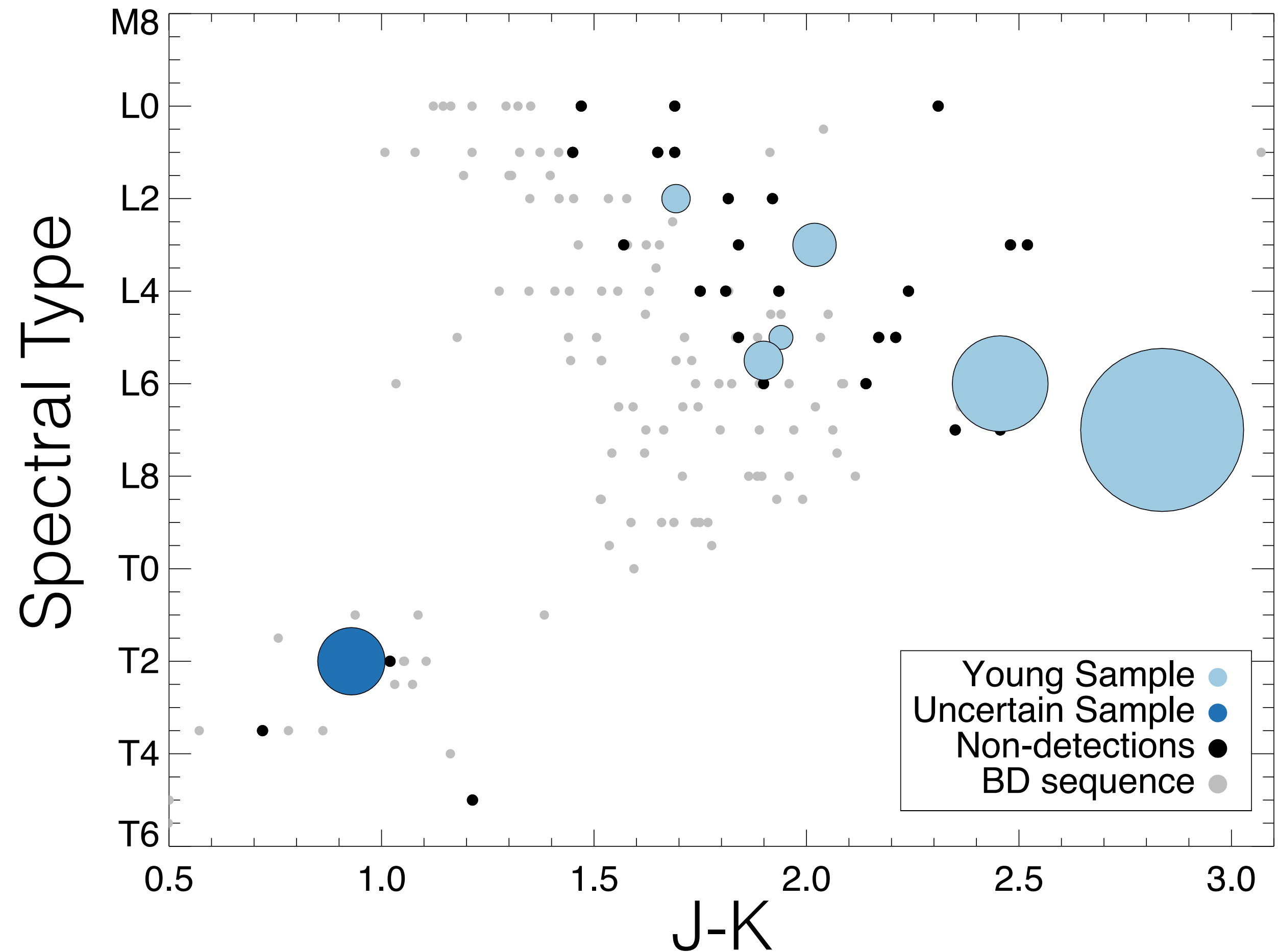
Biller, Vos et al. 2015



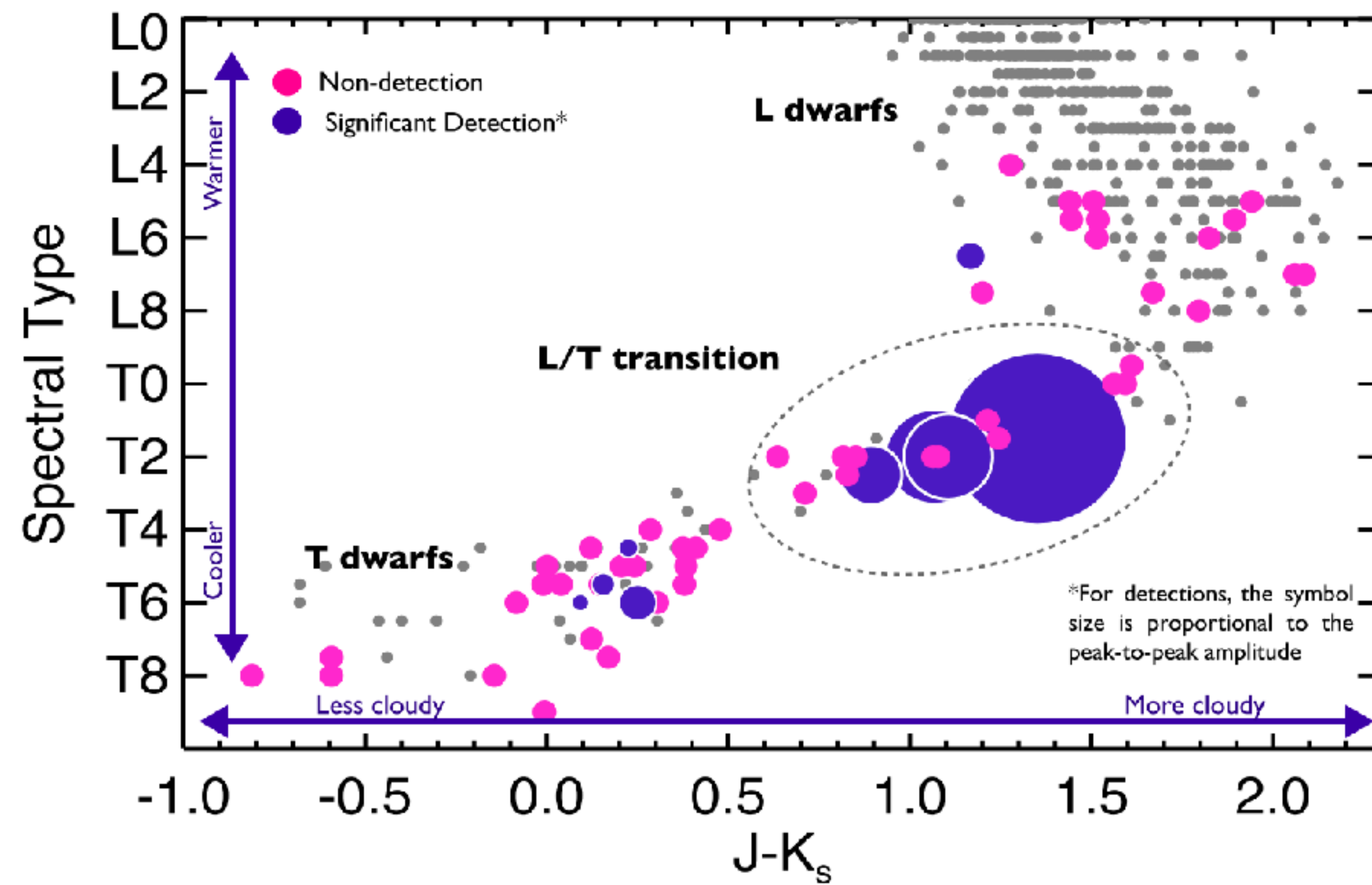
Vos et al. *submitted*

Variability Detections

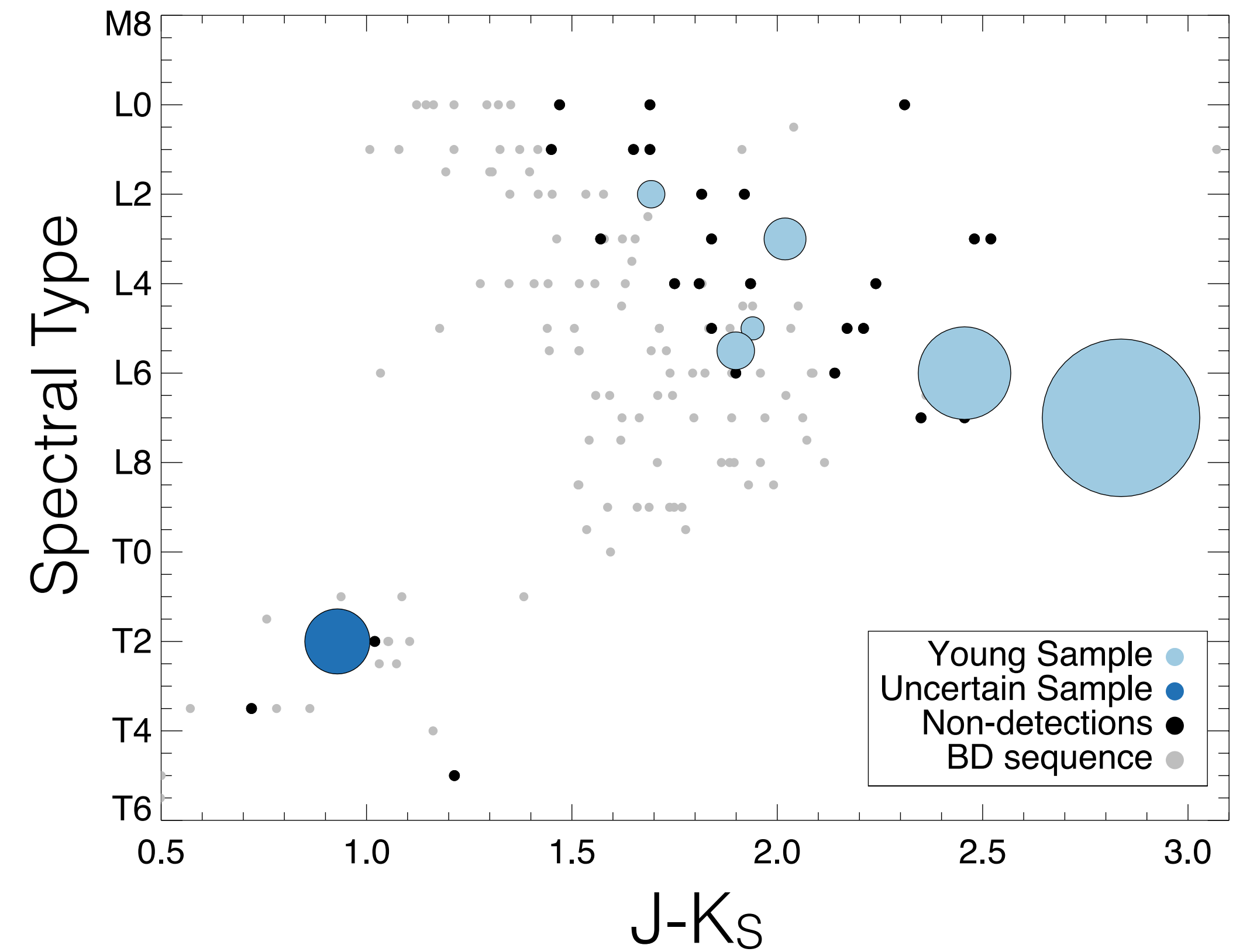
- 6 detections in L-type objects
- Variability amplitude increases with later spectral type
- Prime targets for follow-up observations



Variability Detections



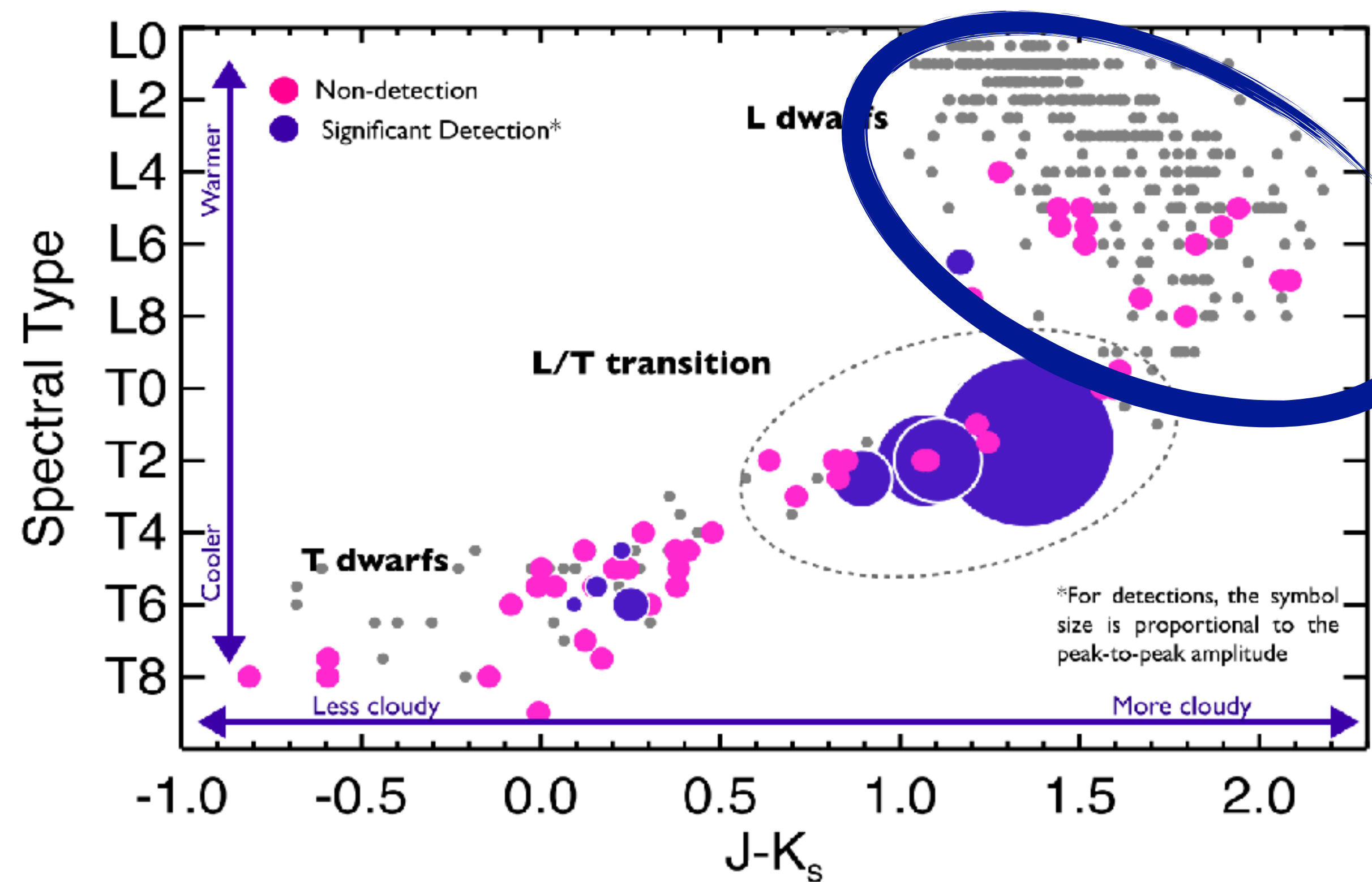
Radigan et al. 2014



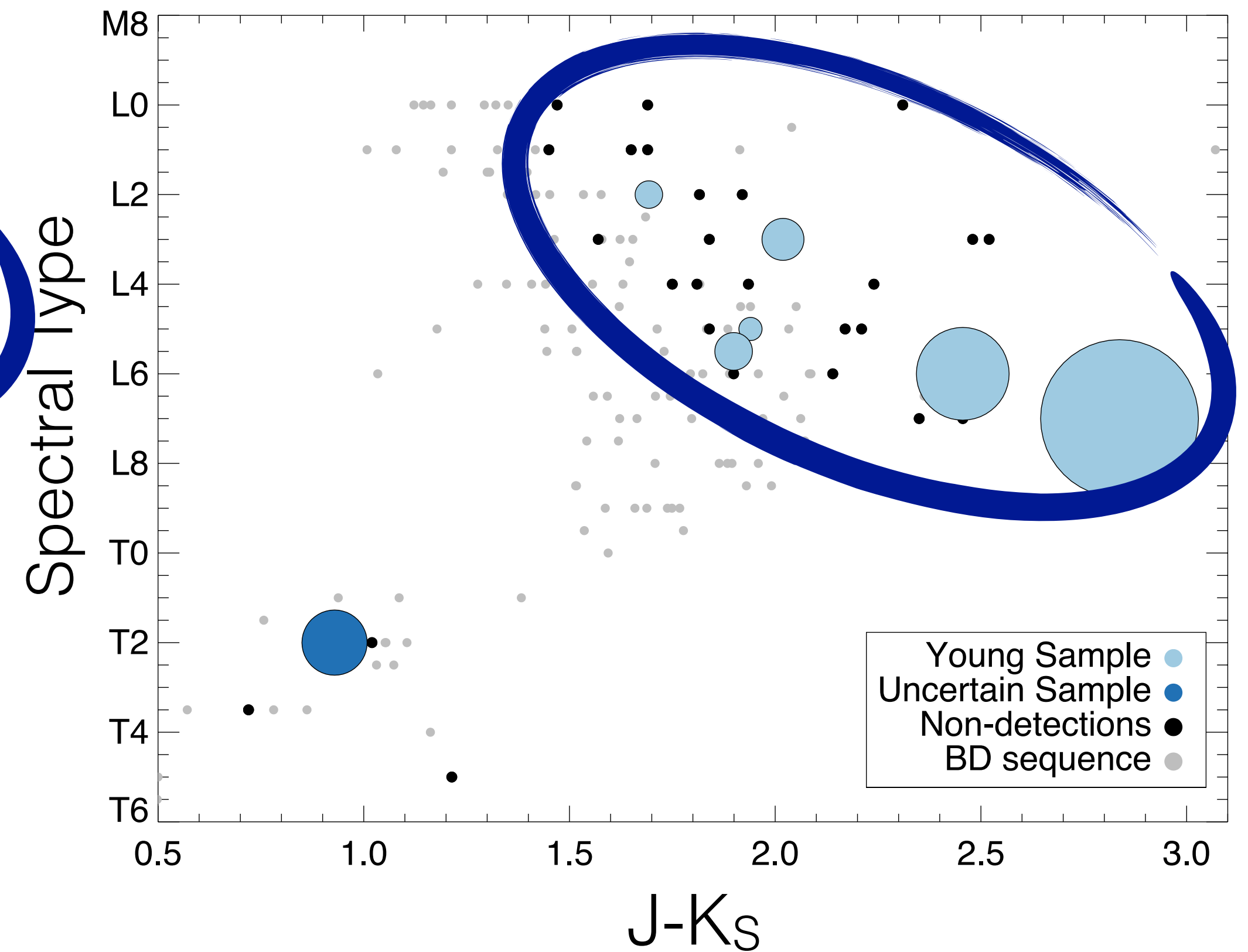
Vos et al. *submitted*

Variability Detections

Comparable sample sizes for L0-L8.5 objects



Radigan et al. 2014



Vos et al. *submitted*

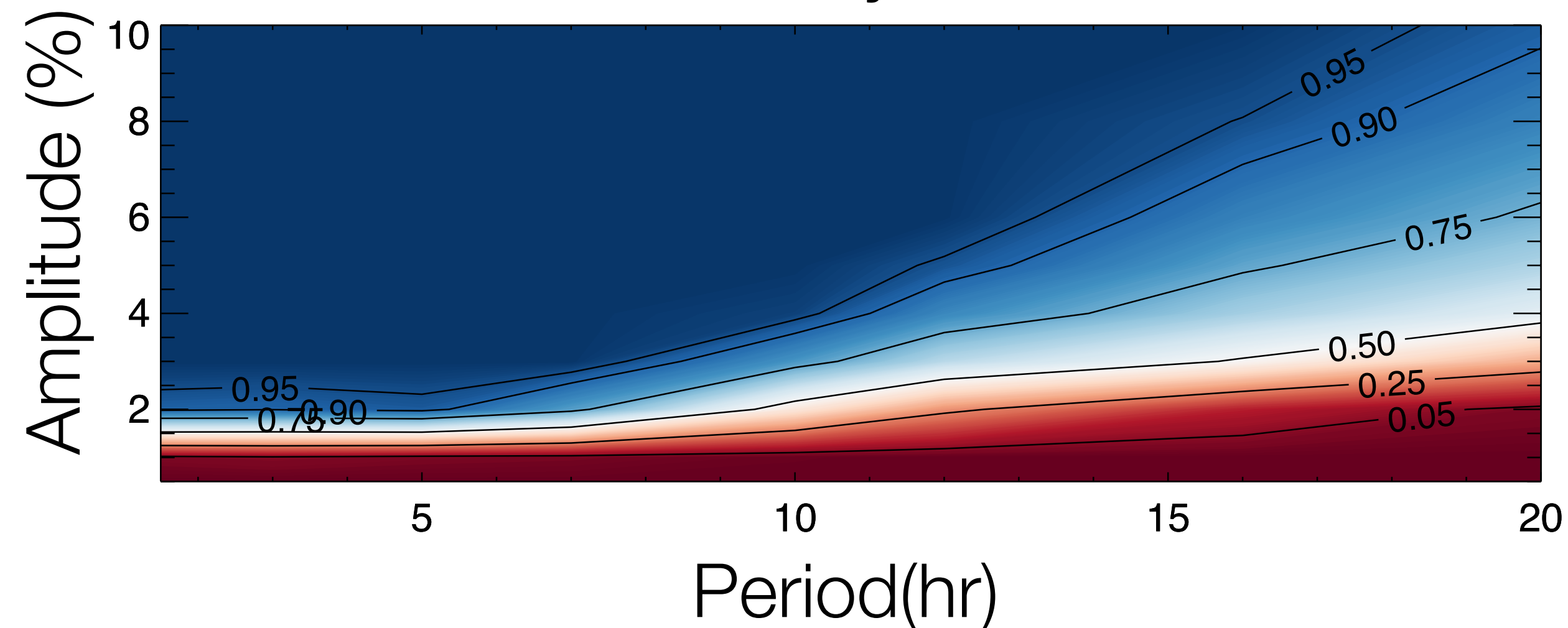
Variability Occurrence Rates in L0-L8.5 Spectral Type Objects

High-gravity Objects: 2/34
(Radigan 2014)

Low-Gravity Objects 6/27
(this work)

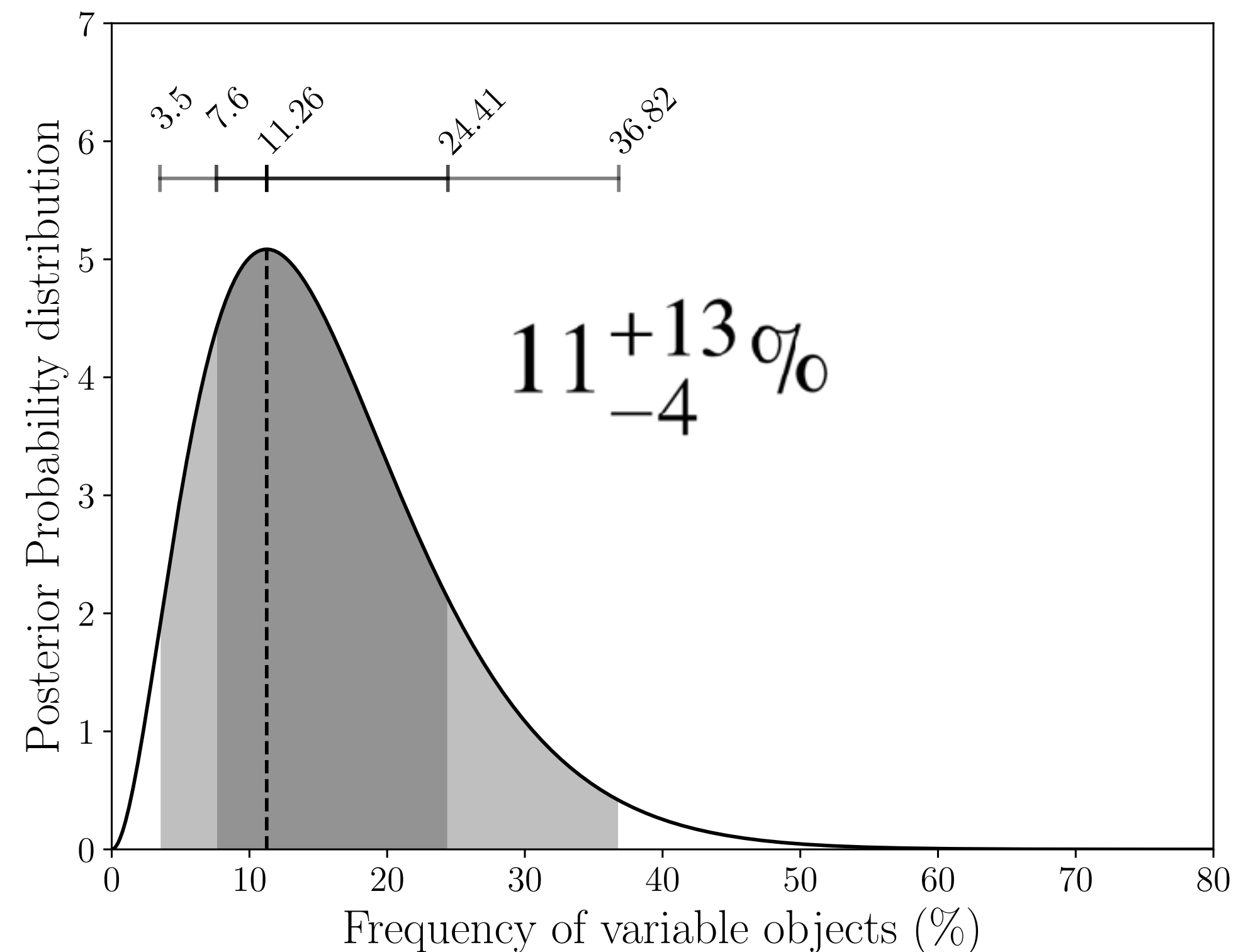
QMESS code: Bonavita et al. 2013

Sensitivity Plot

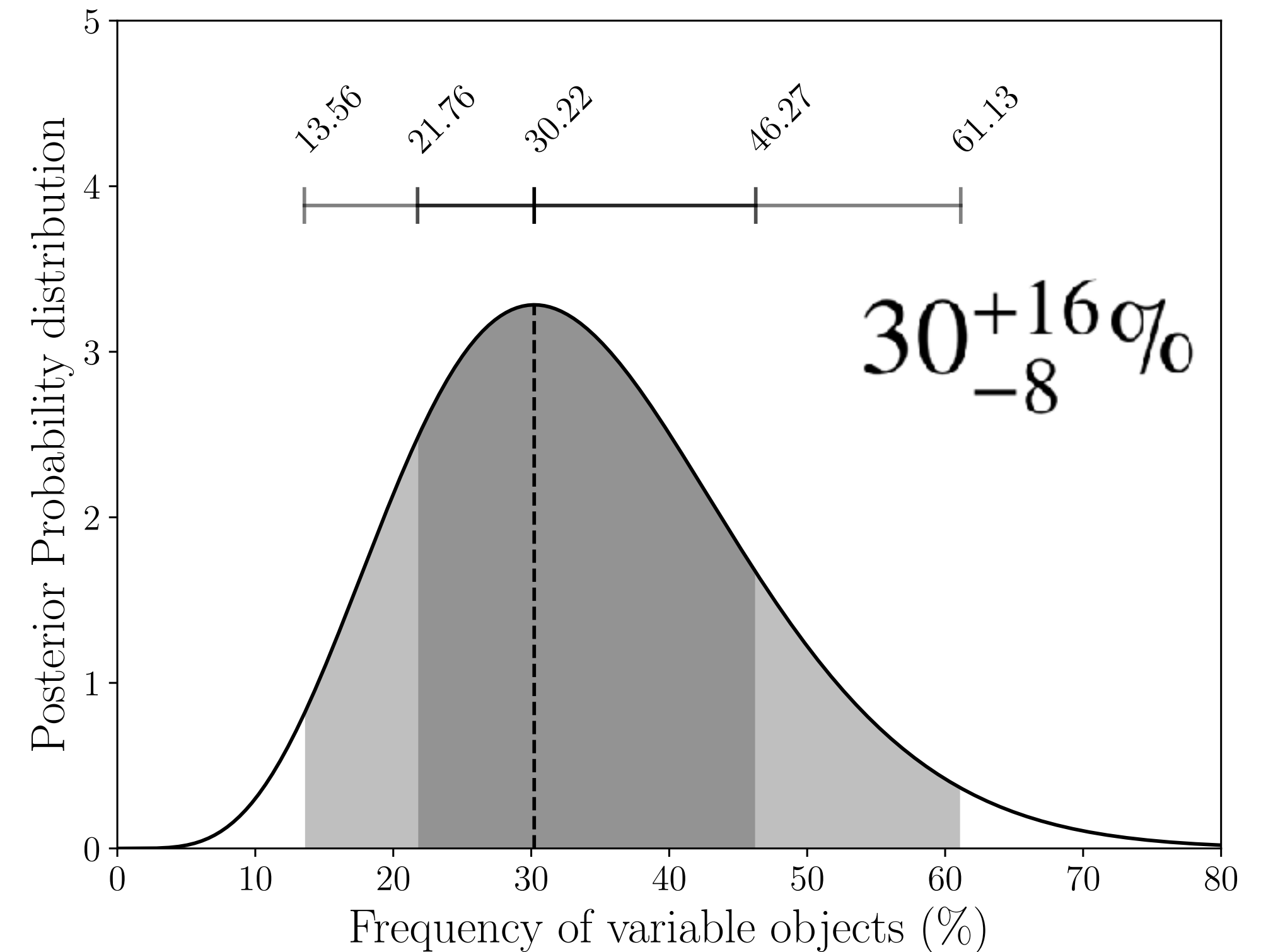


Variability Occurrence Rates Among L0-L8.5 Objects

High-gravity Objects: 2/34
(Radigan 2014)

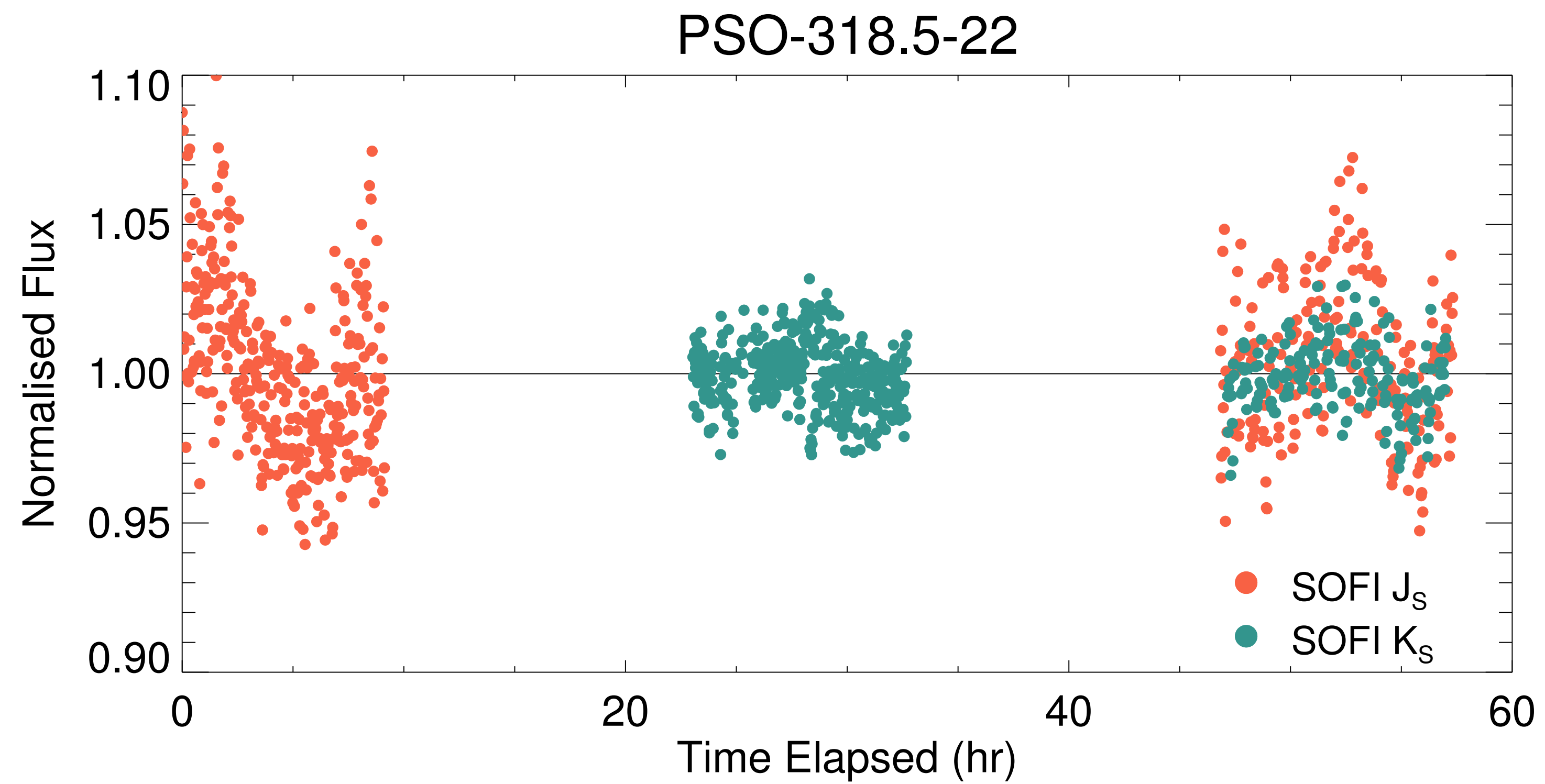


Low-Gravity Objects 6/27
(this work)

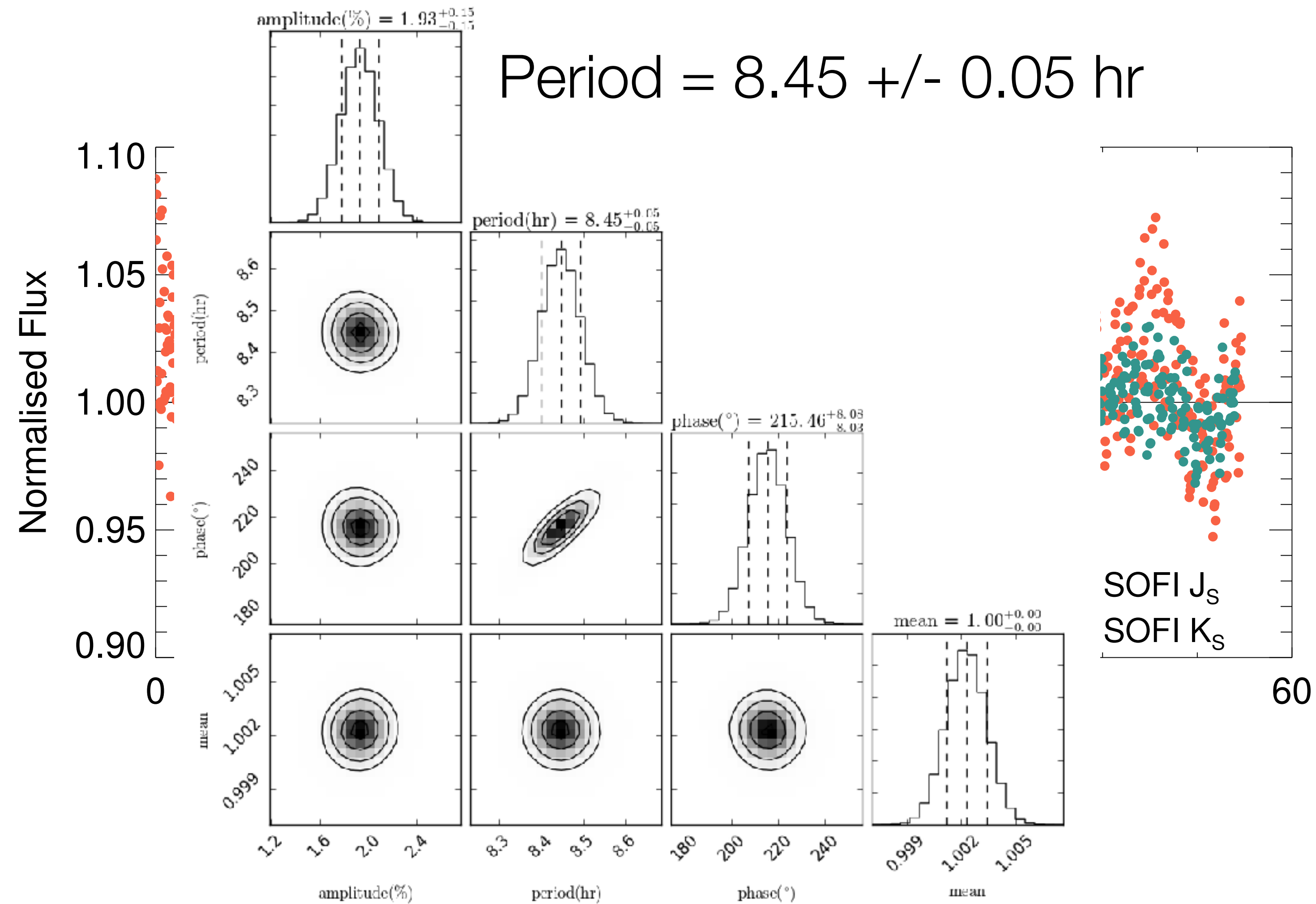


QMESS code: Bonavita et al. 2013

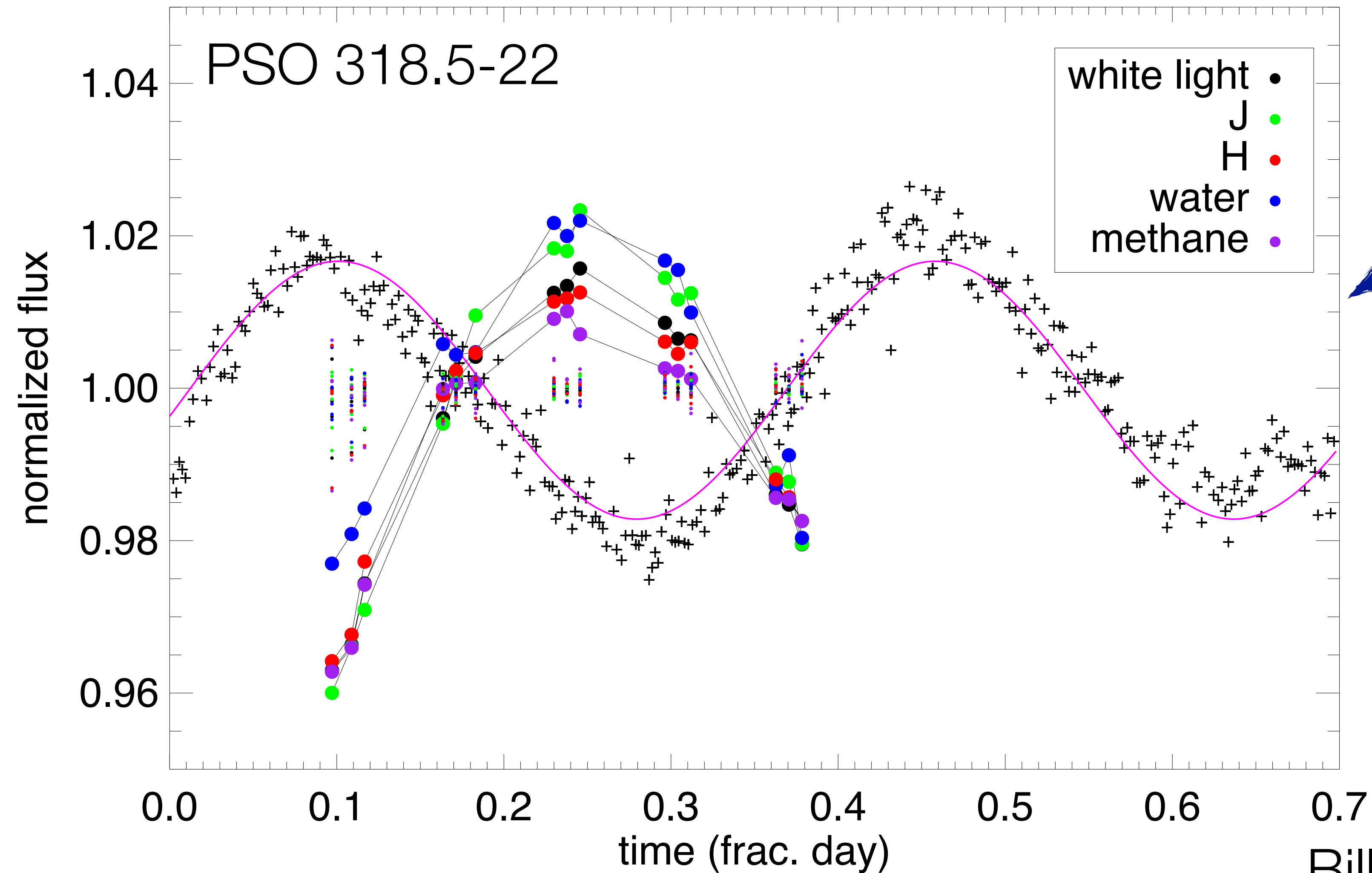
Followup of PSO-318



Followup of PSO-318



Simultaneous HST/Spitzer Followup of PSO-318: Phase shifts between near-IR and mid-IR wavelengths



Conclusions + Future Work

- First large survey for variability on low-gravity objects.
- 6 low-gravity variability detections.
- Prime targets for in-depth characterisation studies.
- Variability occurrence rate among low-gravity L0-L8.5 objects higher than that of high-gravity field objects.

