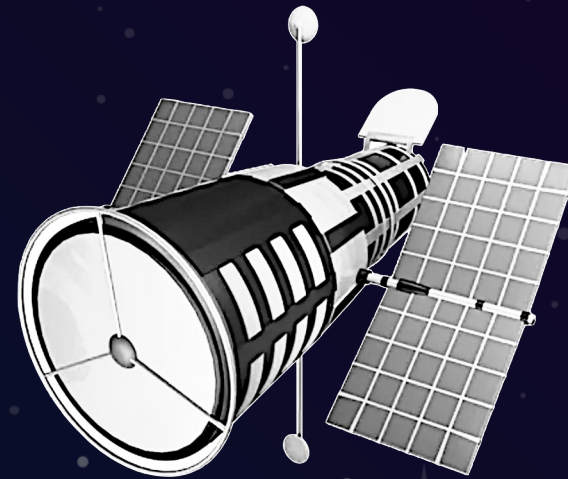


The lonely fate of brown dwarfs

Clémence Fontanive
Trottier Fellow
iREx, UdeM

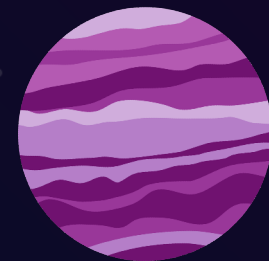


The lonely fate of brown dwarfs *(through memes)*

Clémence Fontanive
Trottier Fellow
iREx, UdeM



Filling the gaps – brown dwarfs to the rescue



STARS

BROWN DWARFS

JUPITER

M

L

T

Y

< 2200 K

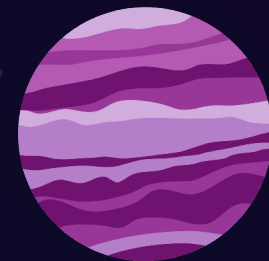
2200–1400 K

1400–500 K

500–250 K

125 K

Filling the gaps – brown dwarfs to the rescue



Y
< 500–250 K
25–3 M_{Jup}



STARS

BROWN DWARFS

JUPITER

M

L

T

Y

< 2200 K

2200–1400 K

1400–500 K

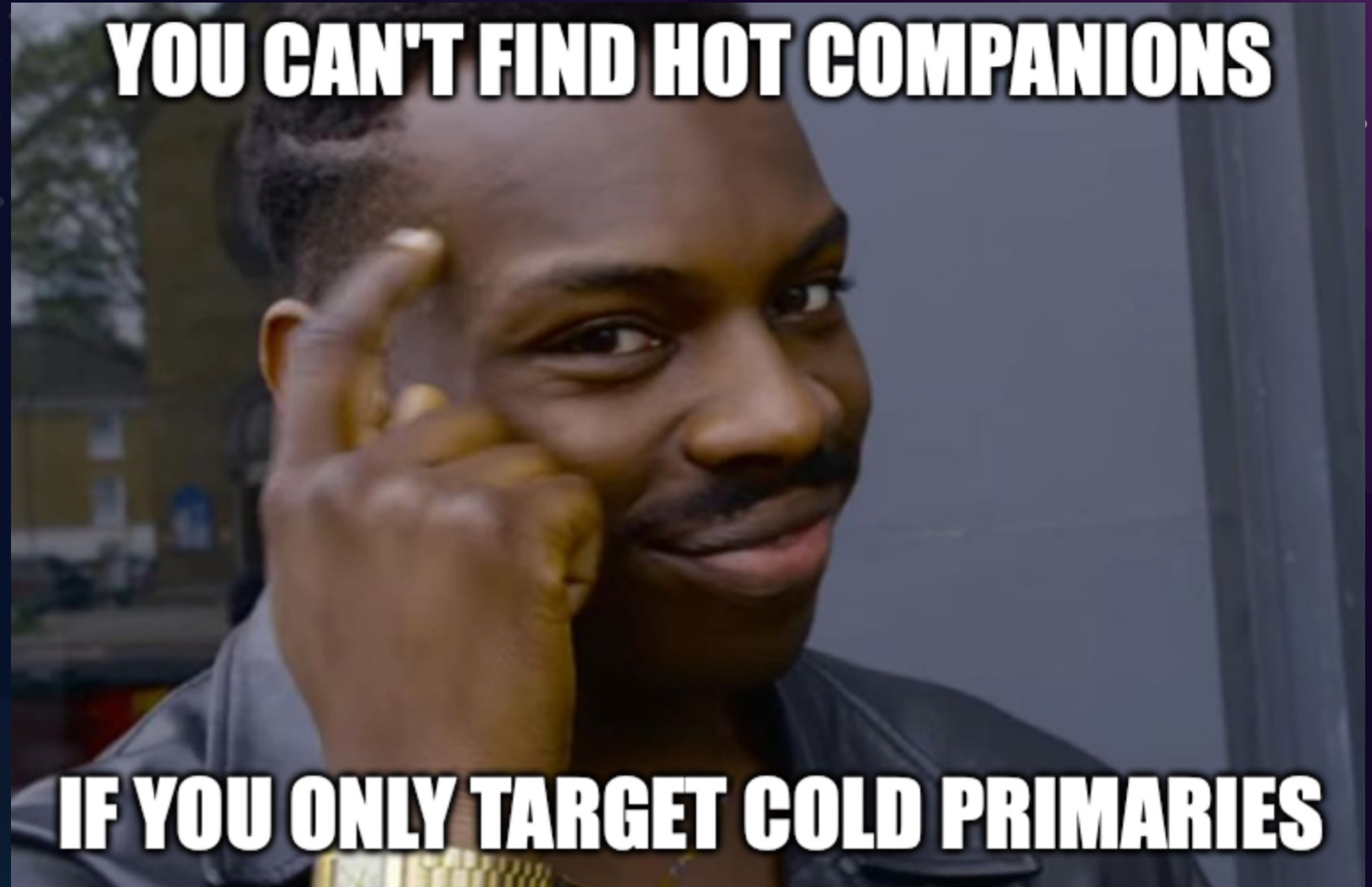
< 500–250 K

125 K

25–3 M_{Jup}

Bridging the temperature gap to Jupiter

Searching for the coldest objects around the coldest brown dwarfs



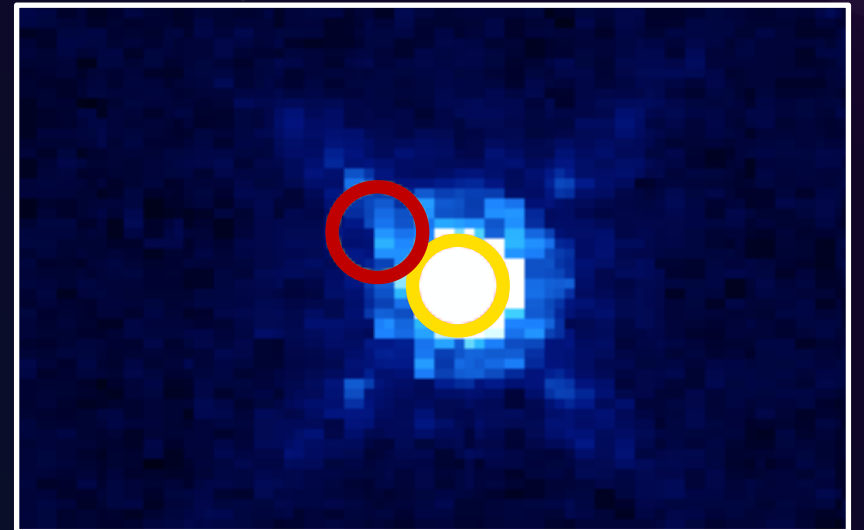
Identifying true companions



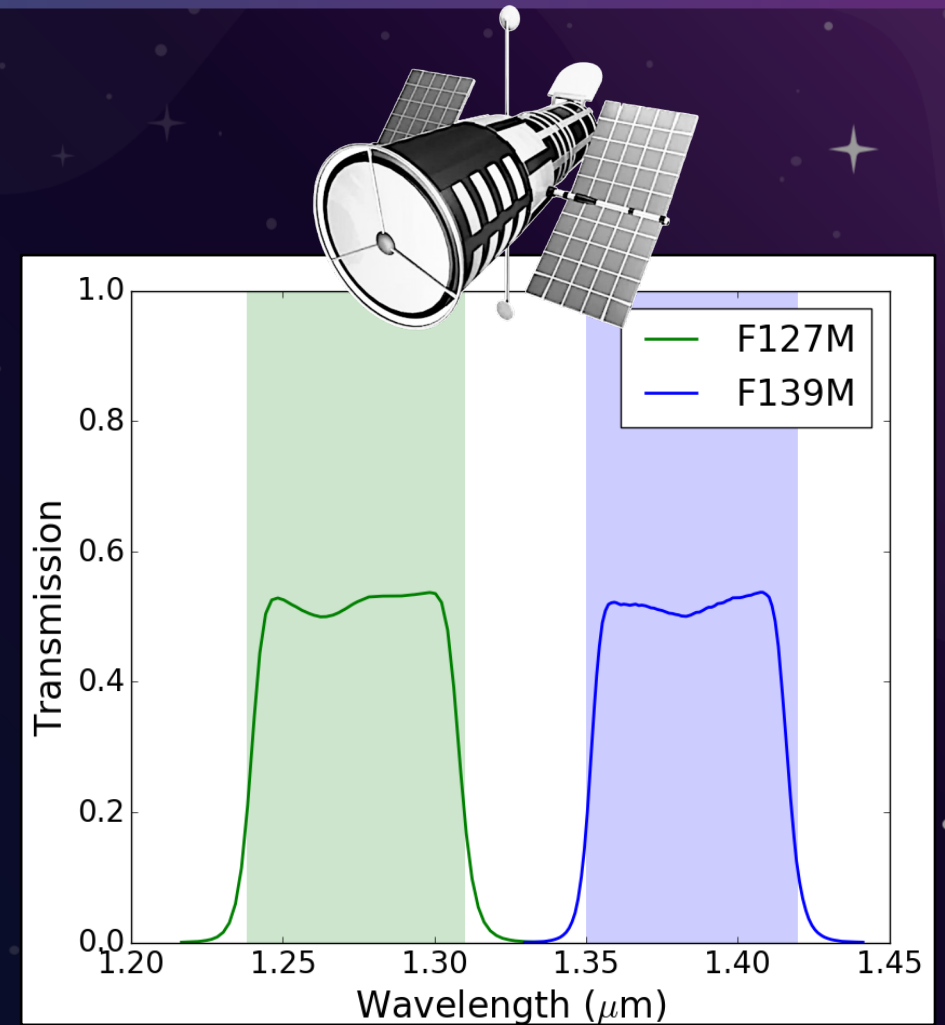
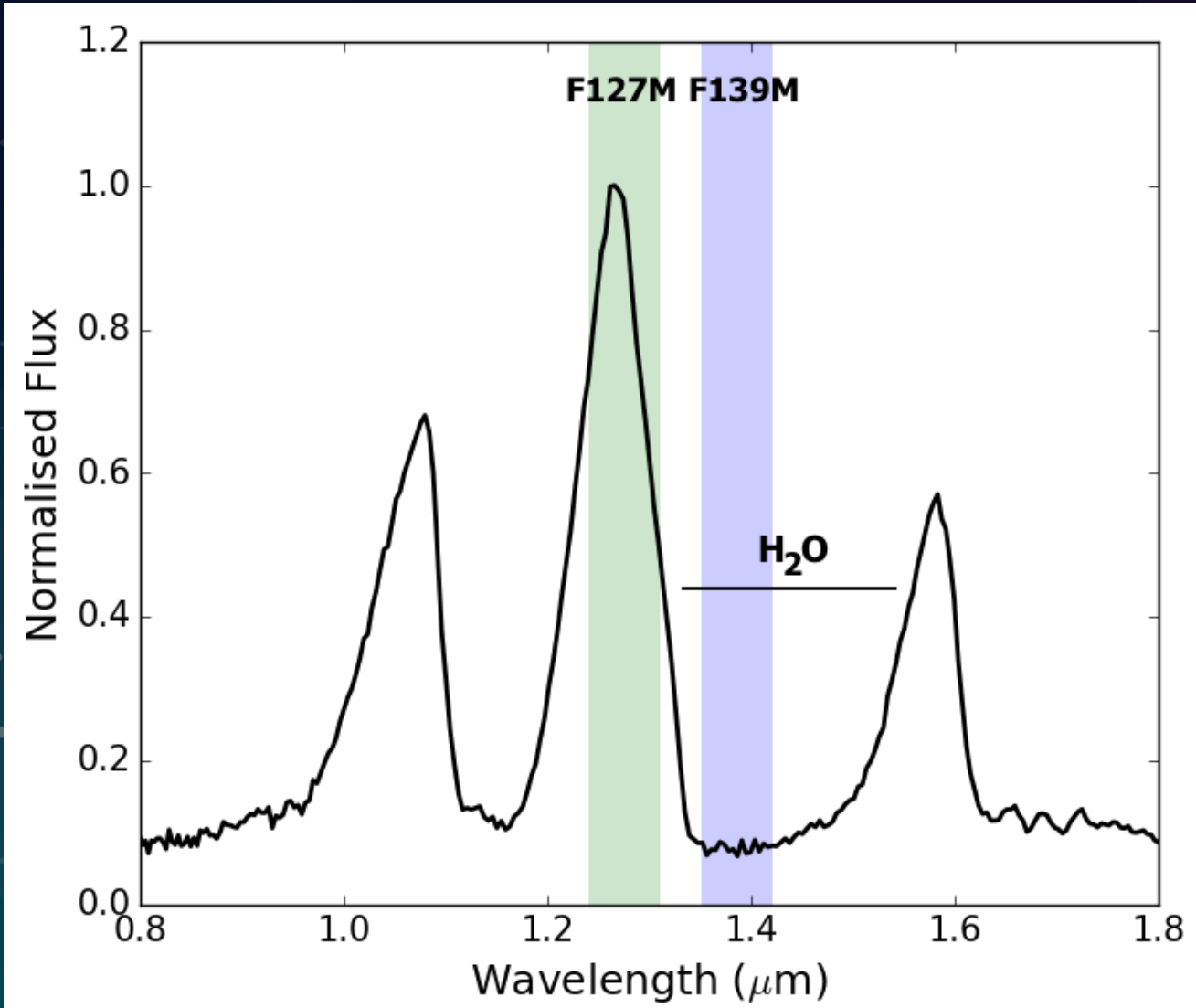
HST program

(PI Fontanive)

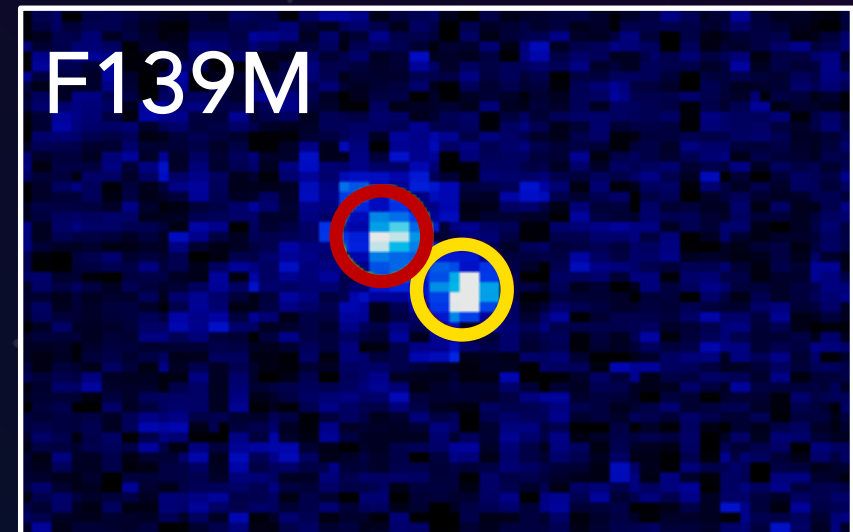
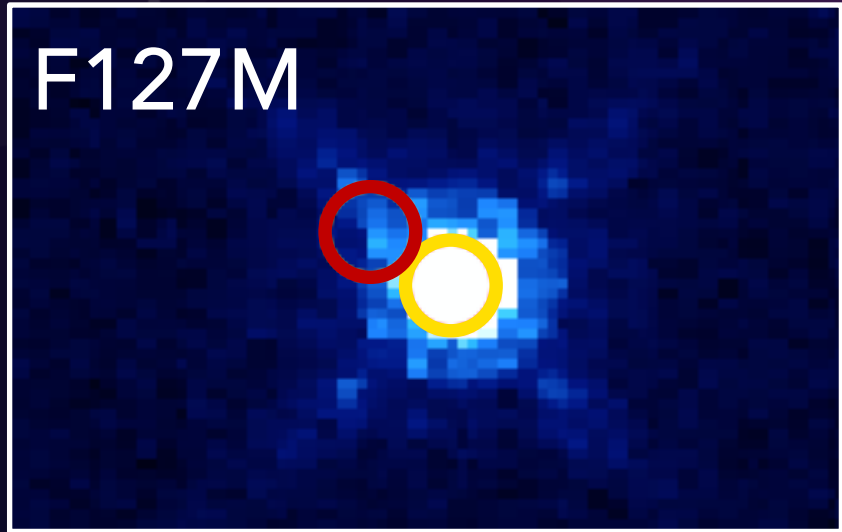
33 T8-Y2 dwarfs



Identifying true companions – with water vapour



Identifying true companions – with water vapour

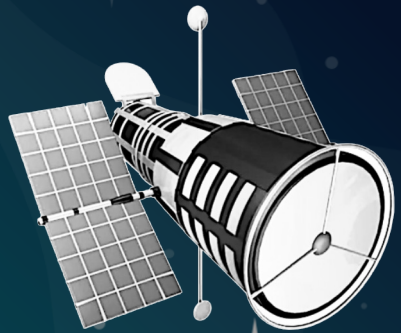


Survey Results – *[drum rolls]*

HST program

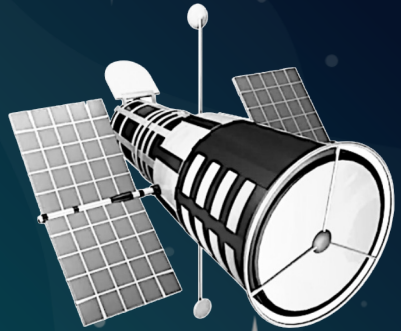
(PI Fontanive)

33 T8-Y2 dwarfs

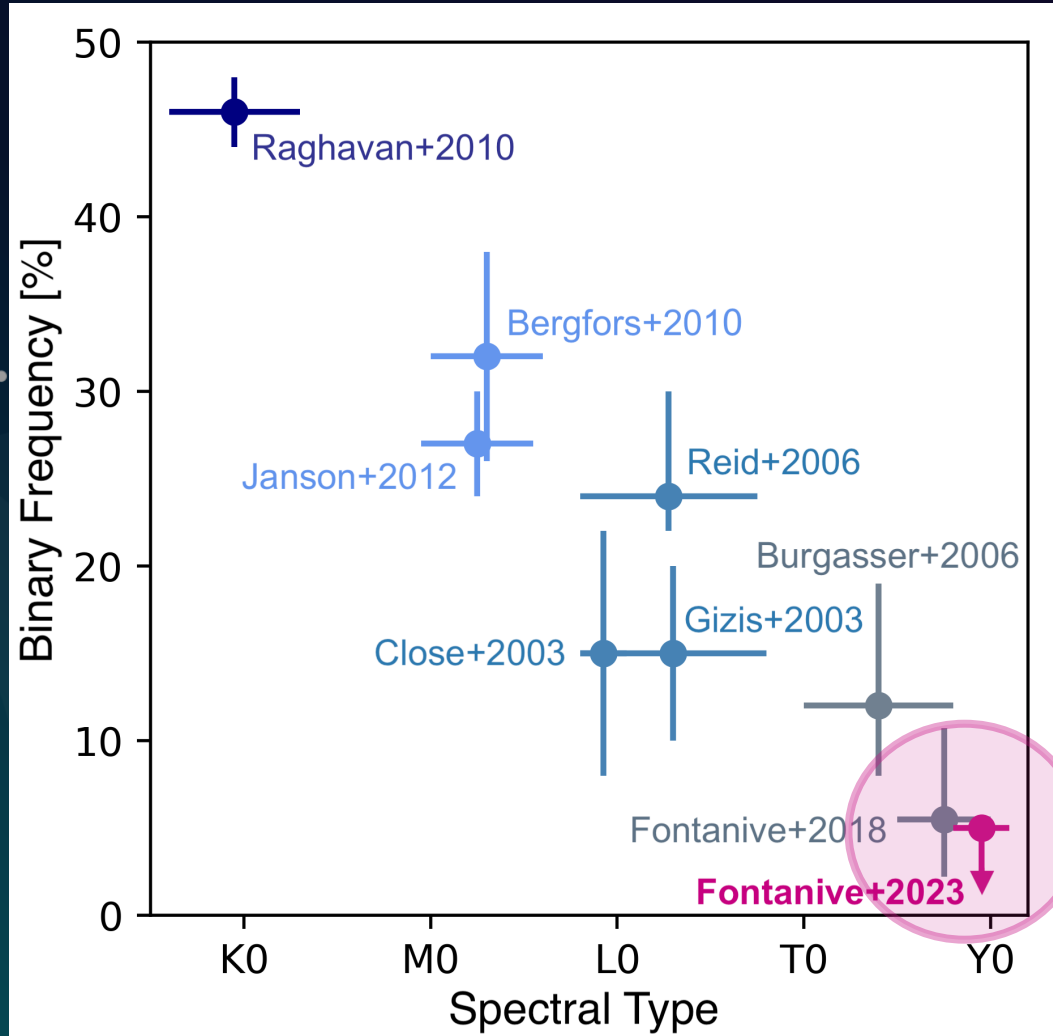


Survey Results – no detection...

HST program
(PI Fontanive)
33 T8-Y2 dwarfs



Survey Results – binary statistics

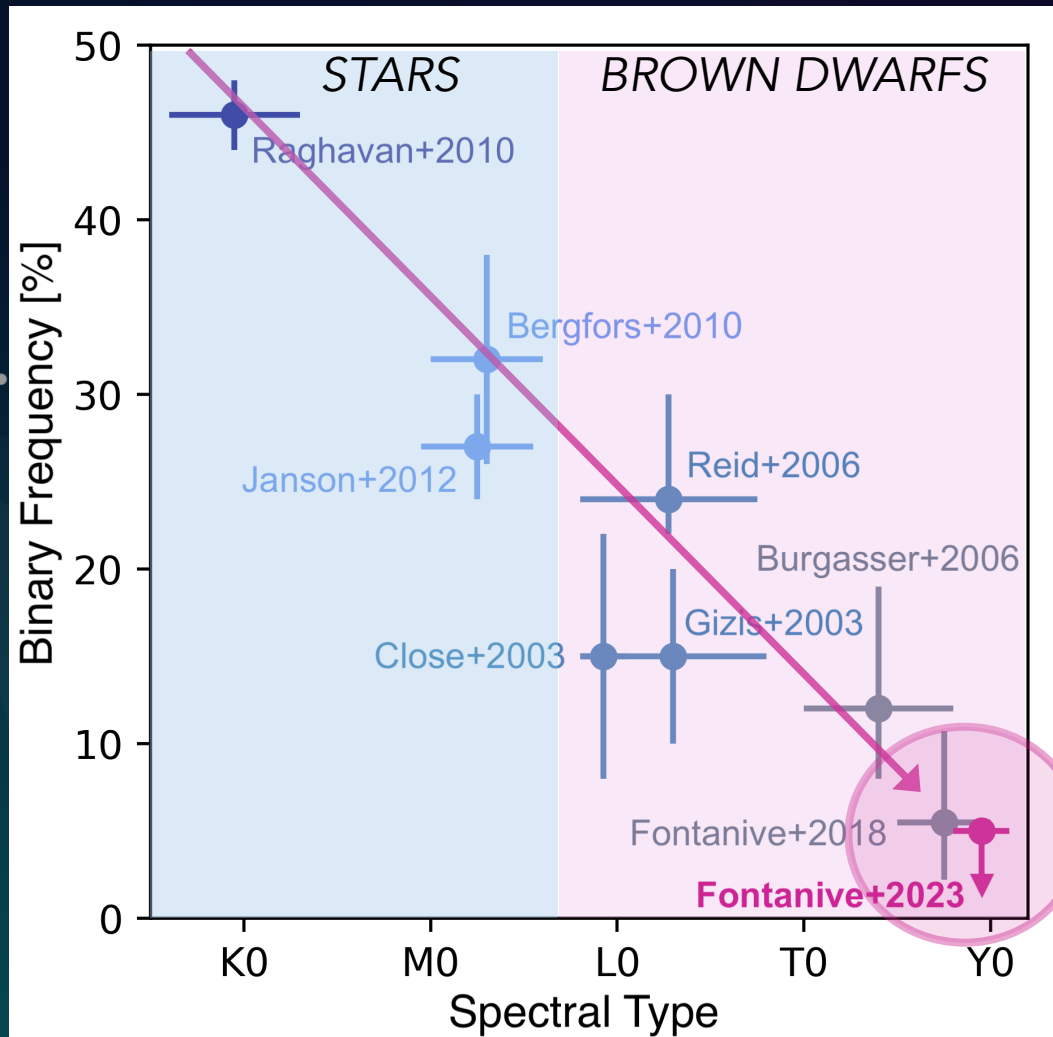


$f < 5\%$ [1–1000 au, $q \sim 0.4–1$]



• Fontanive et al. 2023

Survey Results – binary statistics



$f < 5\%$ [1–1000 au, $q \sim 0.4–1$]

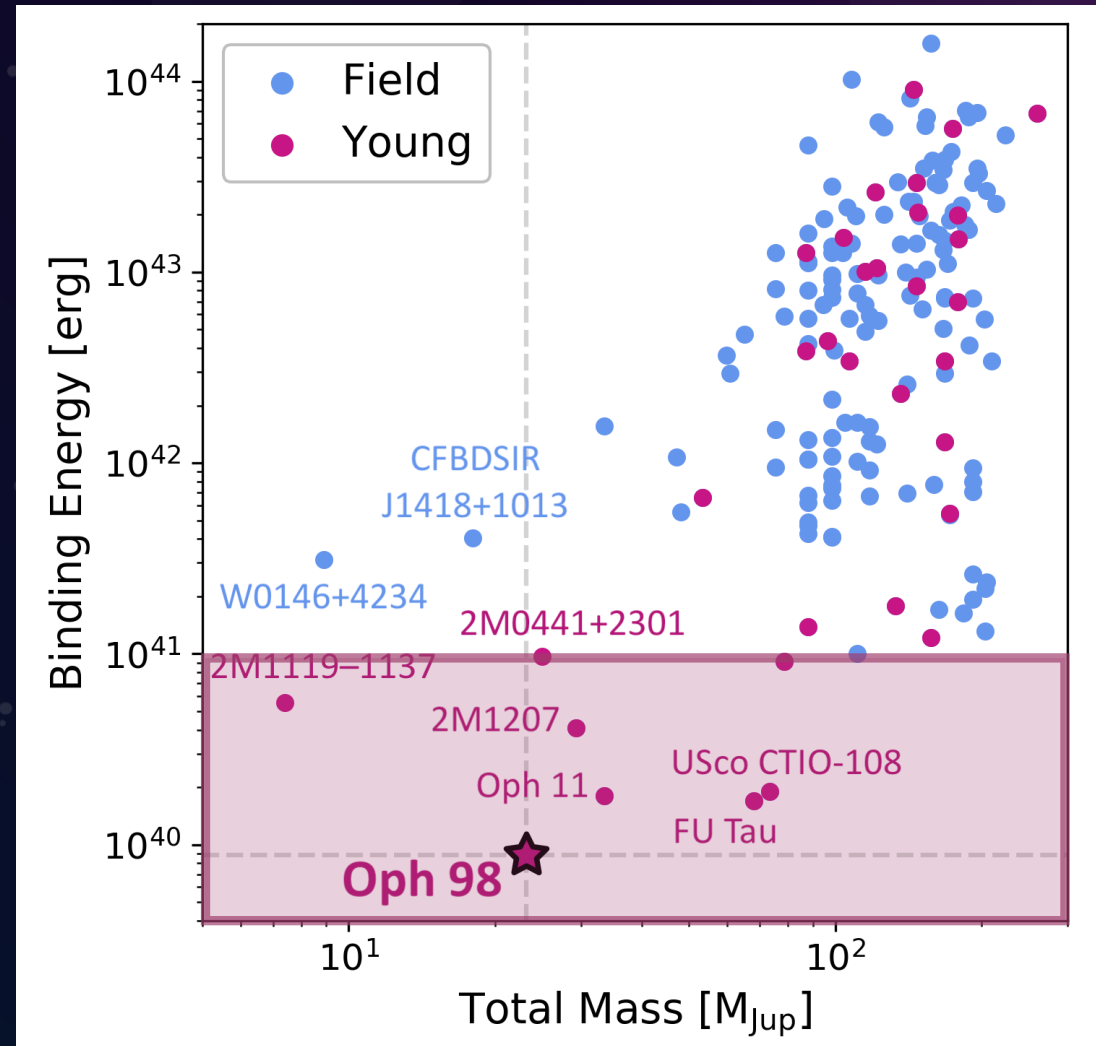
Extension of stellar trends all the way down to the end of the substellar regime



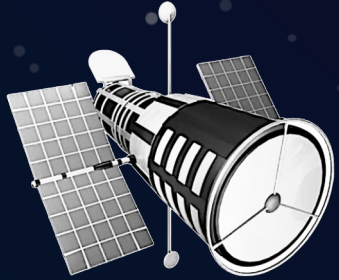
Fontanive et al. 2023

The young binaries plot twist

Y-dwarfs are old,
but their younger
analogues have a
lot more binaries



A planetary-mass binary



$15 + 8 M_{\text{Jup}}$
200 au
3 Myr

Oph 98 B

Oph 98 A

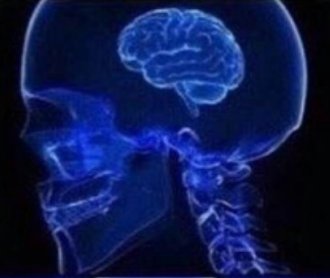
Fontanive et al. ApJL, 2020

**PLANETS
AROUND
STARS**

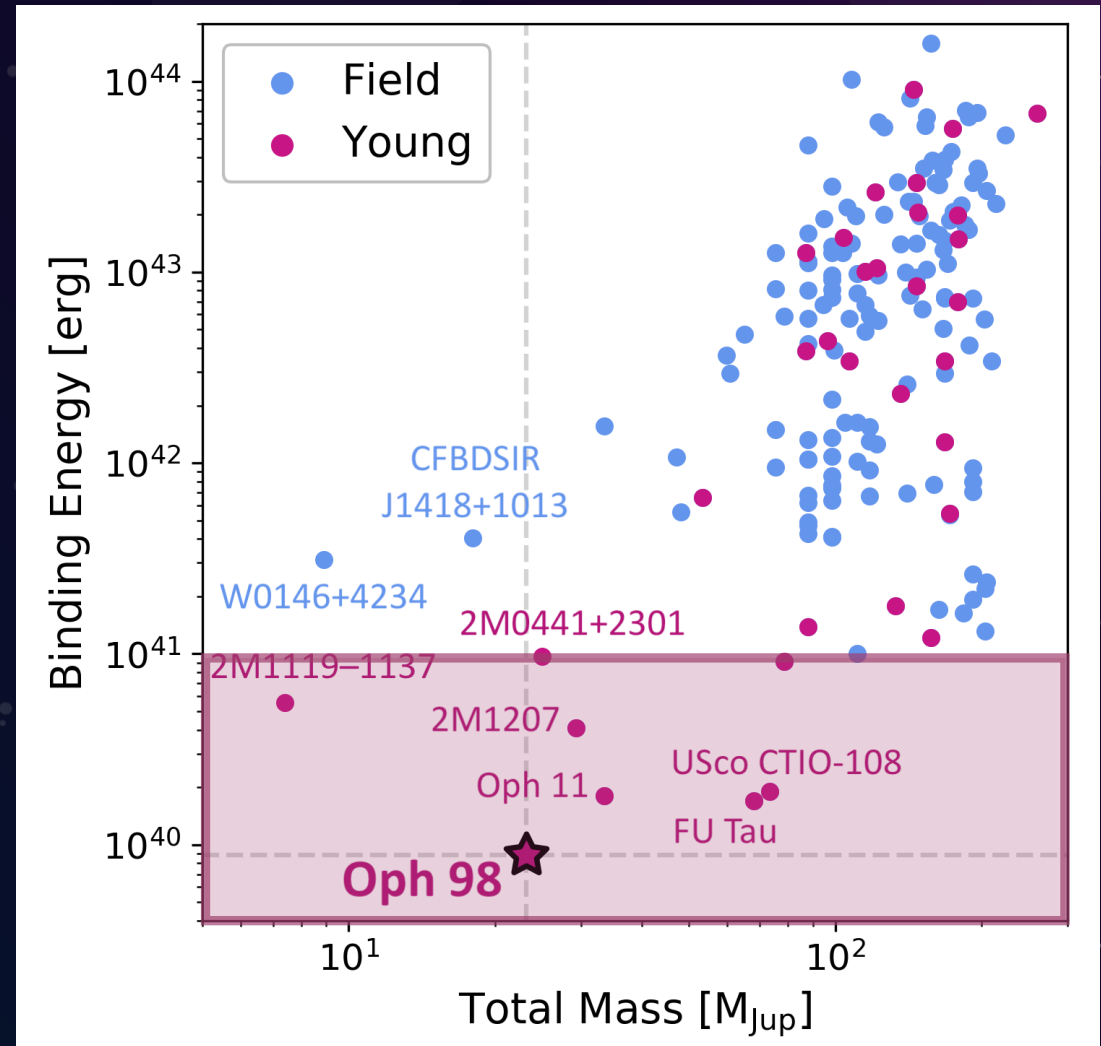
**PLANETS
AROUND
BROWN
DWARFS**

**FREE-FLOATING
PLANETS**

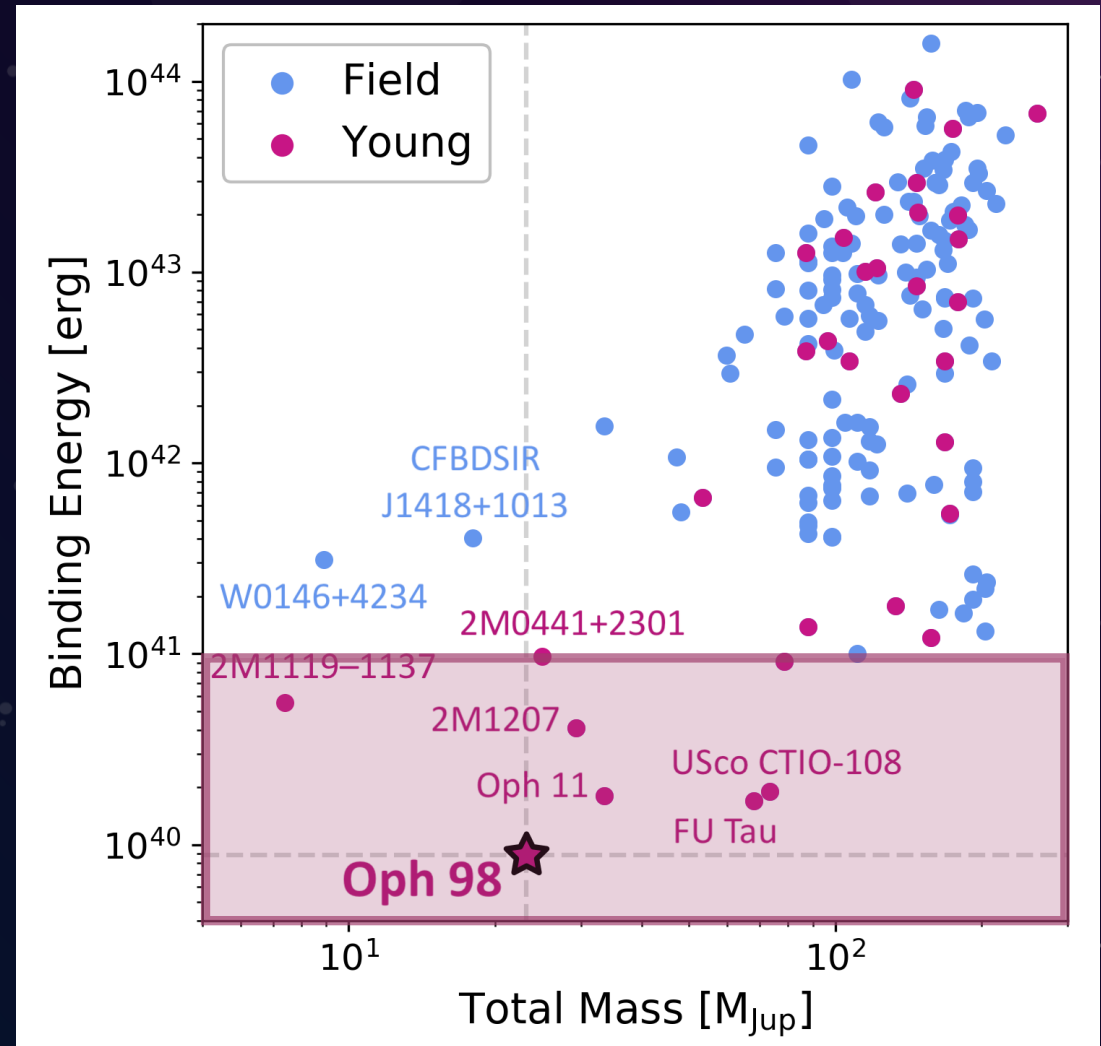
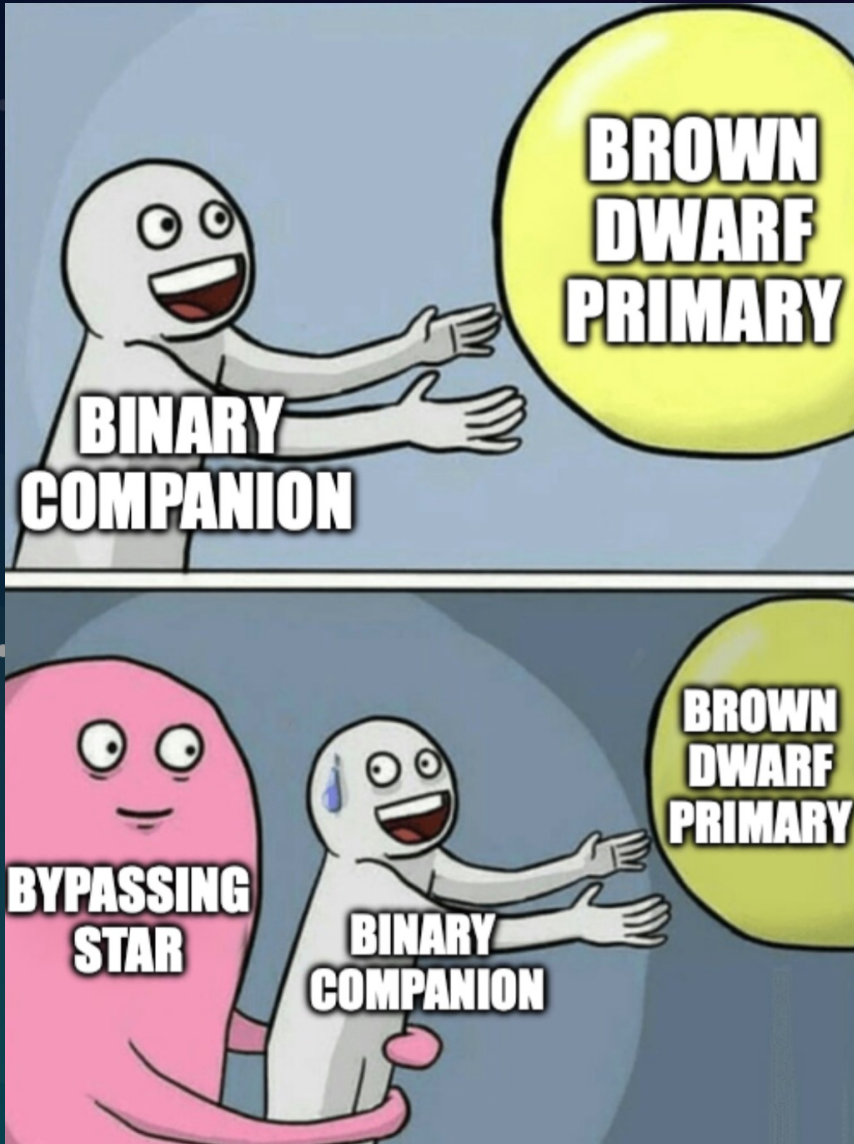
**BINARY
PLANETS**



Low-binding energy systems



Low-binding energy systems get disrupted!



My revenge on NASA




A cool
new
discovery






A null
detection
survey



UniBe Press Release

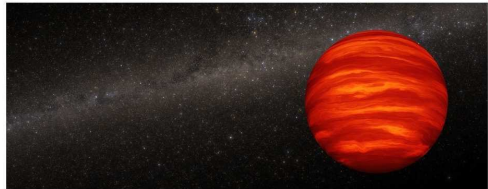
 HUBBLESITE

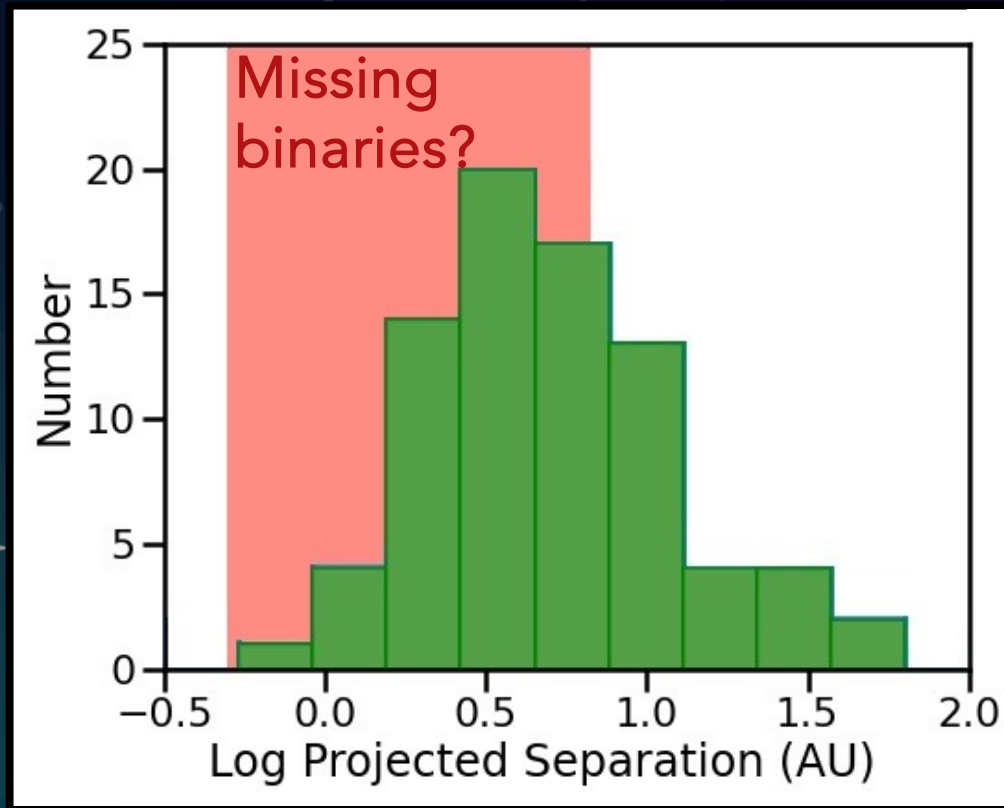
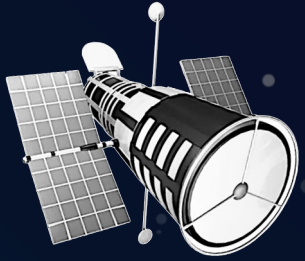
**NASA's Hubble Finds that
Aging Brown Dwarfs Grow
Lonely**

[View All News Releases >](#)

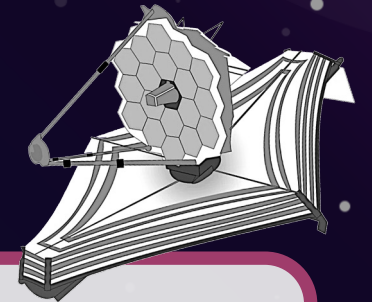
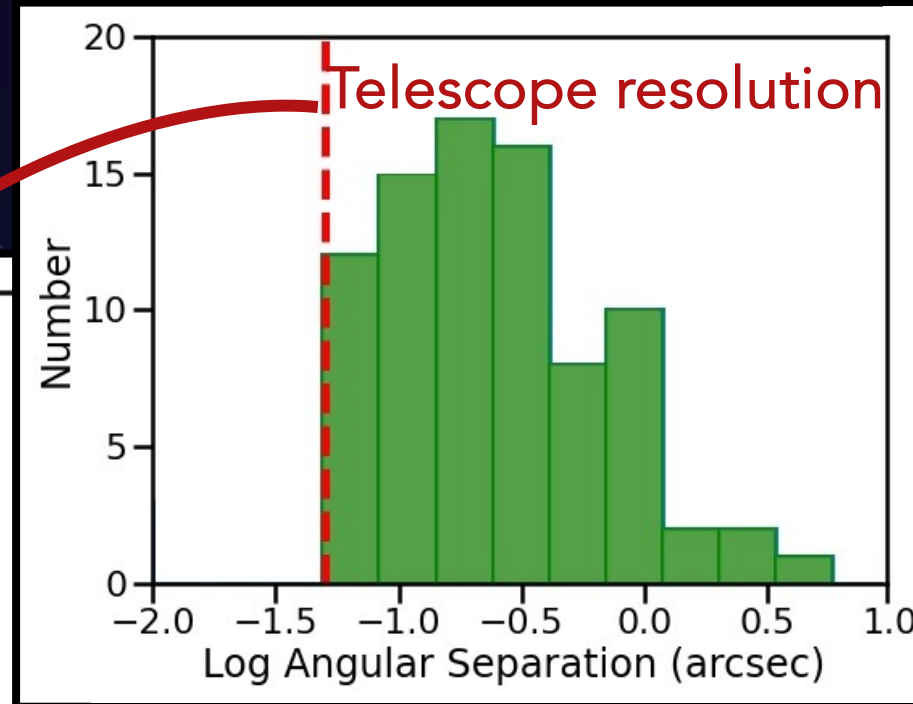
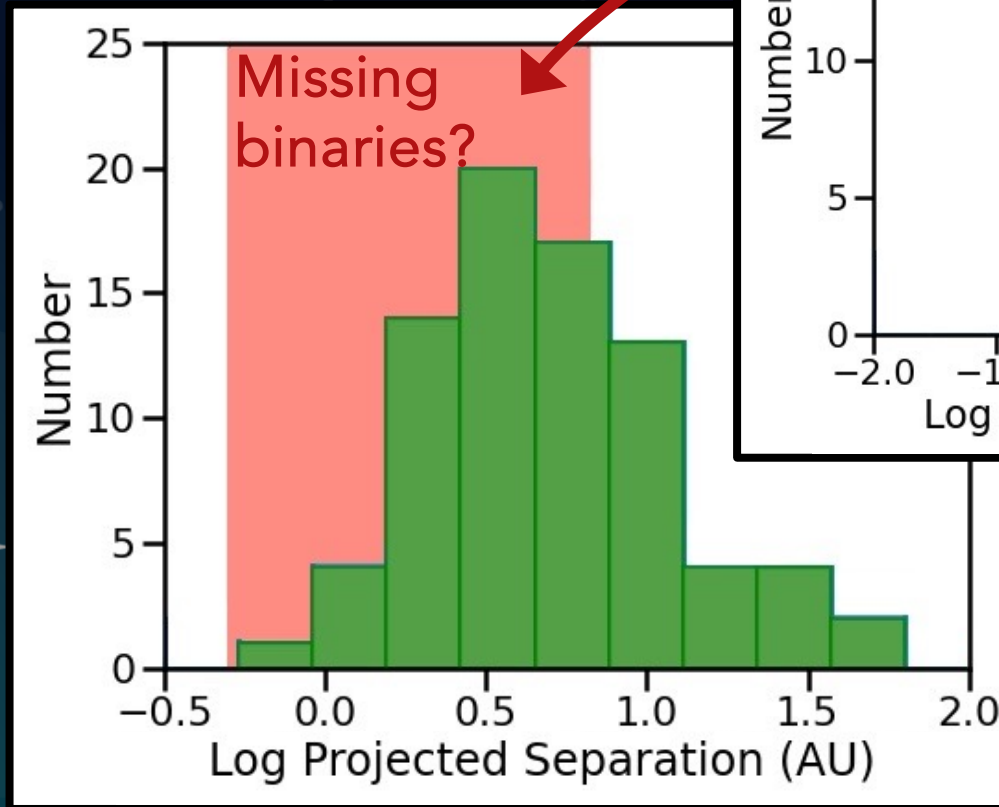
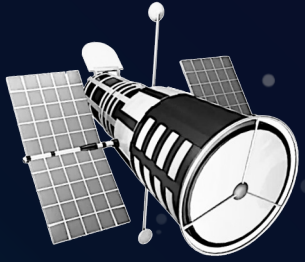
March 21, 2024 10:00AM (EDT) | Release ID:
2024-005



There might still be hope...



There might still be hope...



see next talk by
Thomas Vandal

Summary

