Cold Brown Dwarfs with WISE:

Y Dwarfs and the Field Mass Function

J. Davy Kirkpatrick
IPAC/Caltech

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Overview:

Why study brown dwarfs?

What is WISE and how does it help?

What has WISE found so far?

What are the implications?

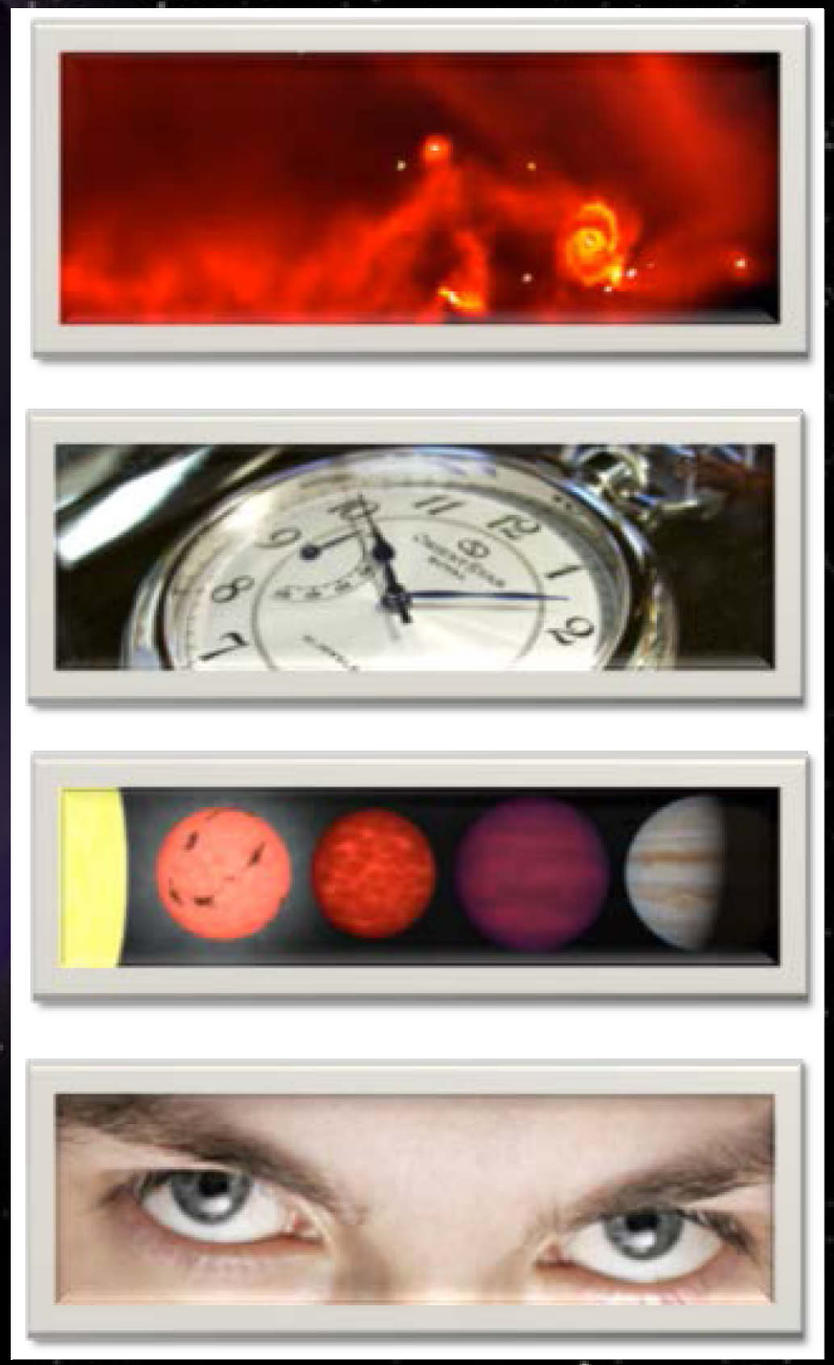
Why Study Brown Dwarfs?

They're the lowest mass byproducts of star formation.

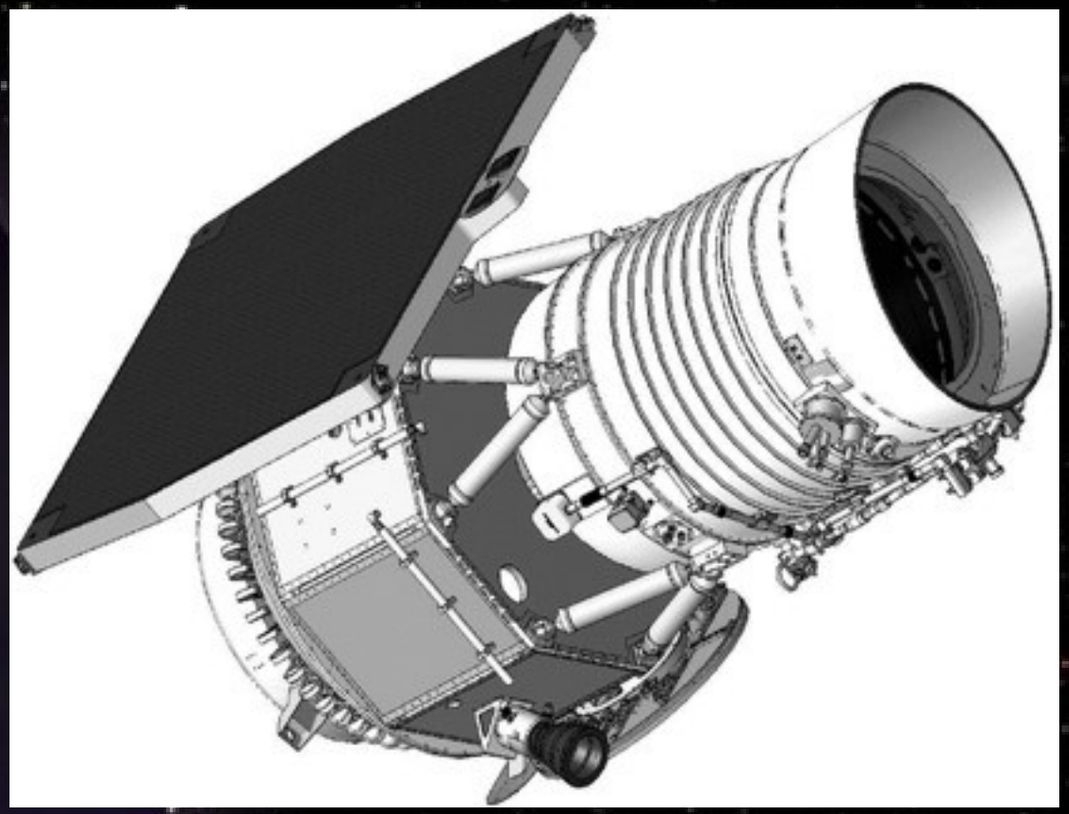
They provide time capsules across the age of the Galaxy.

They show what low-T_{eff} atmospheres look like.

They may be some of our closest neighbors in space.



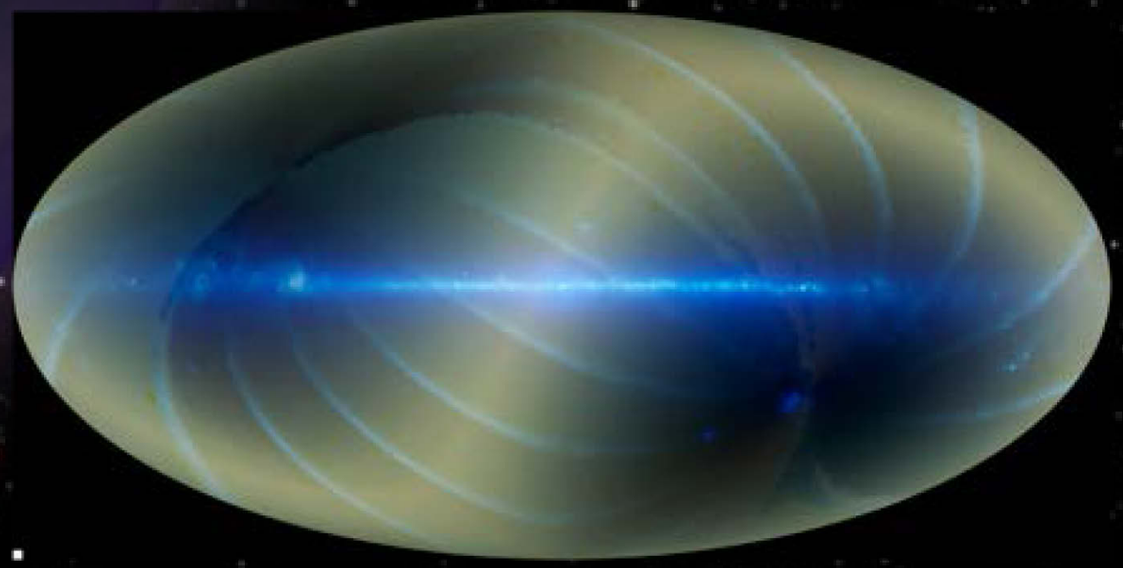
What is WISE?...



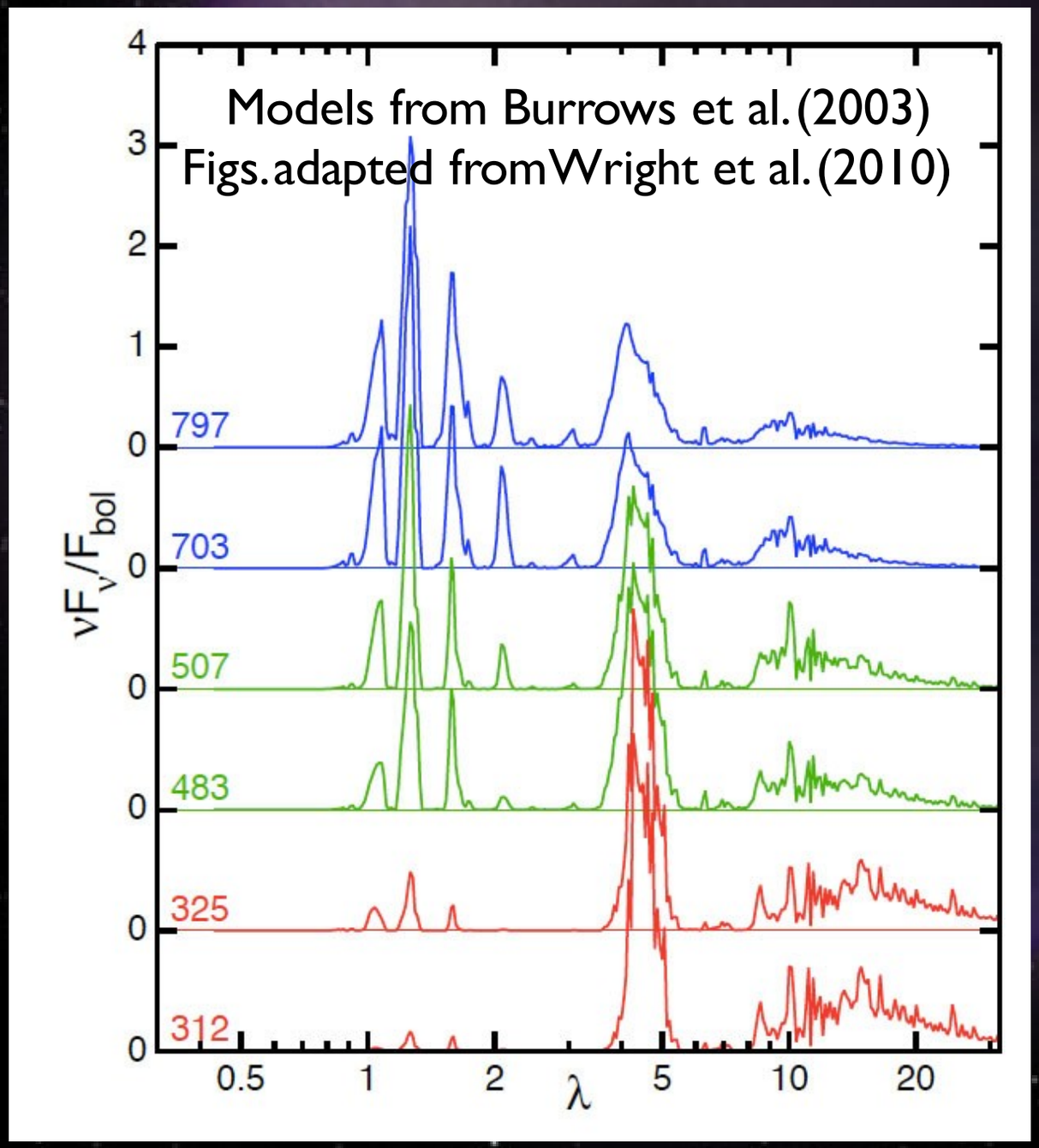
40cm Earth-orbiting telescope.

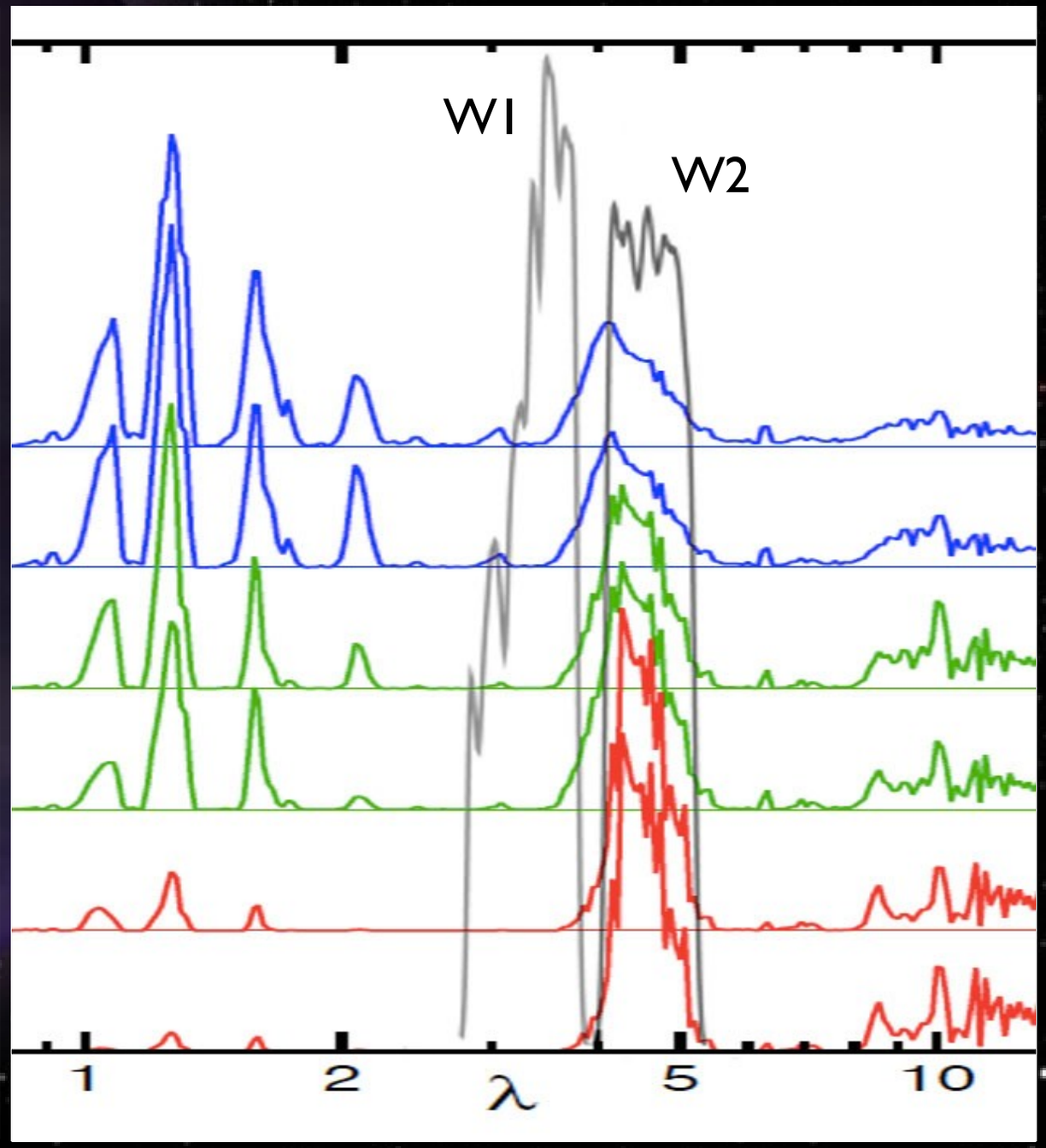
HgCdTe and Si:As 1024x1024 arrays observing at
3.4 um (W1)
4.6 um (W2)
12 um (W3)
22 um (W4).

Resolution of 6" (12" atW4).



...& how does it find brown dwarfs?





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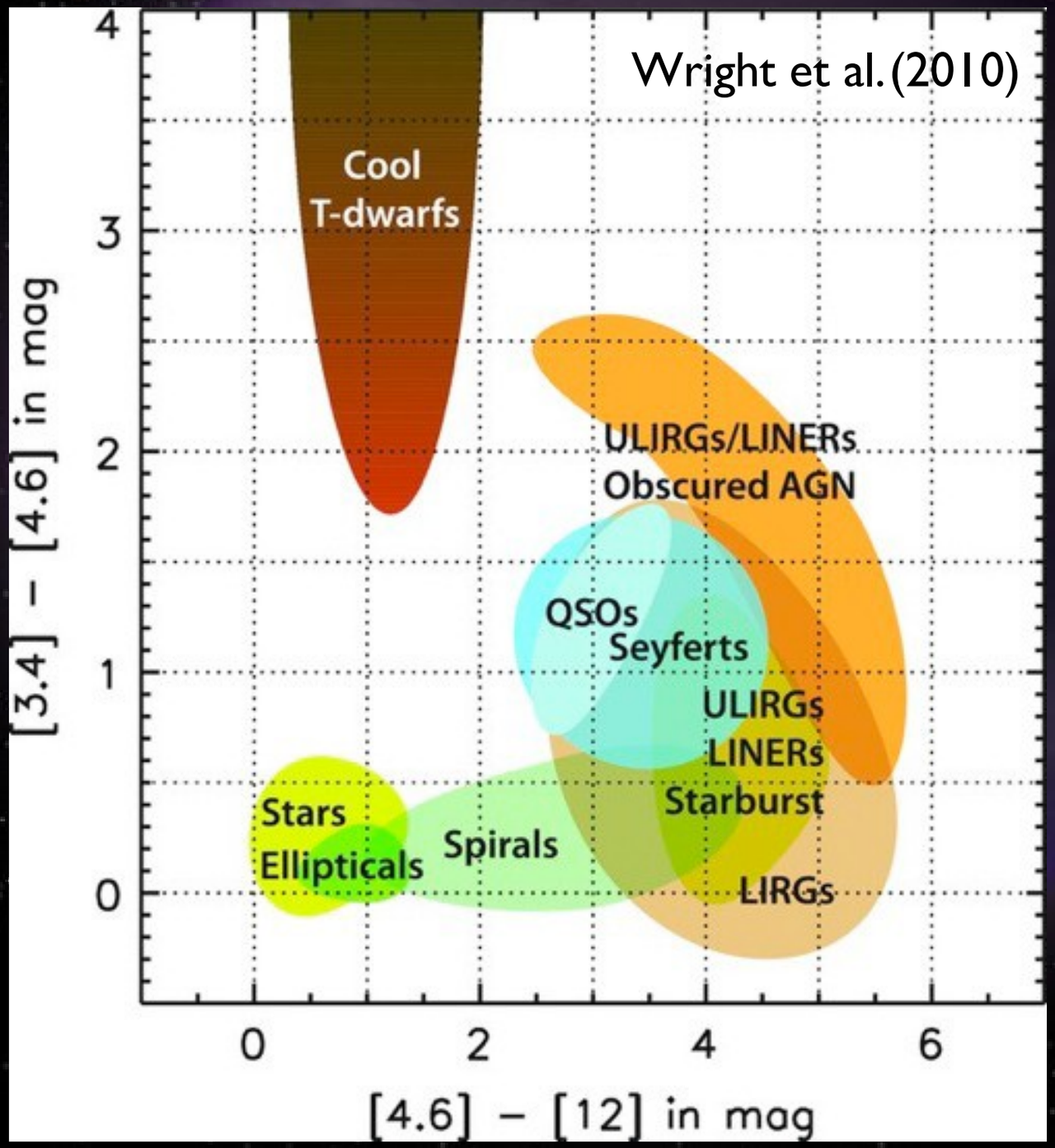
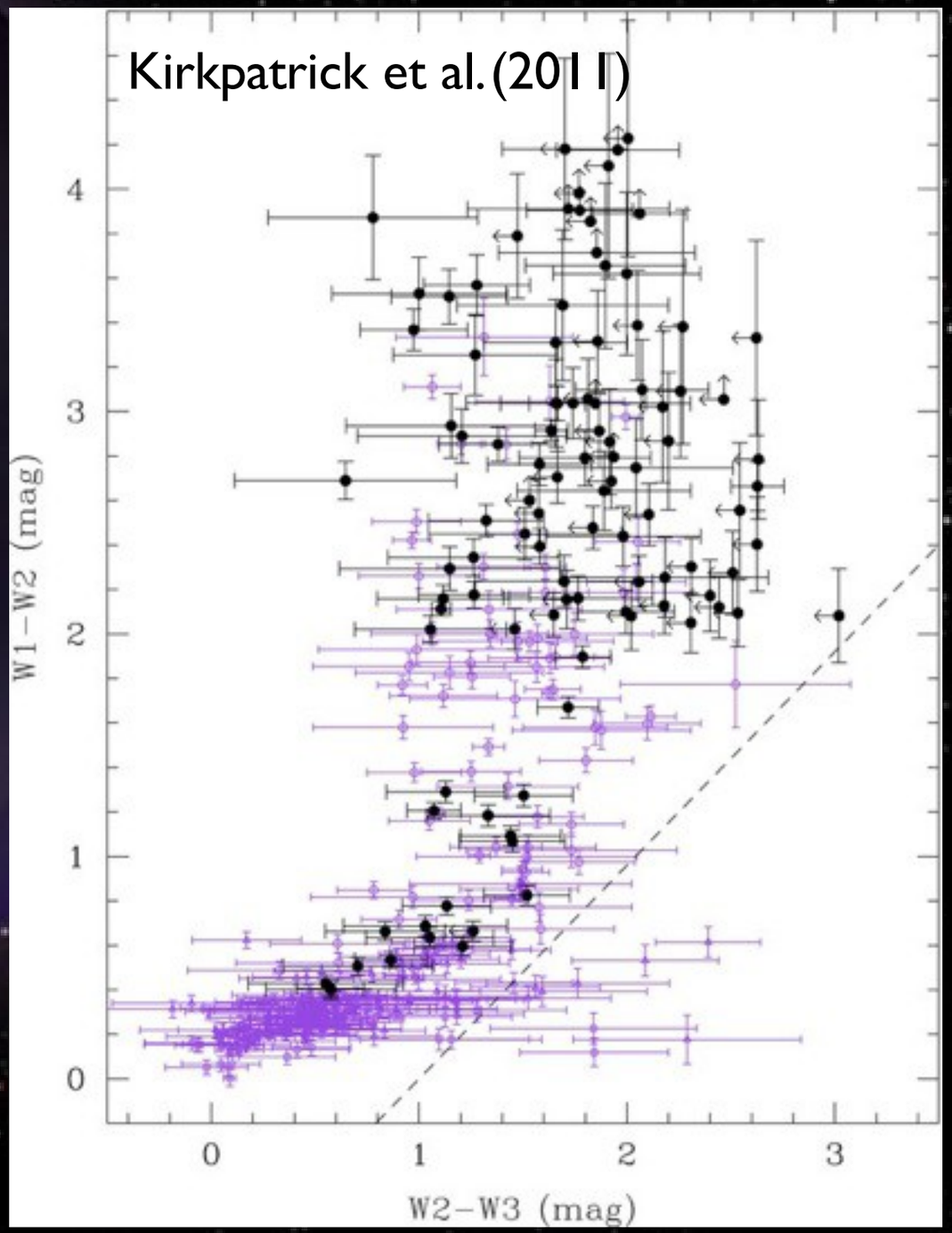
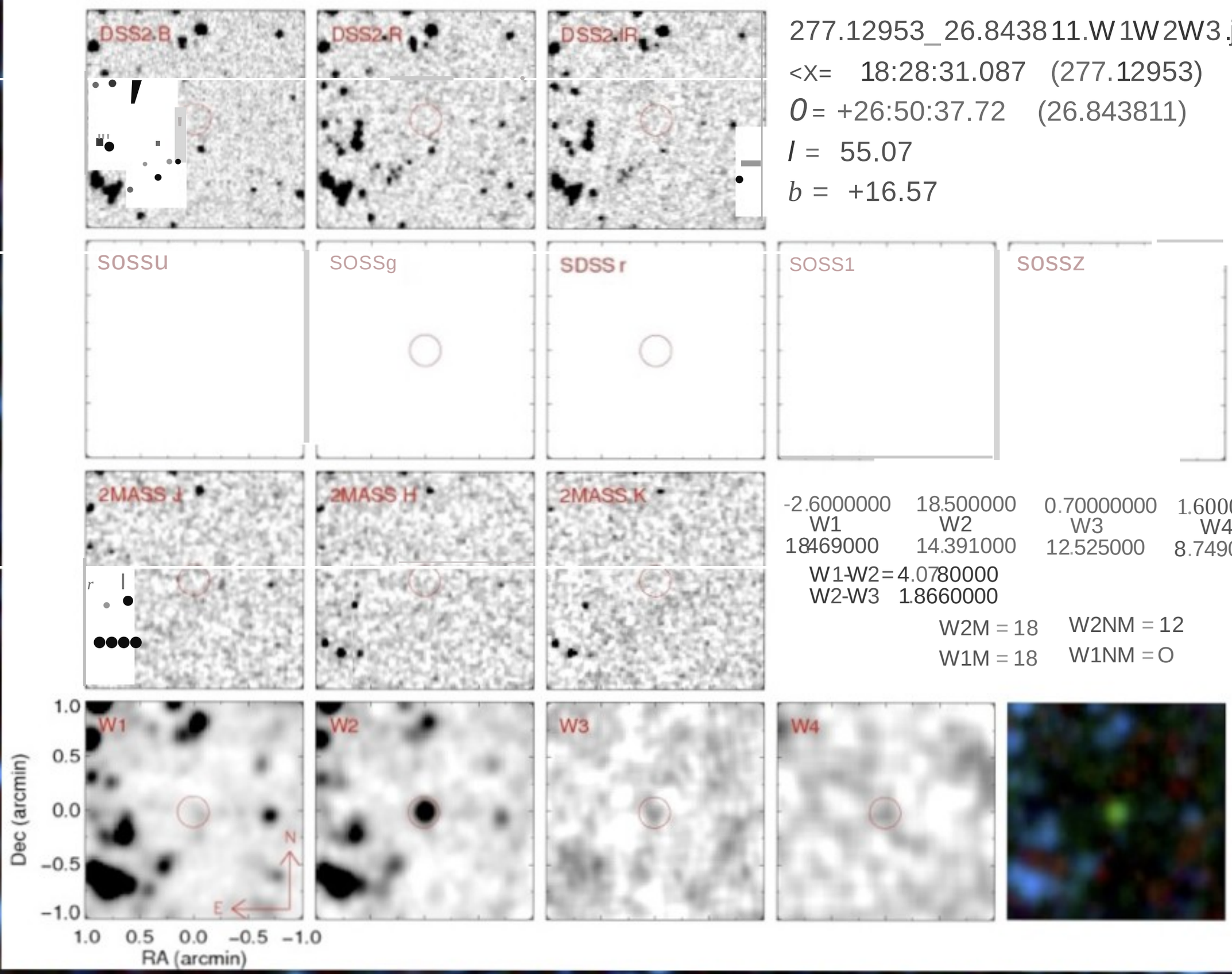




What has WISE found so far?

A new spectral class called "Y dwarfs"



277.12953_26.843811.W1W2W3.jpg

<X= 18:28:31.087 (277.12953)

0 = +26:50:37.72 (26.843811)

l = 55.07

b = +16.57

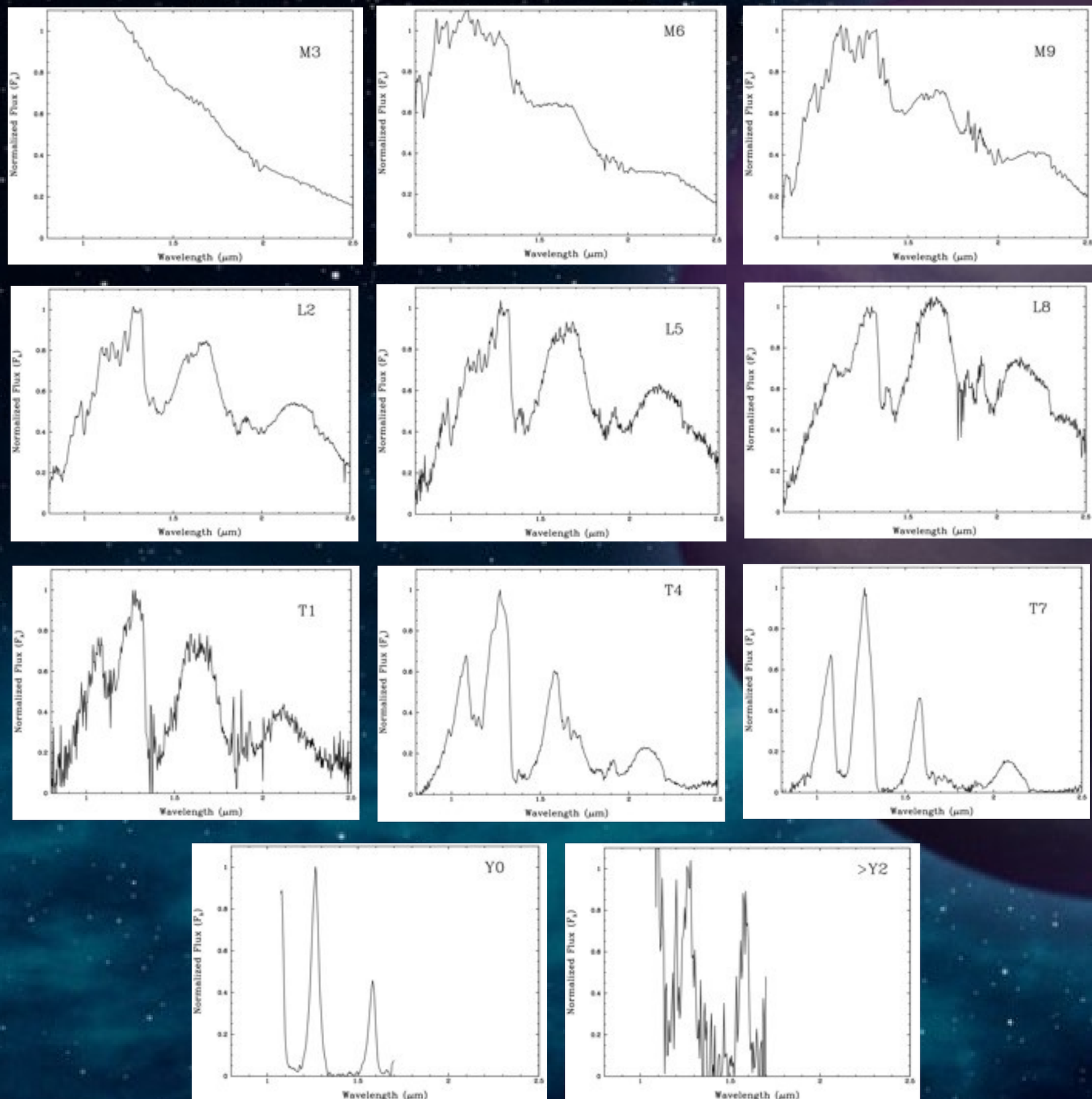
-2.6000000	18.500000	0.70000000	1.6000000
W1	W2	W3	W4
18.469000	14.391000	12.525000	8.7490000

W1-W2 = 4.0780000

W2-W3 1.8660000

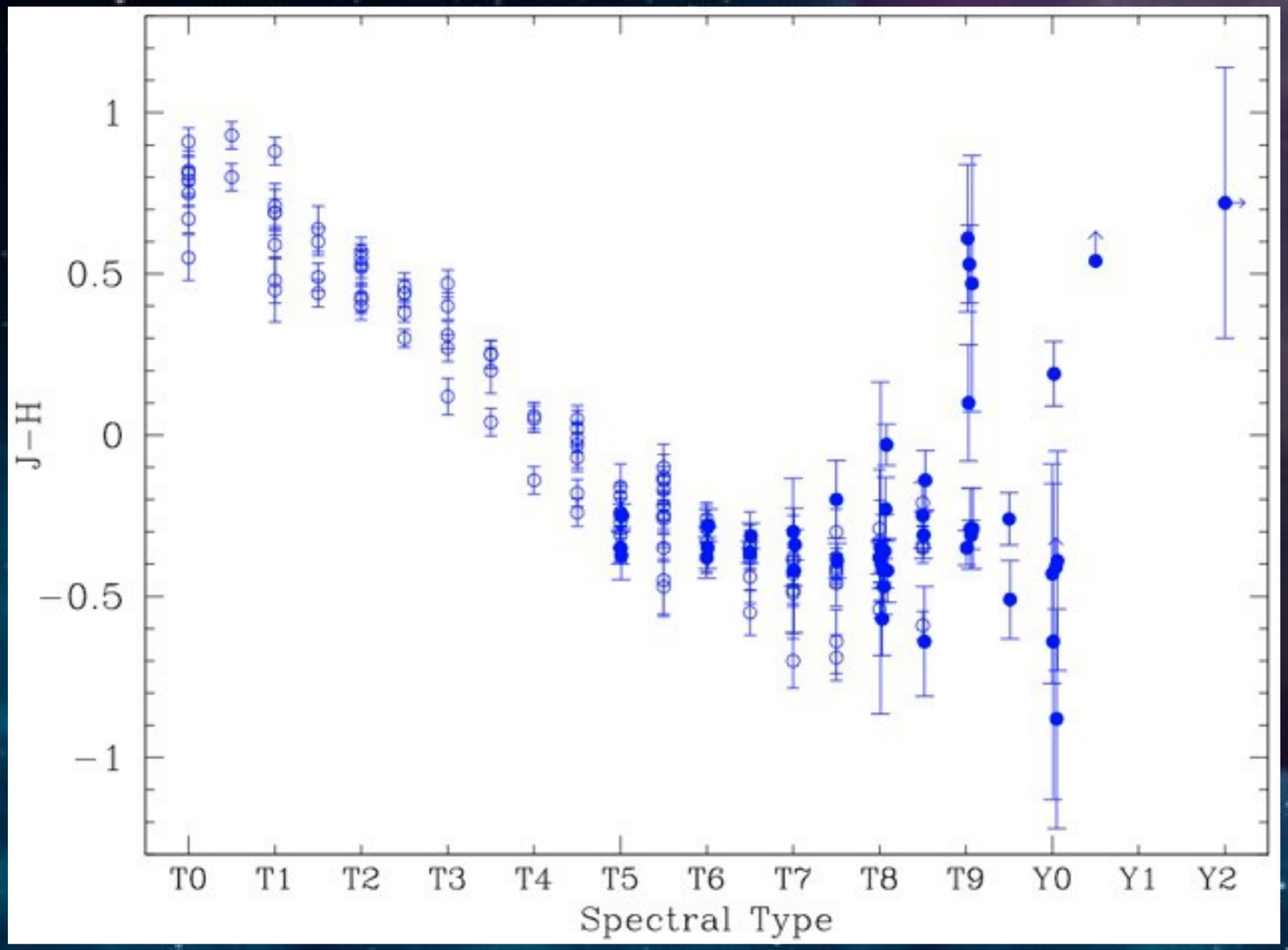
W2M = 18 W2NM = 12

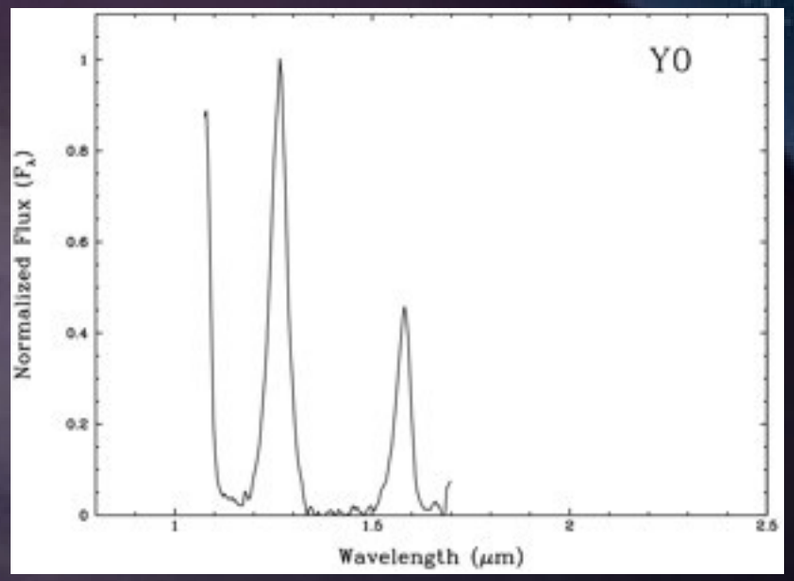
W1M = 18 W1NM = O

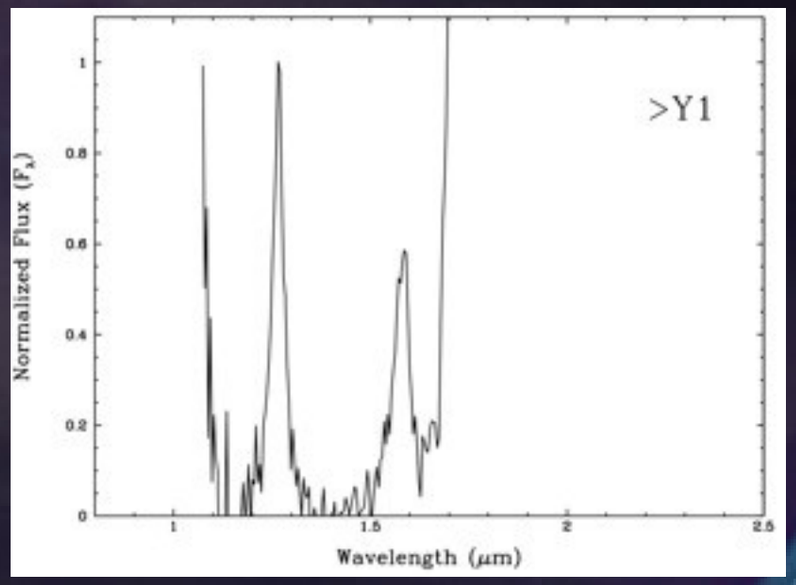


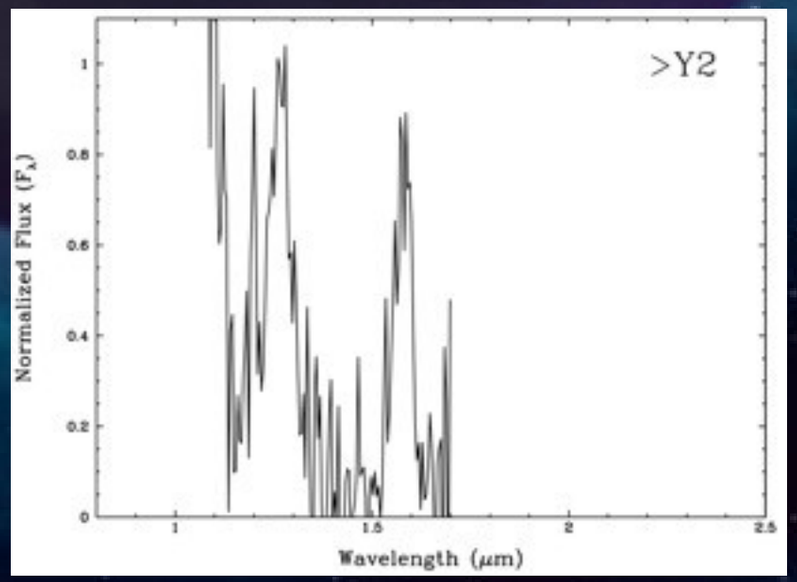
The M through Y spectral sequence

TheY dwarf class

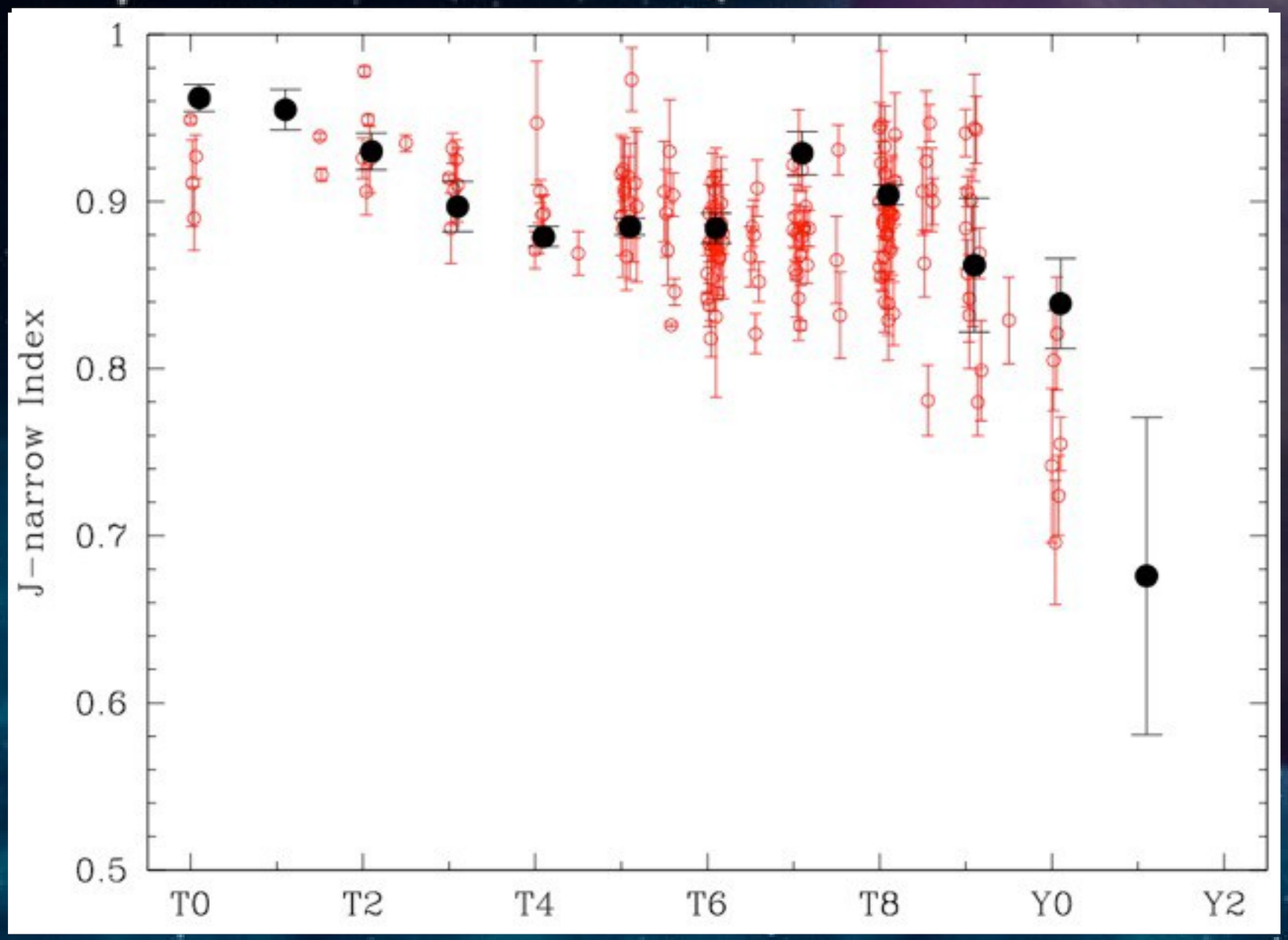


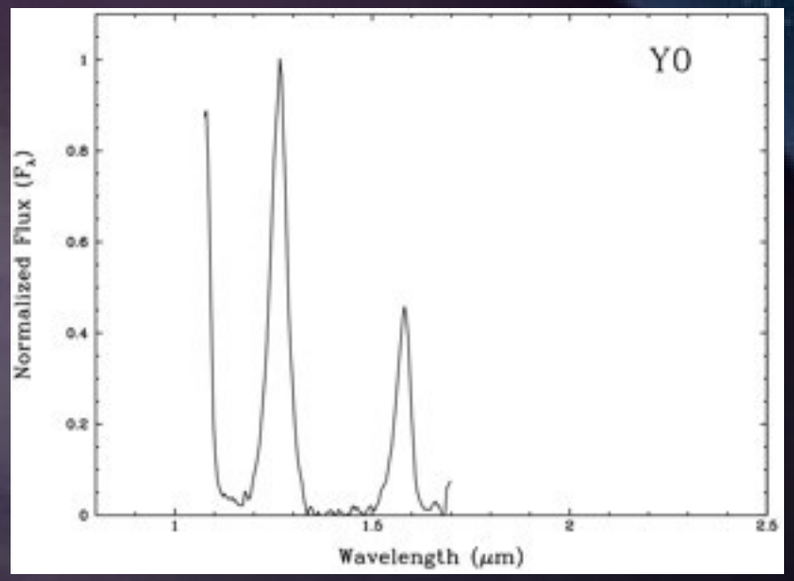


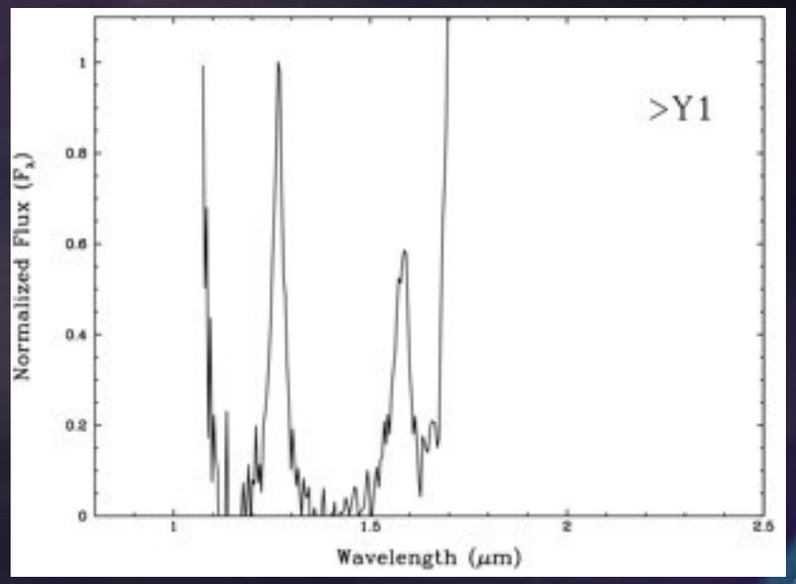


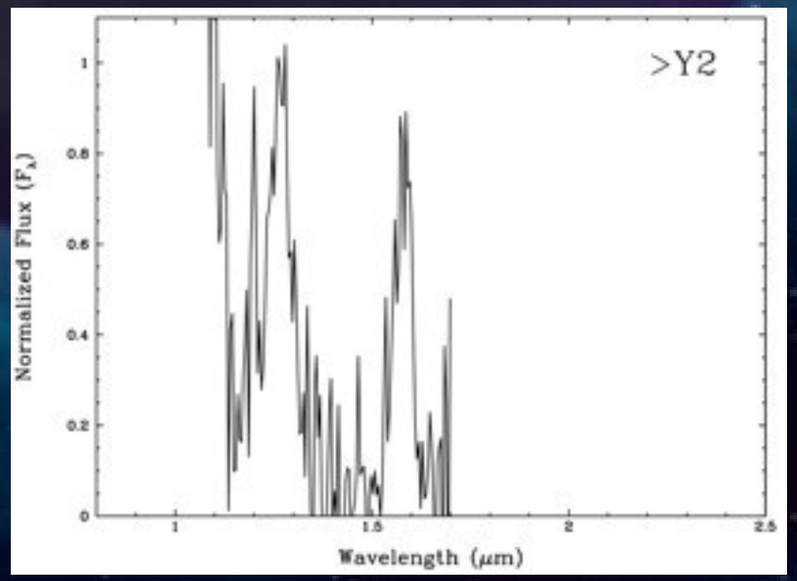


TheY dwarf class





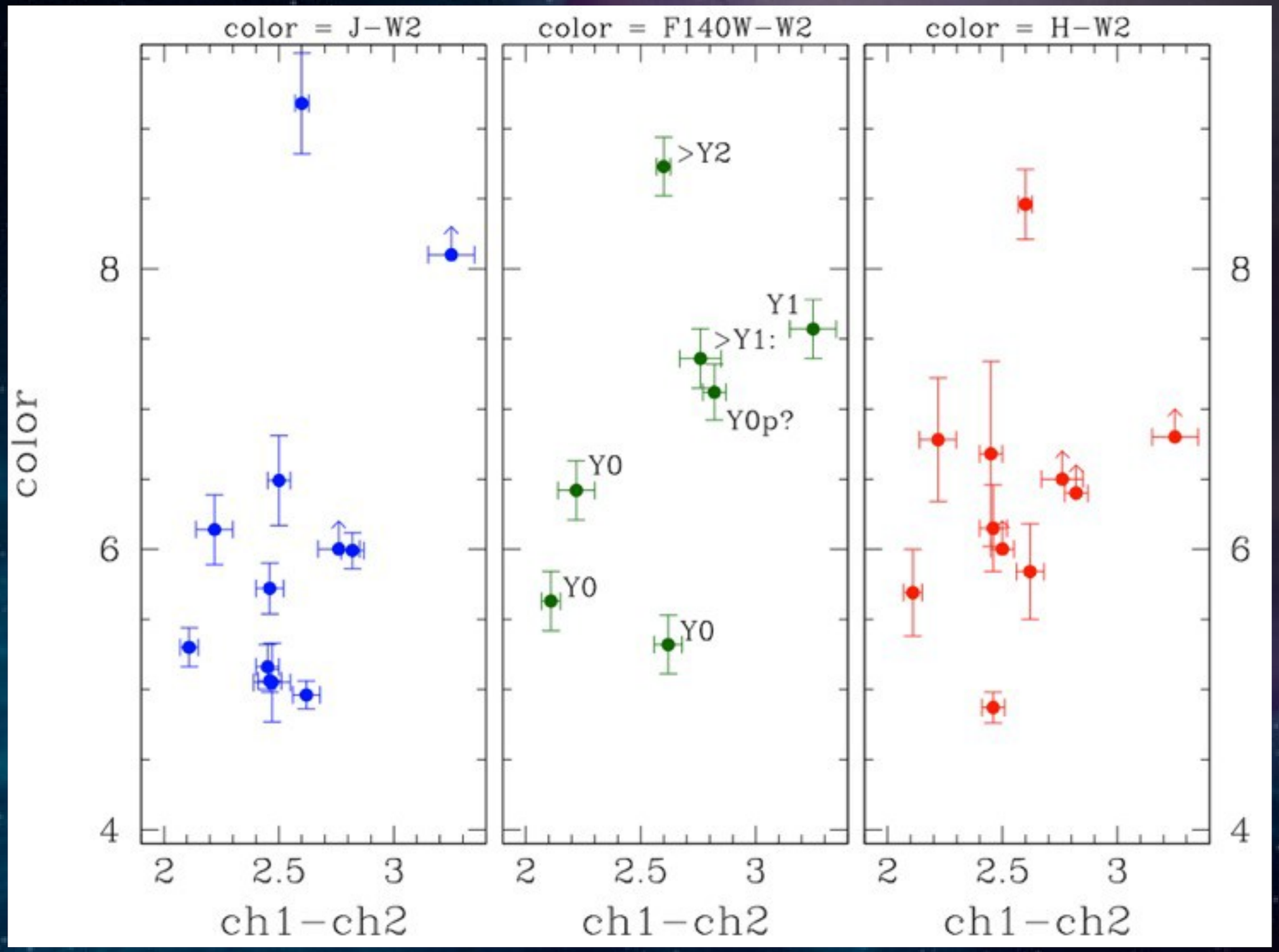




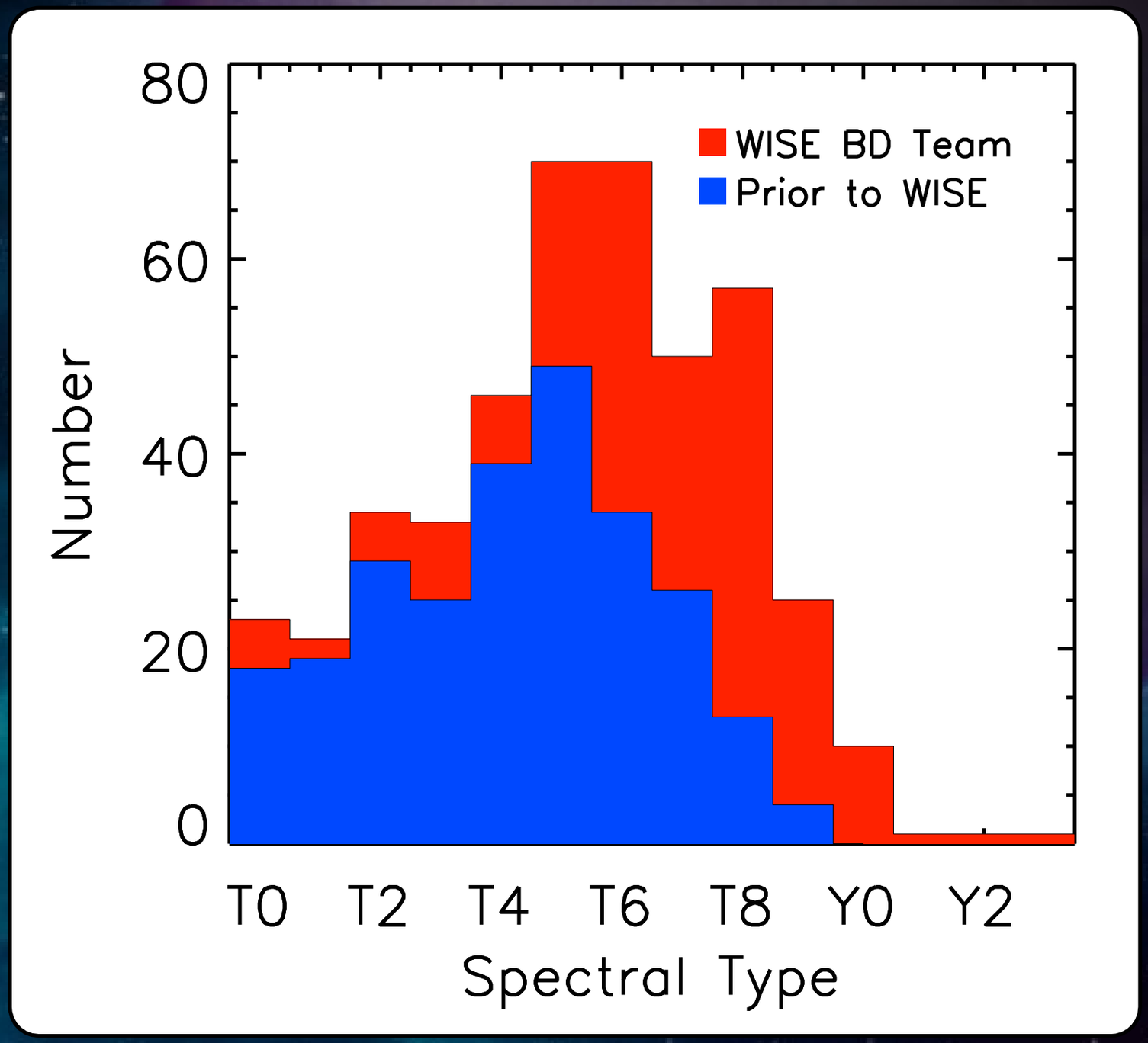
What shapes a Y dwarf?

(1) Disappearance of alkali lines (~450K)
(2) Water cloud formation (400-500K)
(3) Appearance of ammonia below 2.5 um (<800K)
(4) Collapse of optical/NIR flux (<350K)
(5) Shift in position of the 5 um peak

What shapes a Y dwarf?

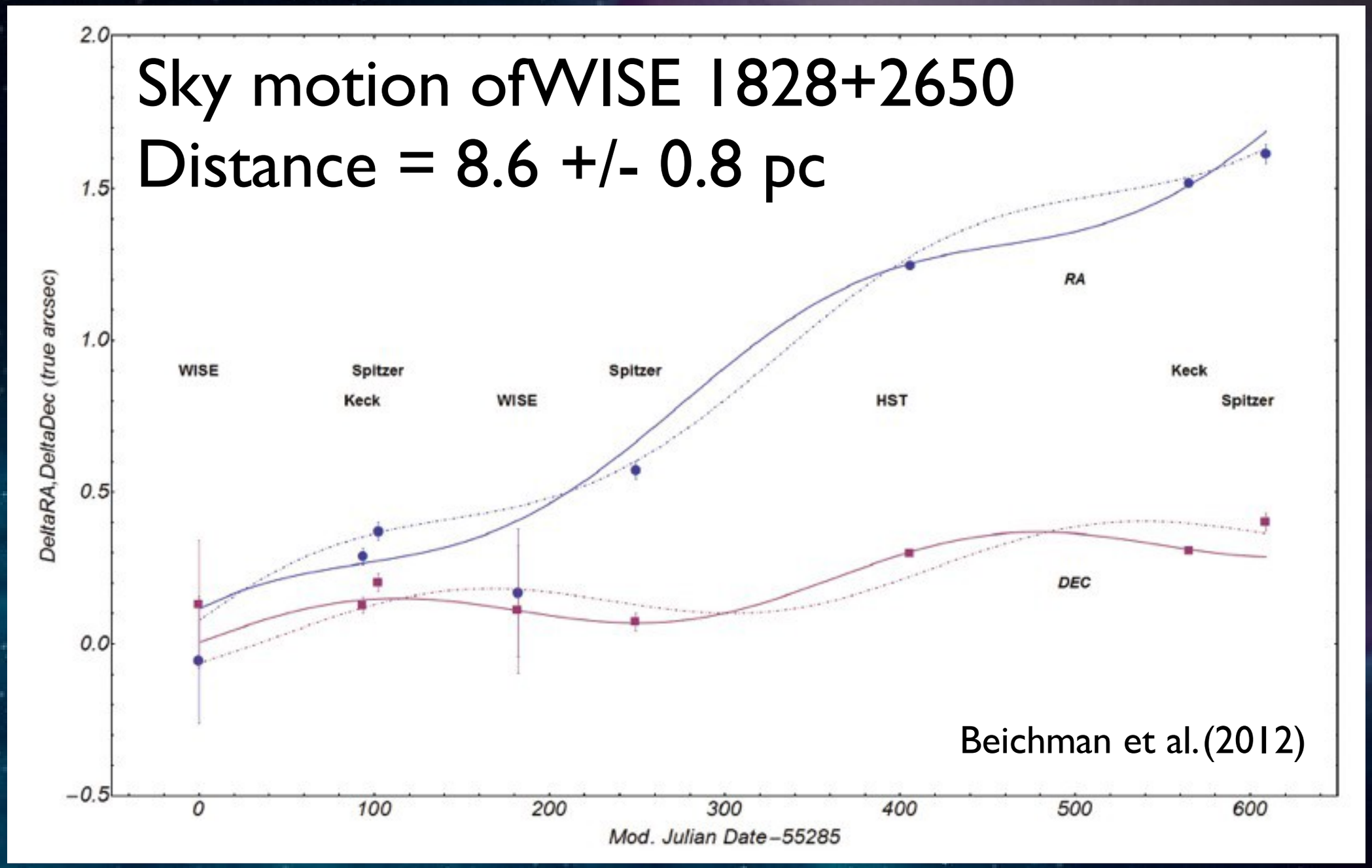


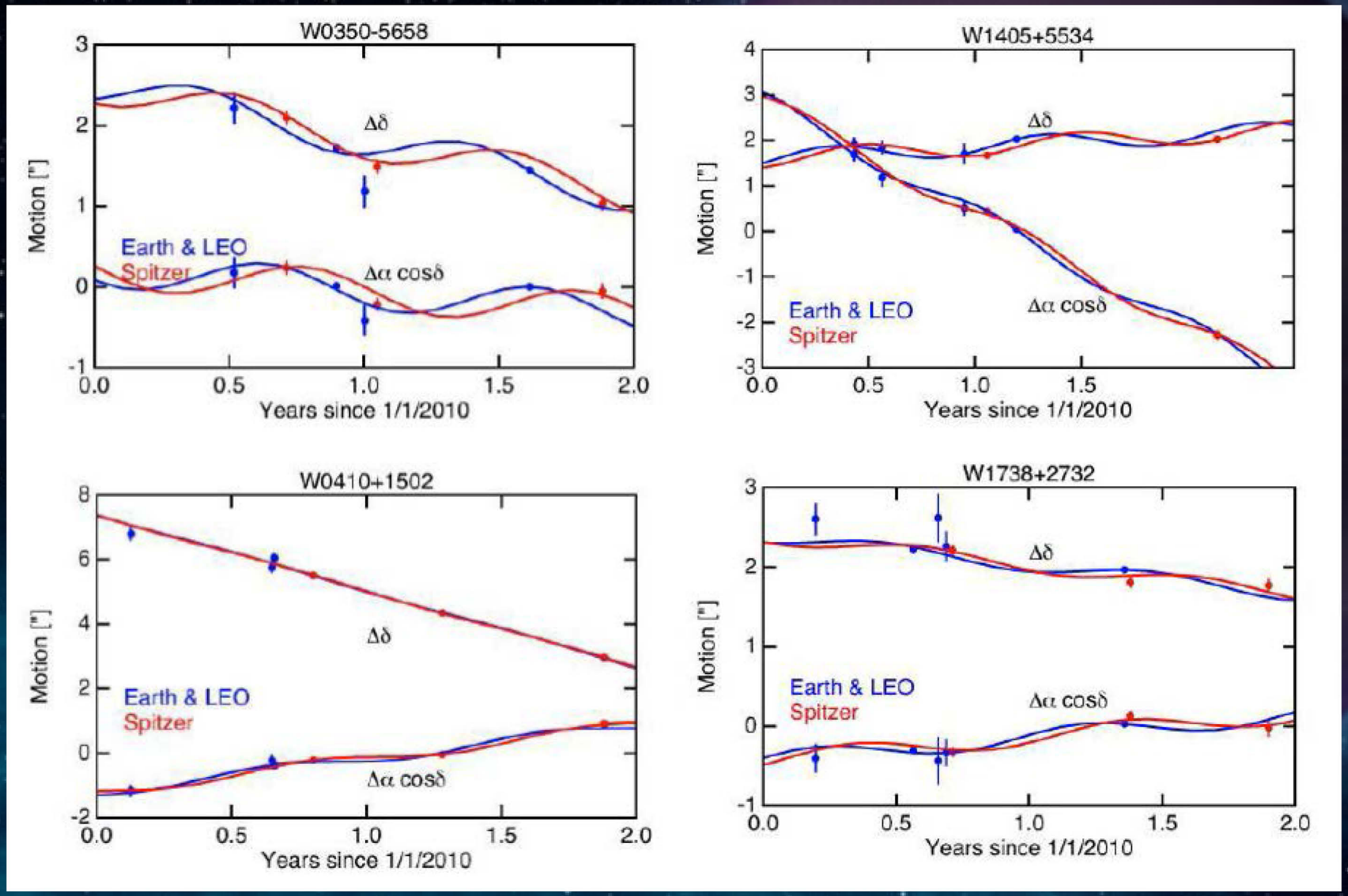
What are the implications?



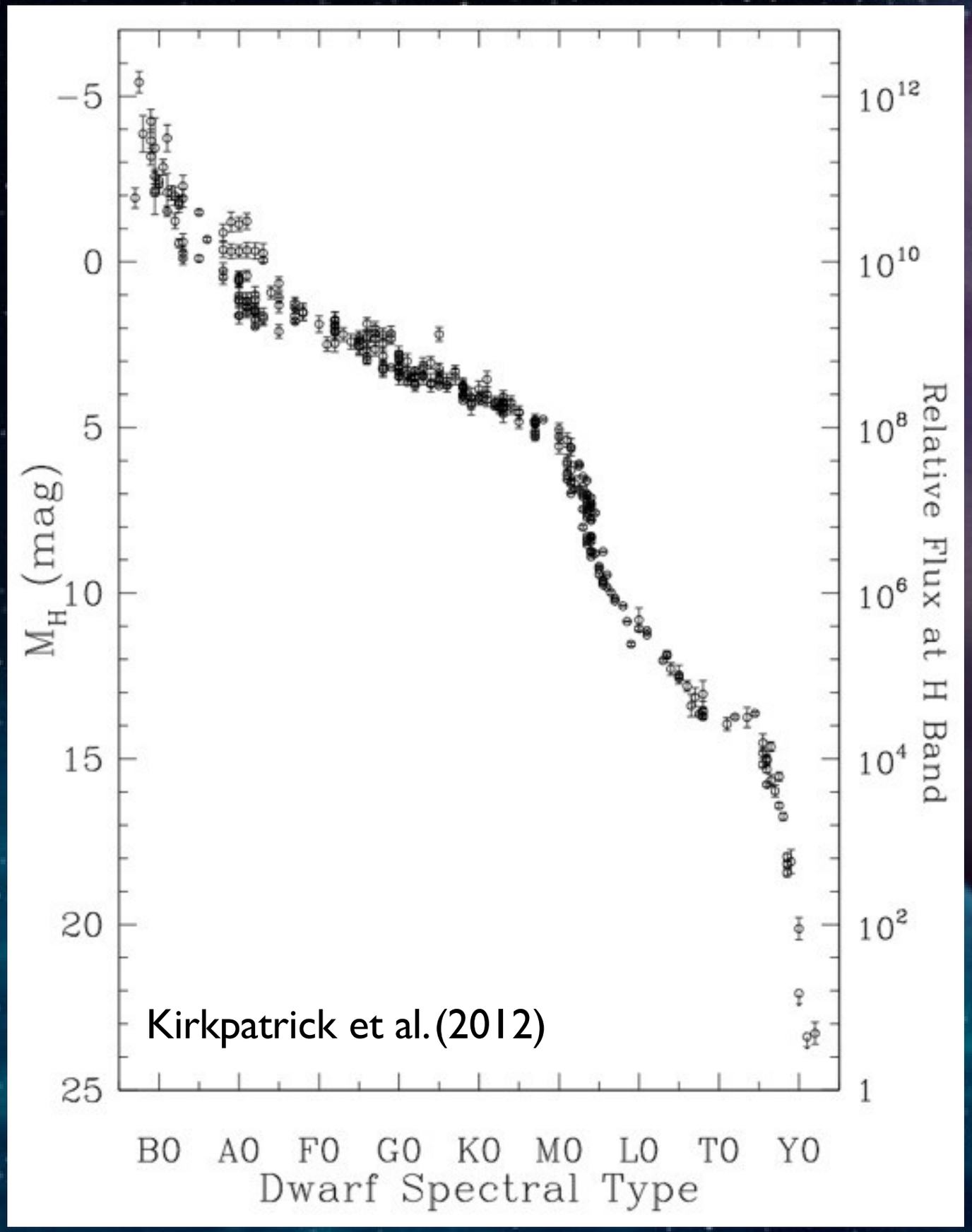
Mace et al. (2012)

What are the implications?

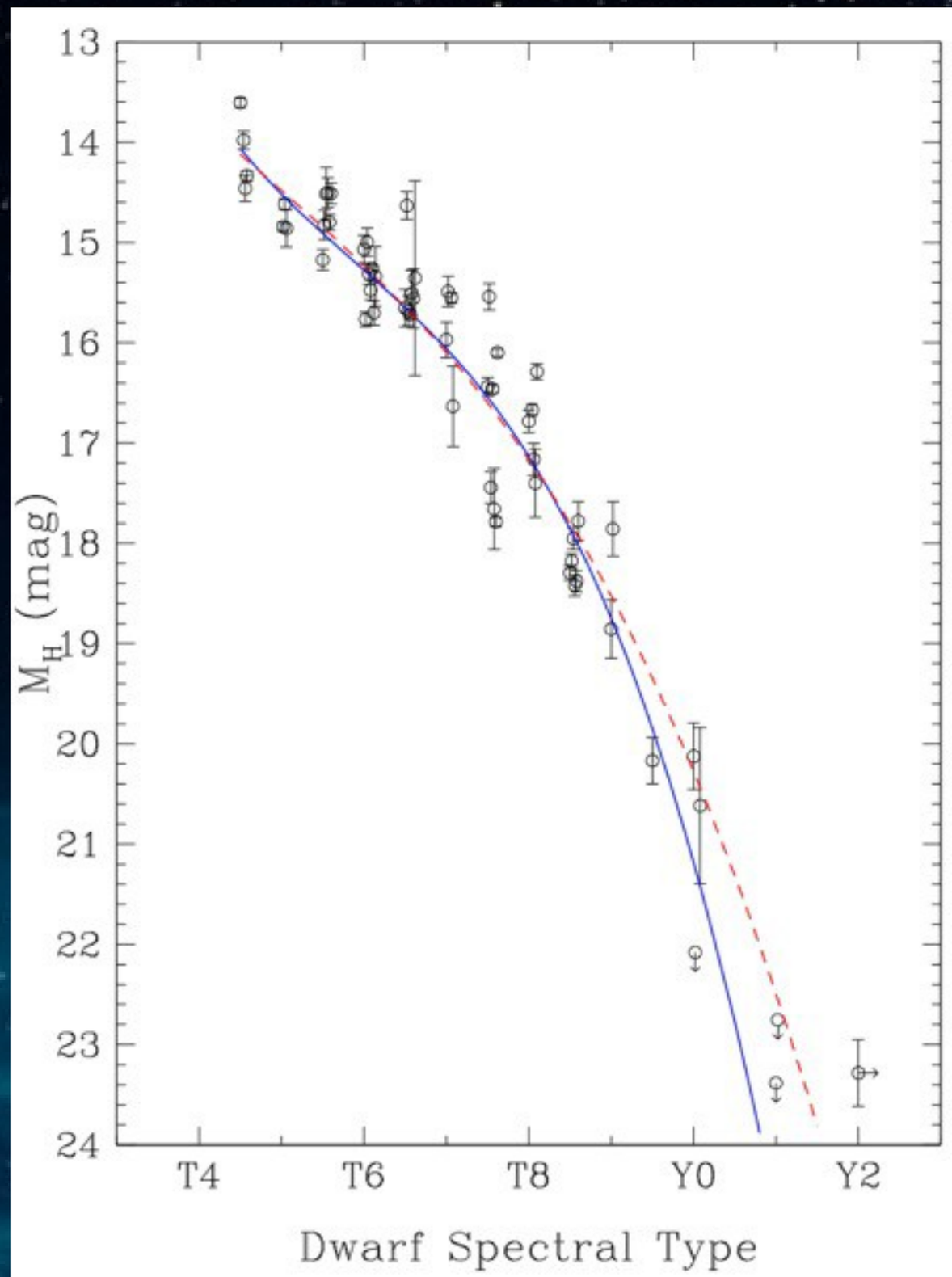


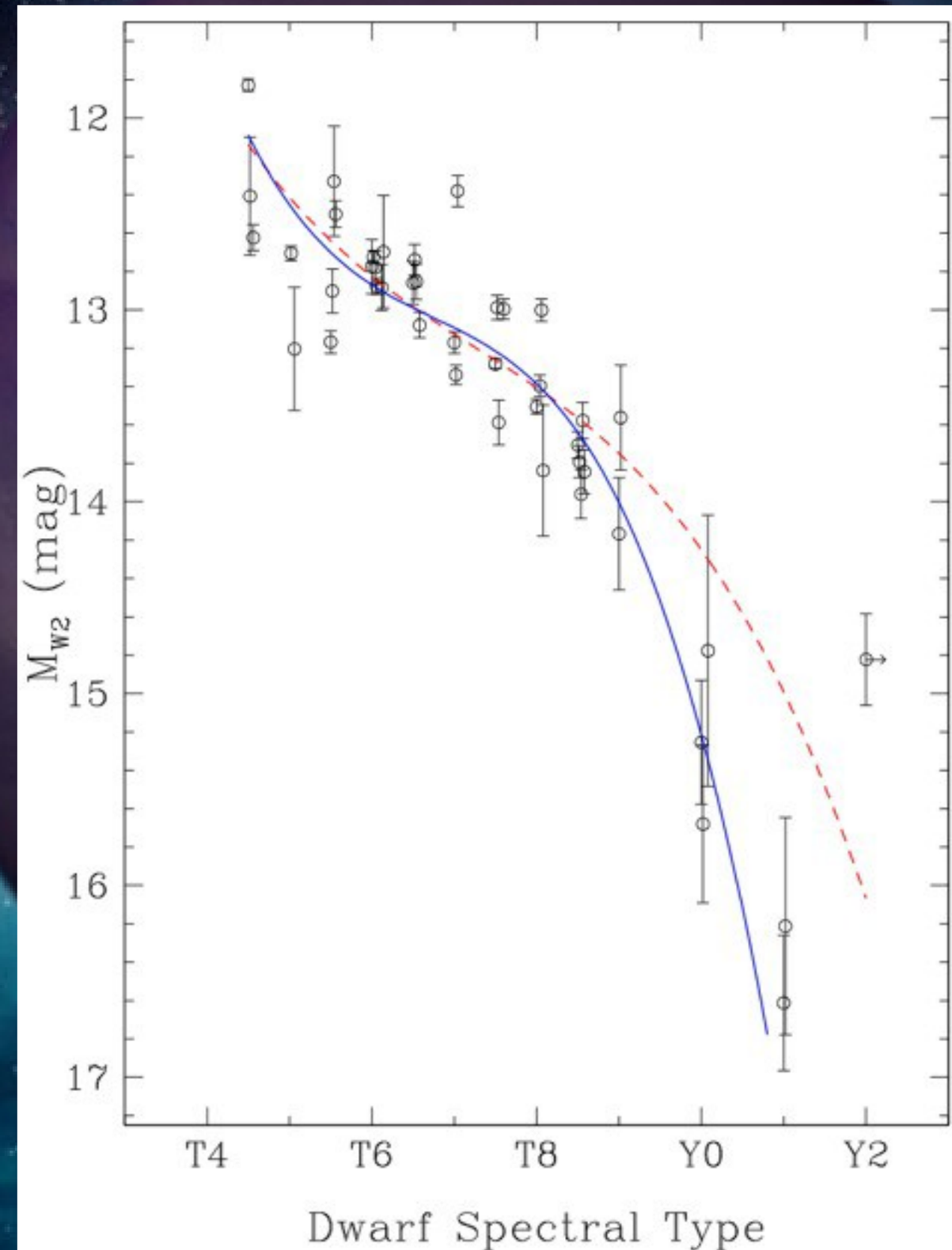


Marsh et al. (2012)

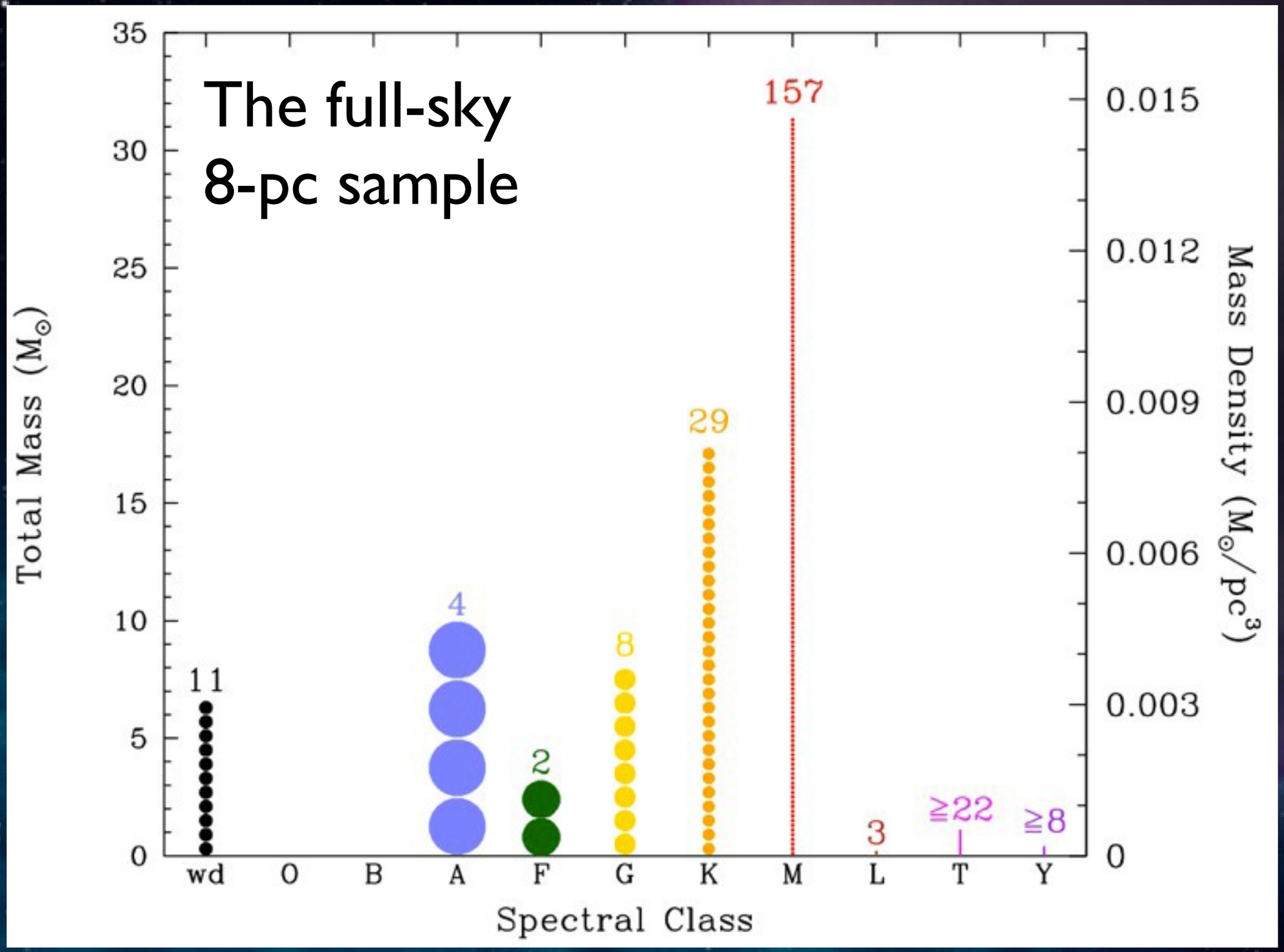


The absolute H-band fluxes of late-O to early-Y dwarfs span 12 orders of magnitude





Kirkpatrick et al. (2012)



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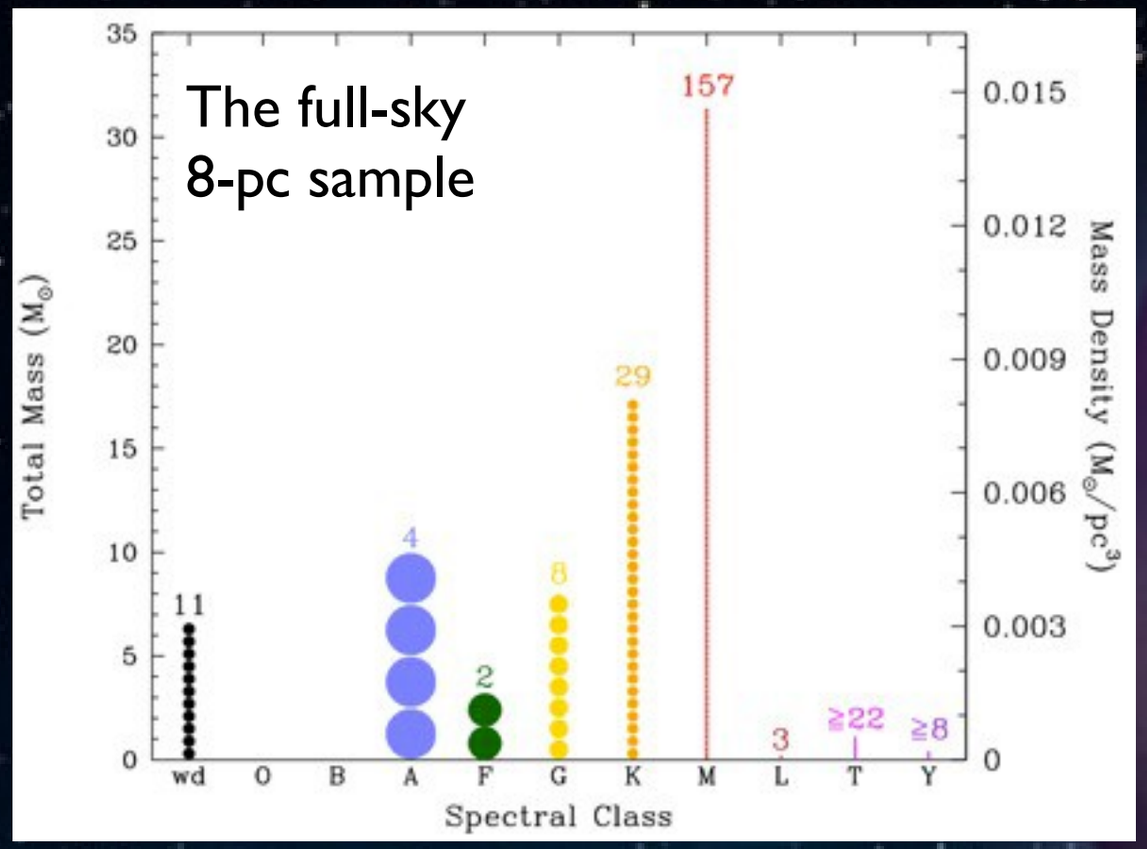
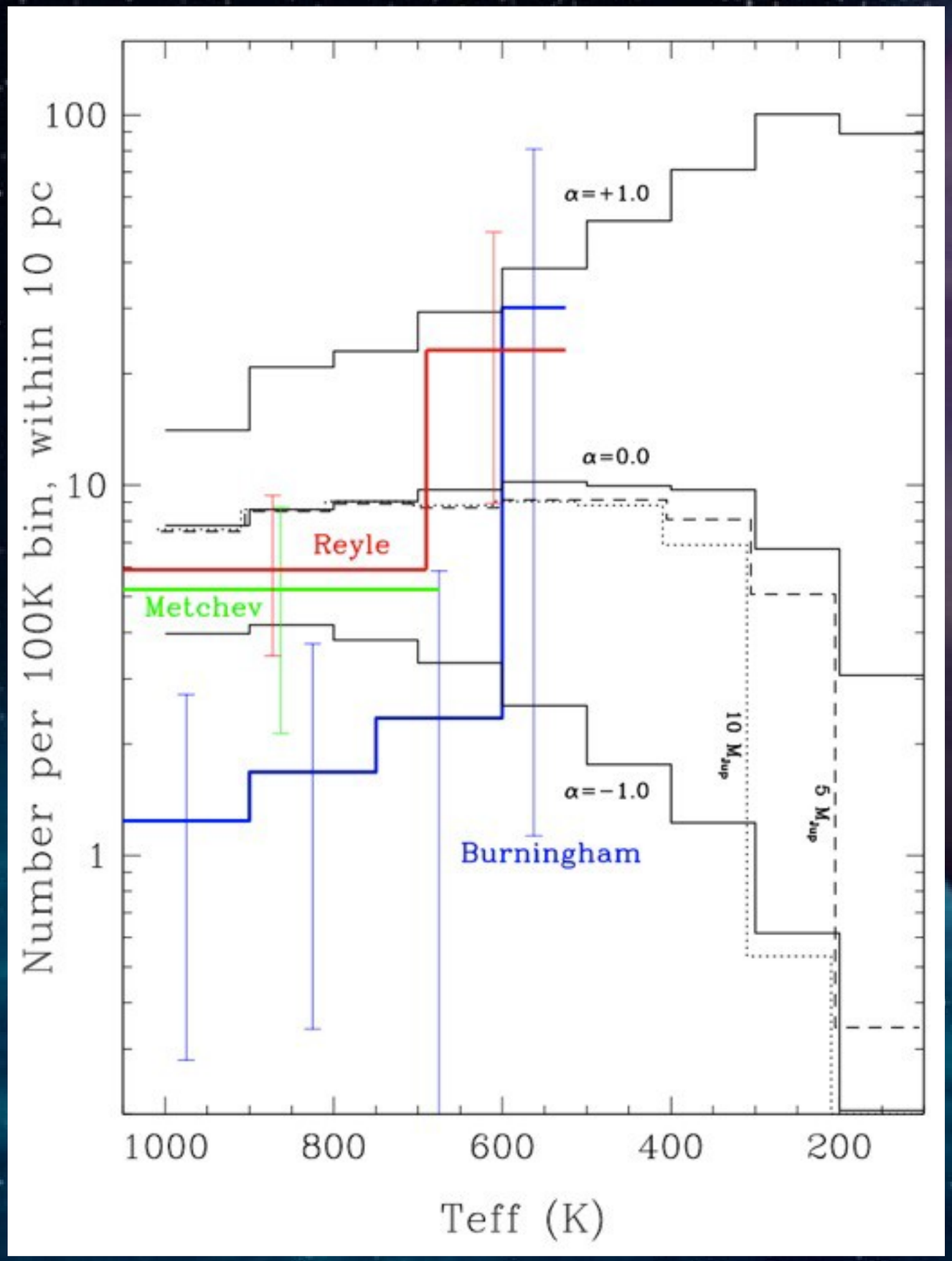


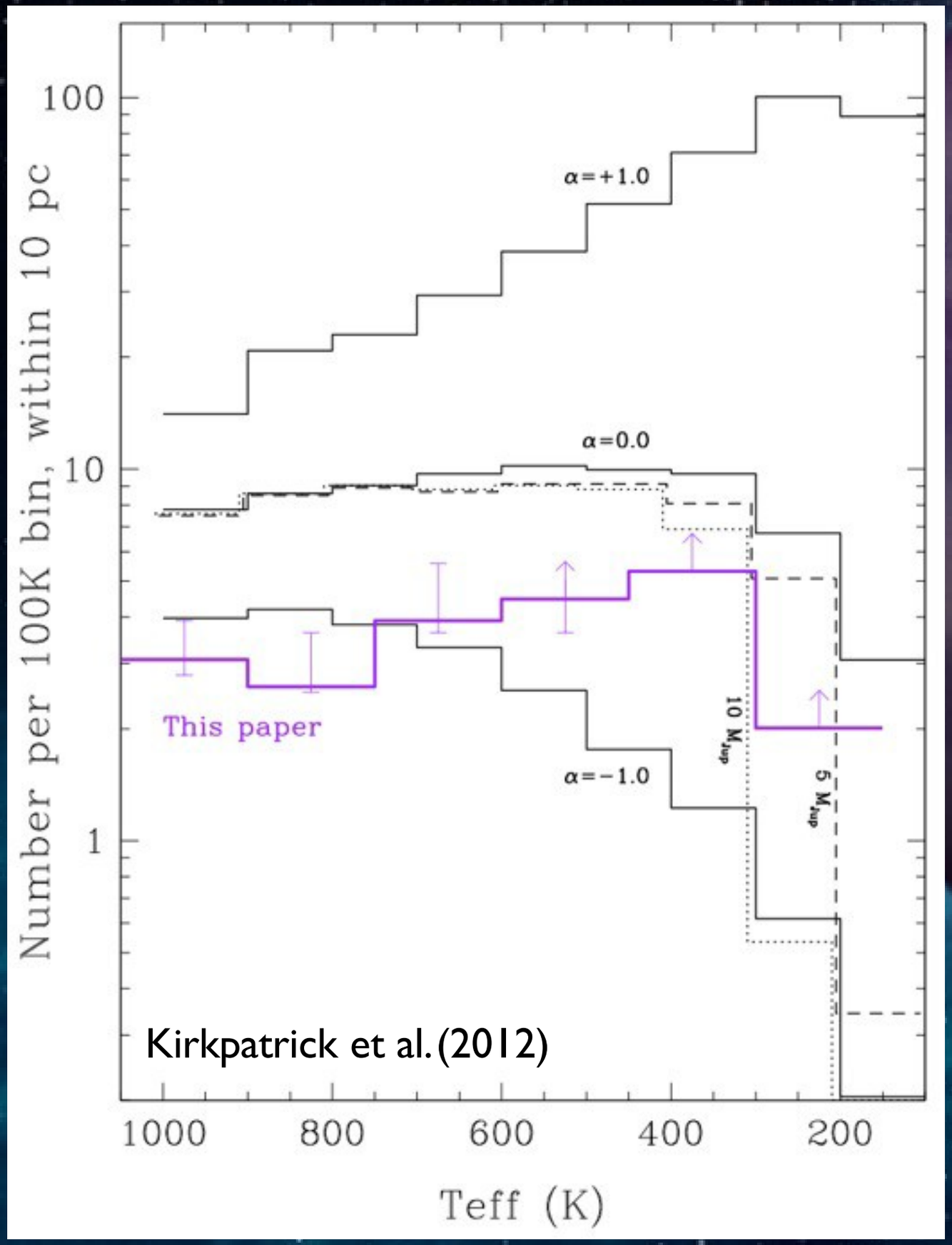
There are 211 stars and only 33 brown dwarfs in this volume.

This means that stars outnumber brown dwarfs by a factor of 6:1 currently.

The number of brown dwarfs will continue to increase if:
(a) more nearby Y dwarf candidates are confirmed, or
(b) our distances to known Y's are overestimated, or
(c) there are colder BDs invisible to WISE.



Simulations from Burgasser (2004,2008) compared to earlier empirical measures by Metchev et al. (2008), Reyle et al. (2010), & Burningham et al. (2010).



The same simulations compared to the 8-pc census.

The End