The latest T dwarfs from the UKIDSS LAS

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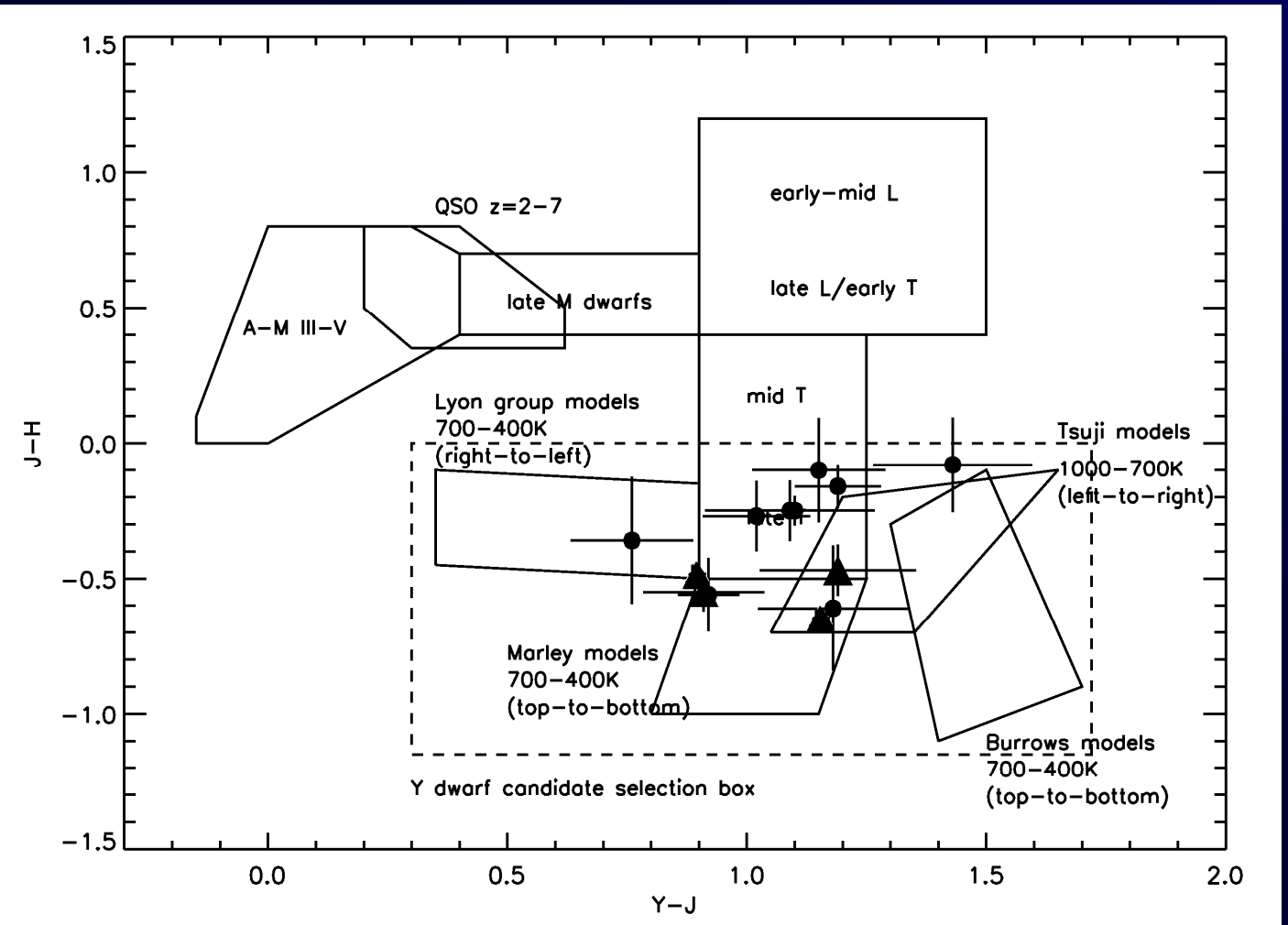
and…
The UKIDSS Cool Dwarf Science Working Group

Full membership list at:
http://star-www.herts.ac.uk/~dpi/cdswg.html

The CDSWG cold brown dwarf search



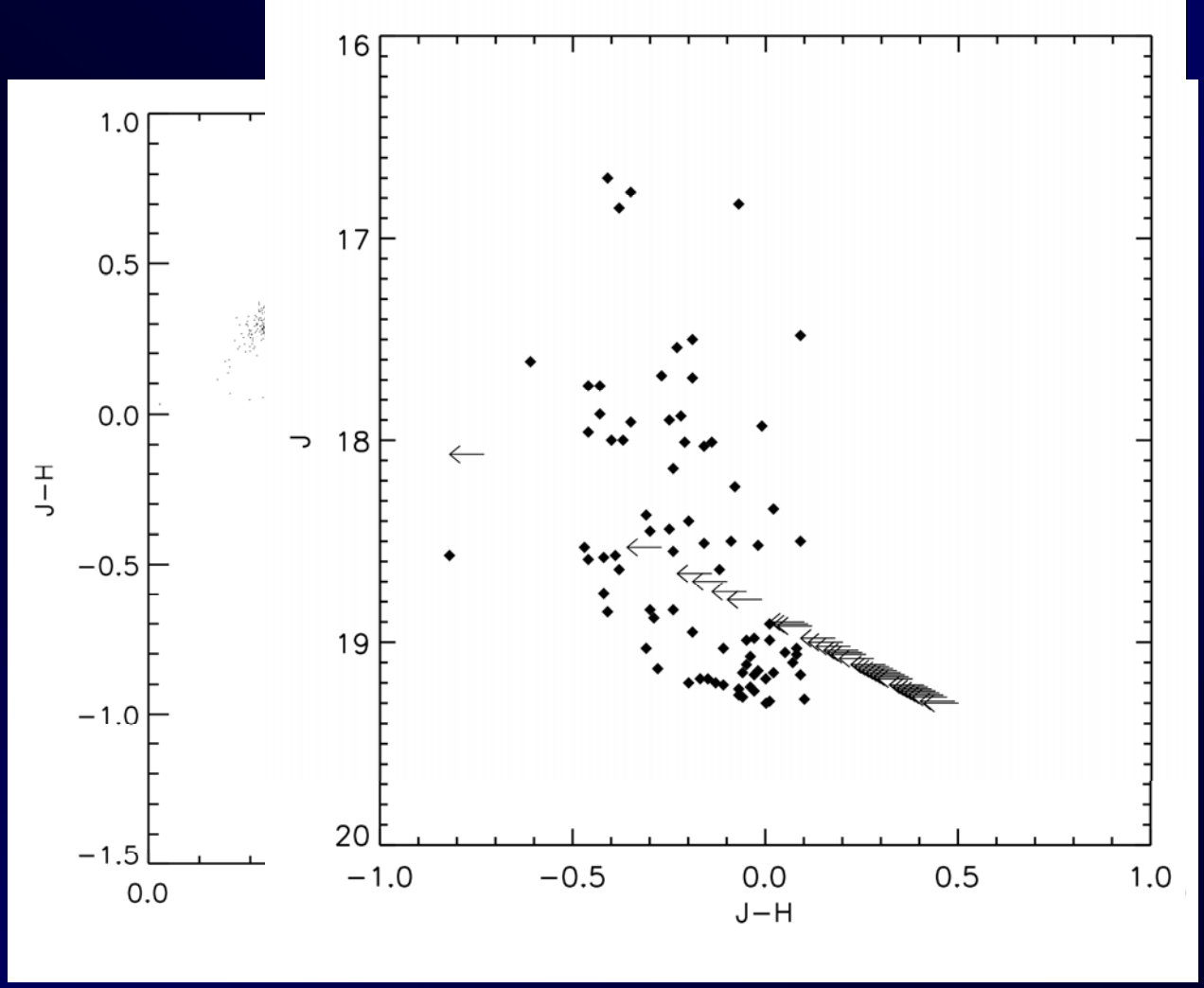
But, H band 5σ limit ≈ 18.5 – so we can probe a volume 10x larger by searching for H+K dropouts, with Y-J > 0.3.

Datamine UKIDSS LAS + SDSS:
- **near-IR colours (see box)**
- **optical near-IR colours/limits**

Follow-up 1: Photometry to fill in gaps/improve limits (NIR + optical)

Prioritise

Follow-up 2: 8m NIR spectroscopy

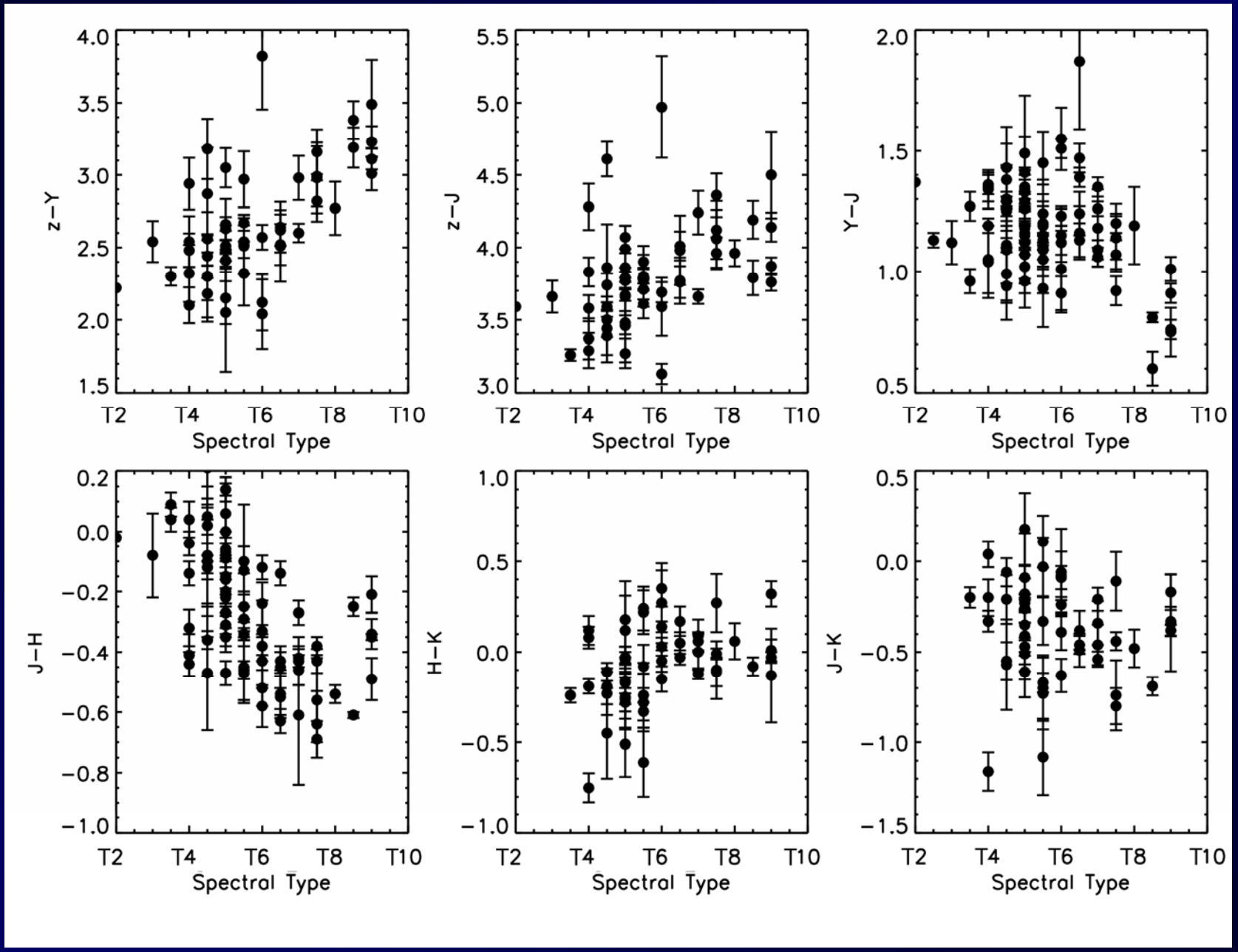


- *J-H <0.1; J-K* < 0.1
- Or Y-J > 0.5 and *H&K* non-detection
- *z'-J* > 2.5 or SDSS non-detection

- YJH(K) selection catches 1 candidate per ~10 sq degs
- YJ-only selection adds 2 candidates per ~30 sq deg
- Follow-up optical + near-IR photometry eliminates contamination

- Spectral types then confirmed using Gemini-N and Subaru
- ~85 T dwarfs now confirmed in the LAS sky
  - 7 T8+ (ULAS0034,ULAS1238,ULAS1335,CFDBS0059, Wolf 940B,ULAS1302, + 1 that shall remain unnamed)

  (Kendall et al 2007; Lodieu et al 2007; Warren et al 2007; Pinfield et al 2008; Burningham et al 2008; Burningham et al 2009, Burningham et al in prep)
- cf 56 from 2MASS; 53 from SDSS (dwarfarchives.org); 41 from CFDBDS (Reyles et al, in prep)

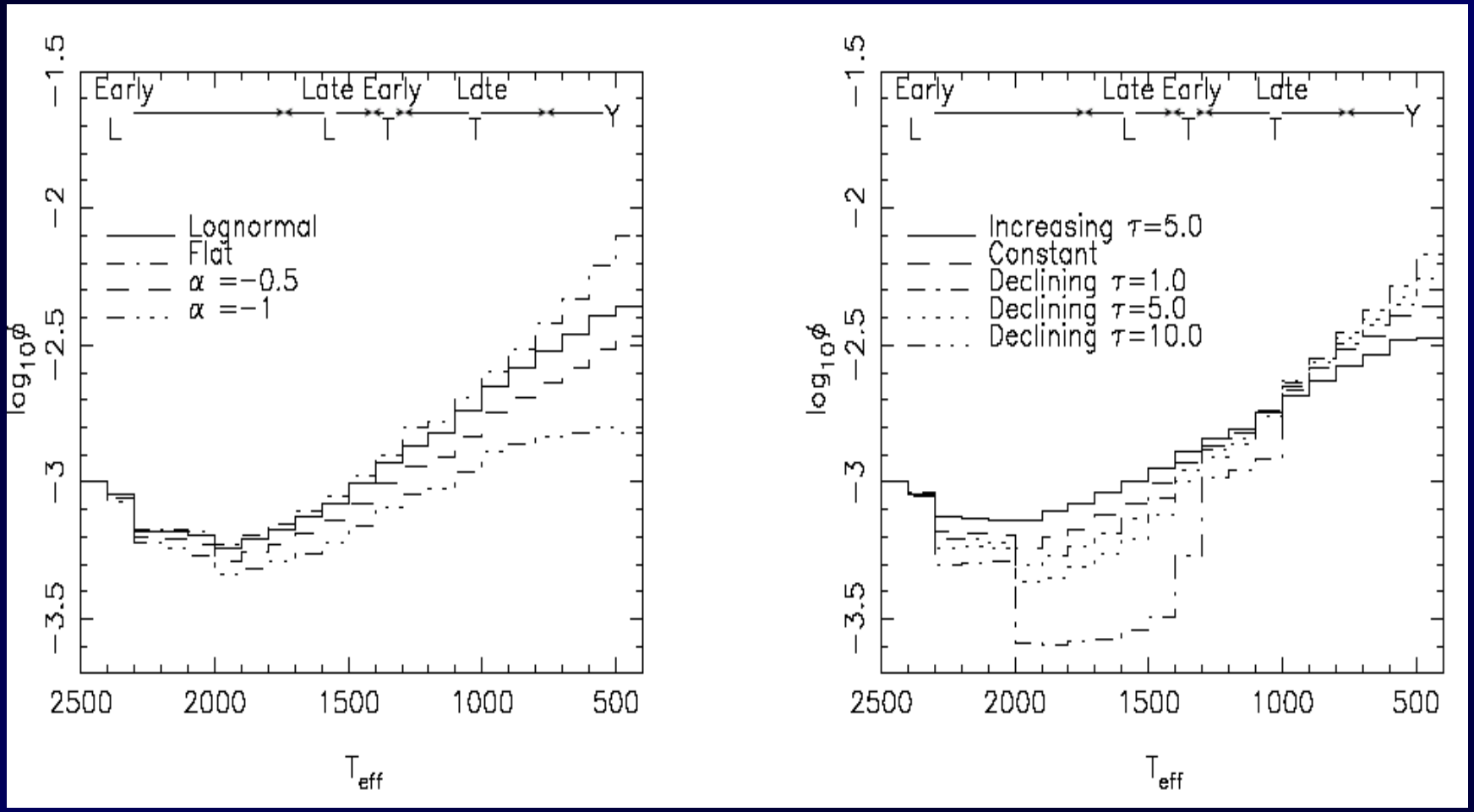

z−Y
z−J
Y−J
J−H
H−K
J−K
Spectral Type
T2
T4
T6
T8
T10

After applying corrections for:

- scatter from J-H selection (+5)
- unresolved binaries (correction factor 76-93%)
- exclusions due to mis-matches with SDSS (3%)
- Malmquist bias

…we estimate 56±7 ≥T4 dwarfs in DR4 down to J = 19.0

What can this tell us about the form of the IMF?



Deacon & Hambly (2006)

- simulations based on Deacon & Hambly (2006)
- normalised to 0.0038 ± 0.0013 pc^{-3}

IMF: $dn/dm \propto m^{-\alpha}$	# ≥ T4 dwarfs
α = -1.0	53±18
α = -0.5	88±32
α = 0.0	154±53
α = 0.5	200±67
α = 1.0	417±140

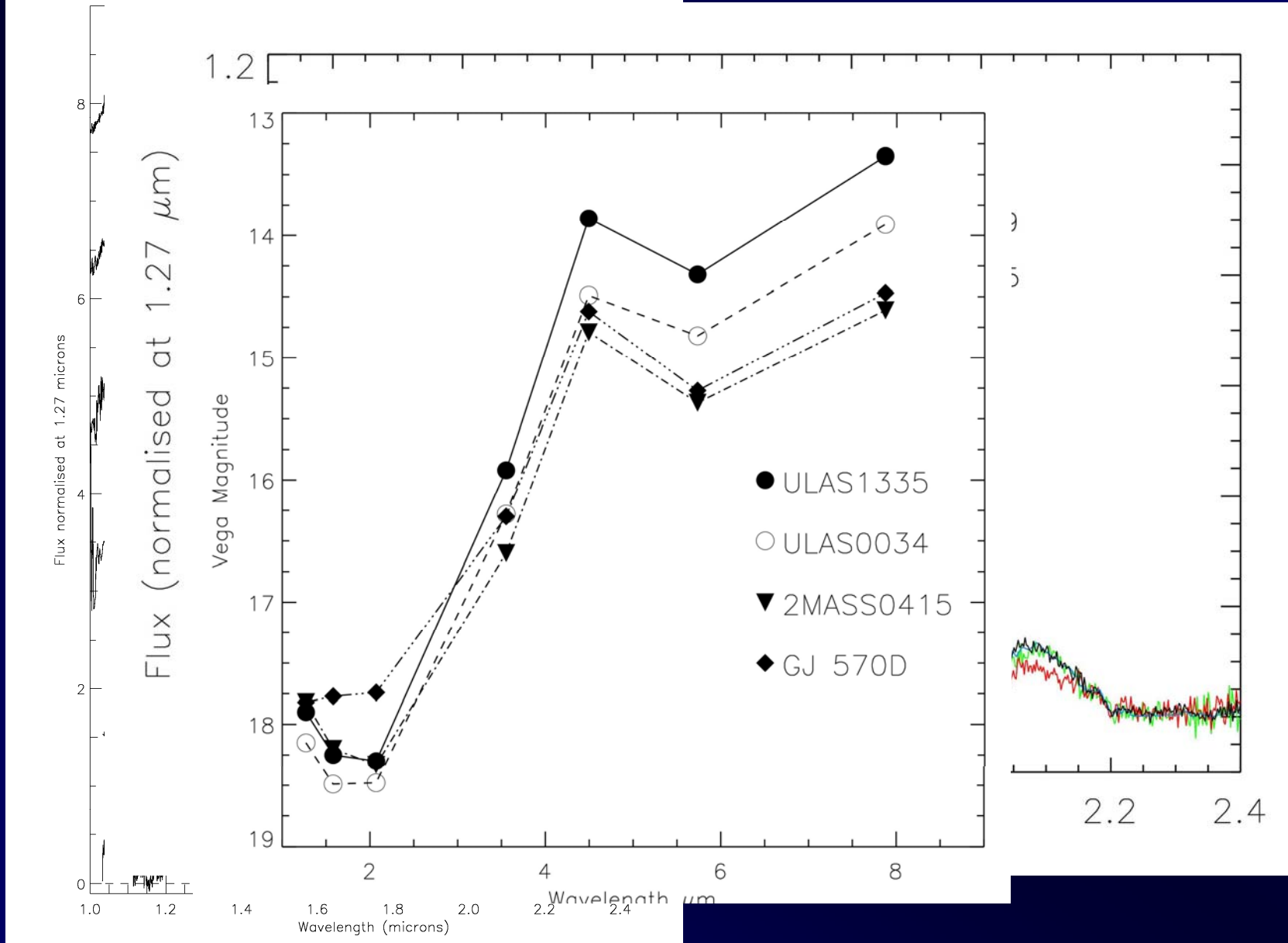
Constant birthrate

α= 0 for T0-T8
(Metchev et al 2008)

We have 56 ± 7 ≥ T4 dwarfs → α < 0

- α = +0.6 Upper Sco
  (0.3 – 0.01 Msun; Lodieu et al 2006)
- α = +0.6 in Pleiades
  (Moreaux et al 2003)
- α = +0.27 in Trapezium
  (Muench et al 2002)
- α = +0.59 in α Per
  (Barrado y Navascues et al 2002)
- α = +0.8 in σ Ori
  (Bejar et al 2001)

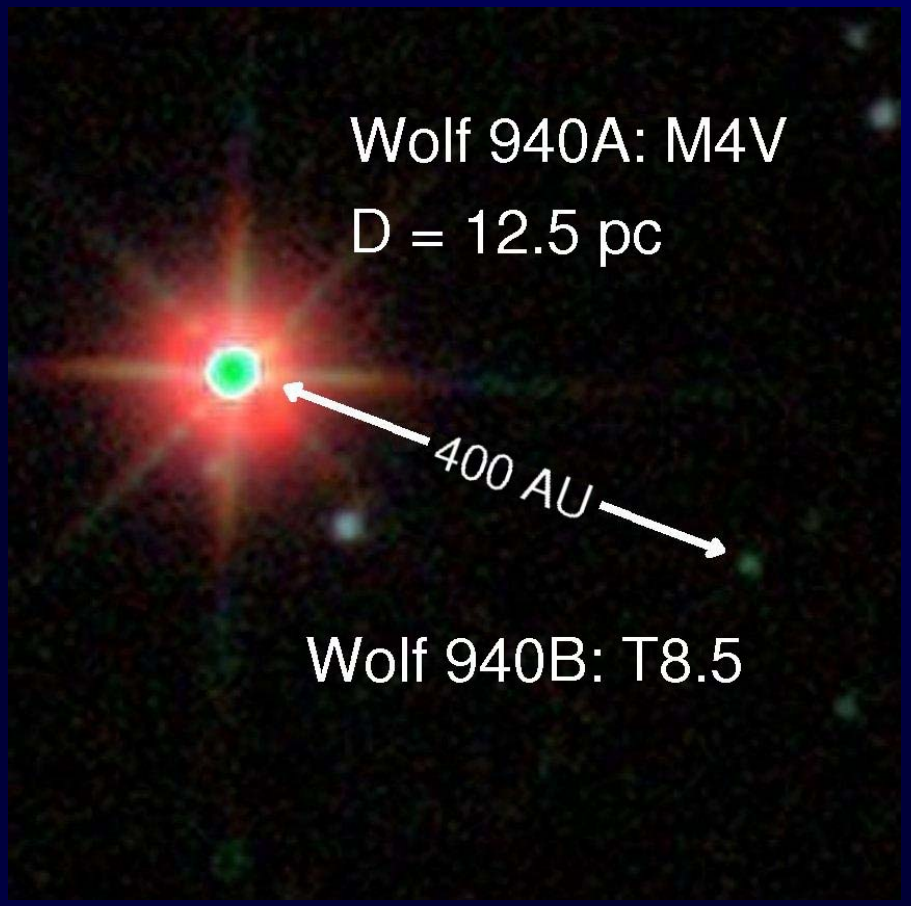
The T8+ dwarfs



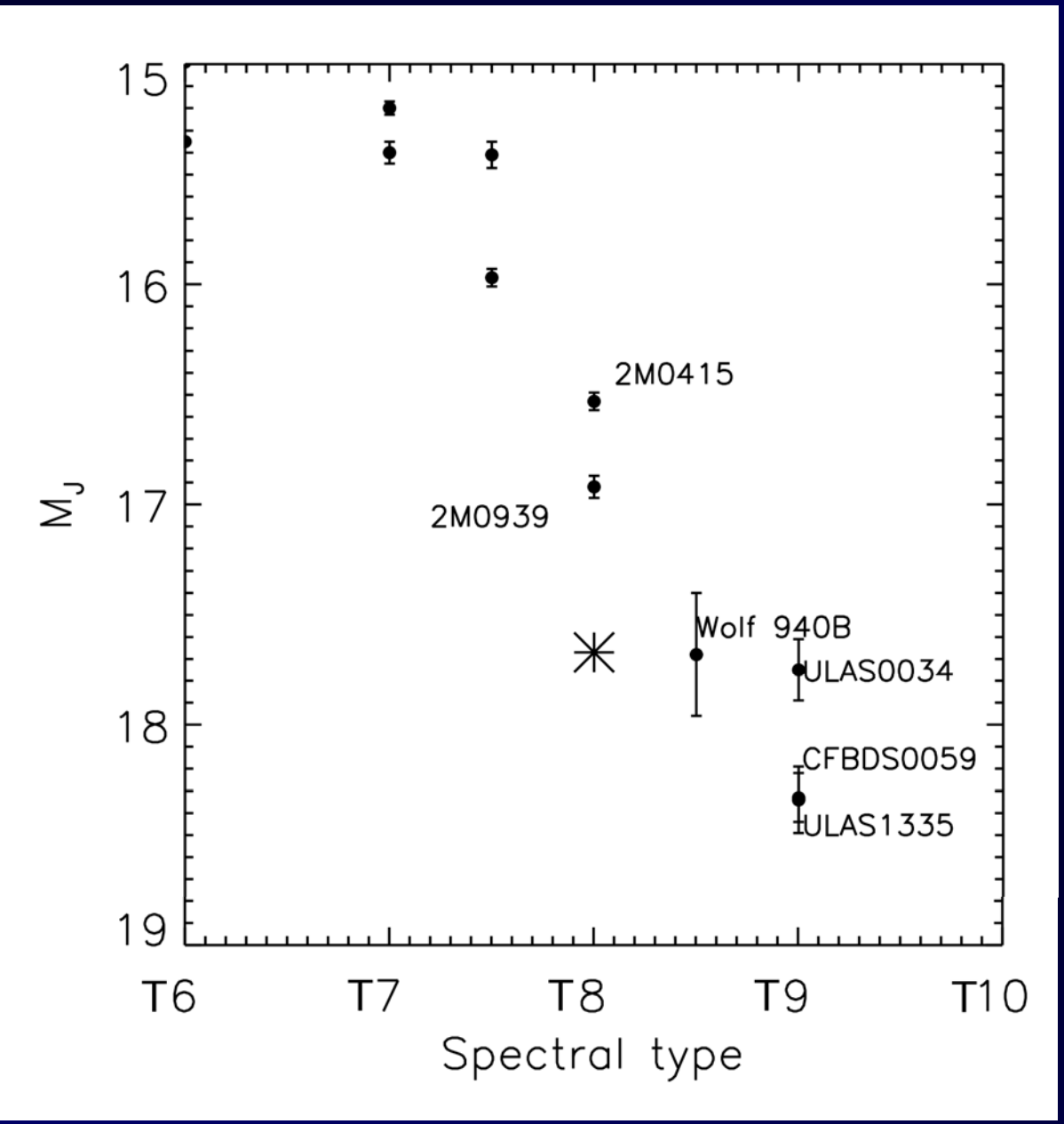
An extremely cool T dwarf (in a binary system)

- **Primary M4 – Wolf 940A**
  - **$\mu_{\alpha\cos\delta}$ = 765 ± 2 mas/yr**
  - **μ_{δ} = -497 ± 2 mas/yr**
- **Secondary T8.5 Wolf 940B (ULAS2146)**
  - **$\mu_{\alpha\cos\delta}$ = 771 ± 92 mas/yr**
  - **μ_{δ} = -585 ± 92 mas/yr**
- **Distance to primary combined with near-IR spectroscopy + mid-IR photometry, age constraints from primary…**

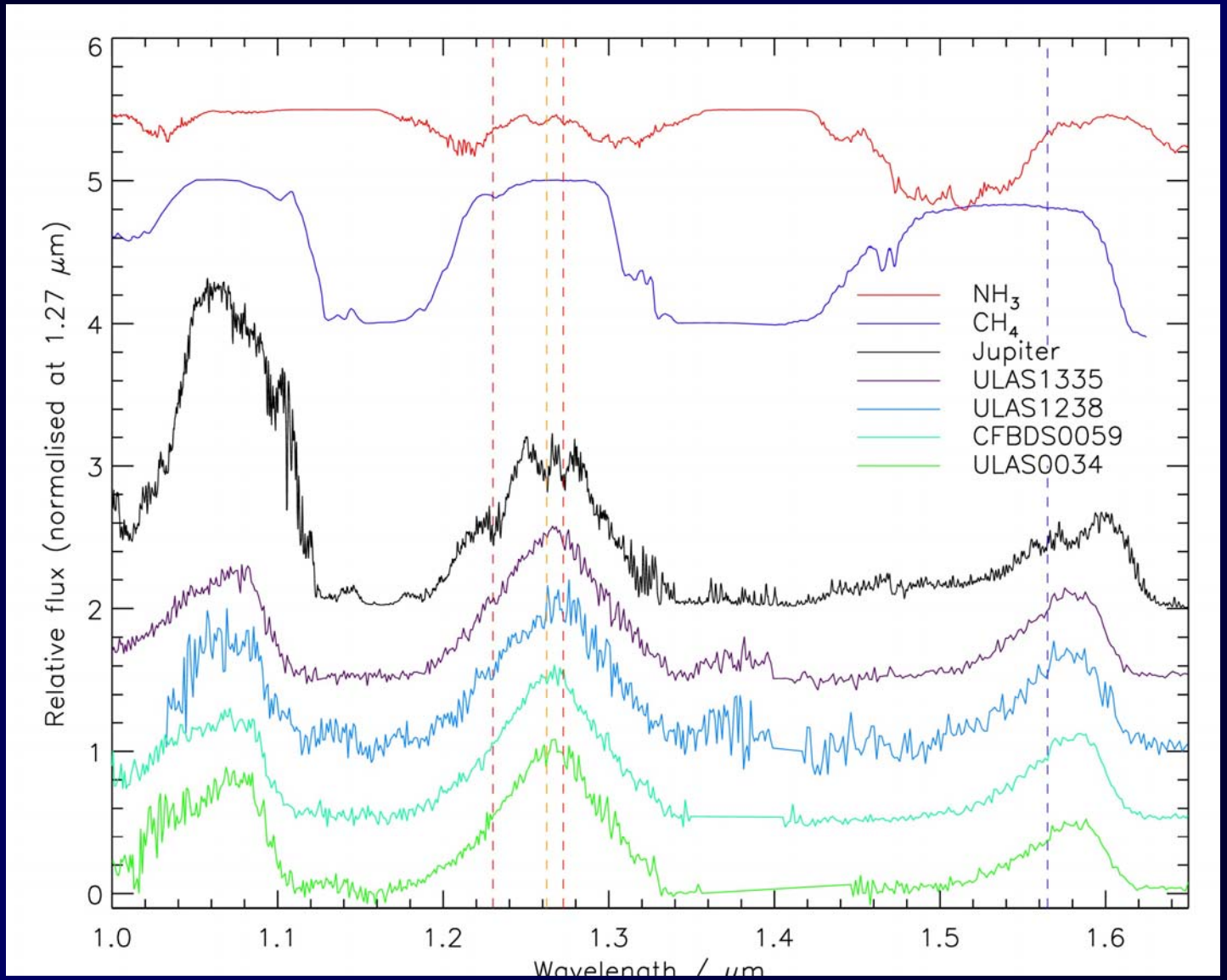
  → T_{eff} = 570 ± 25 K



Burningham et al (2009)



UKIRT/WFCAM parallaxes from Smart (priv comm)


Relative flux (normalised at 1.27 μm)
Wavelength / μm
NH3
CH4
Jupiter
ULAS1335
ULAS1238
CFBDS0059
ULAS0034