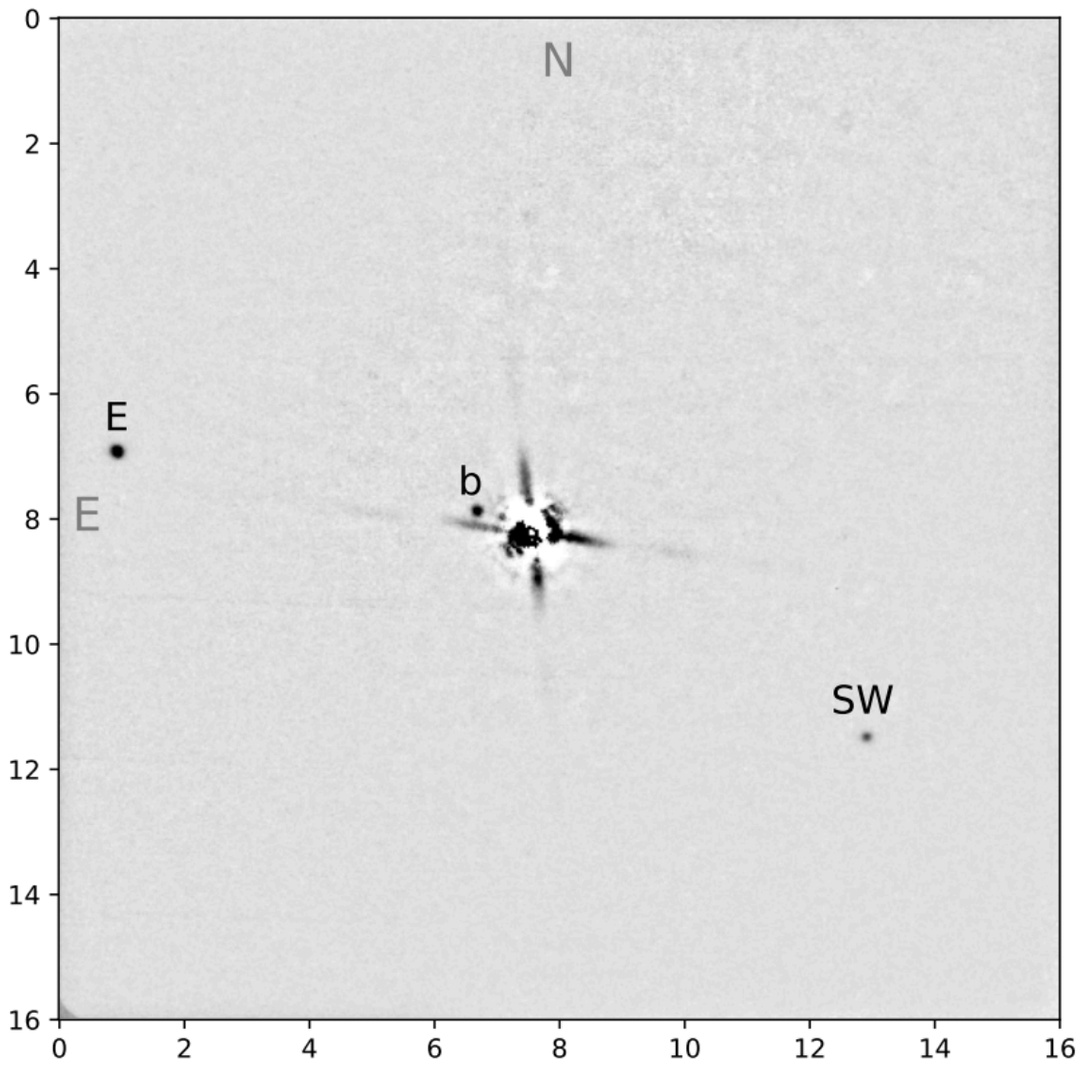
Looking at the youngest imaged exoJupiter with RDI-IFU spectroscopy

M. Bonnefoy + COBREX TEAM + P. Palma-Bifani (Nice), S. Petrus (U. Valparaiso), D. Demars (IPAG), C. Dougados (IPAG)

Target



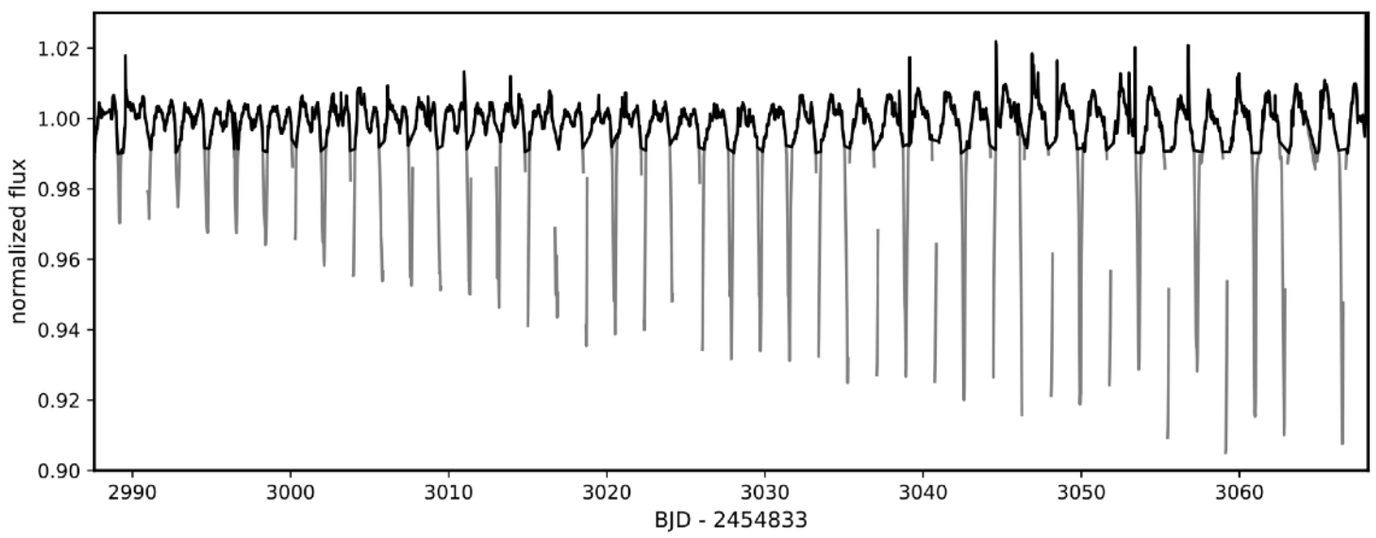
2M0437b: new companion in Taurus
(Gaidos et al. 2022)

Star: 0.15-0.18M⊙

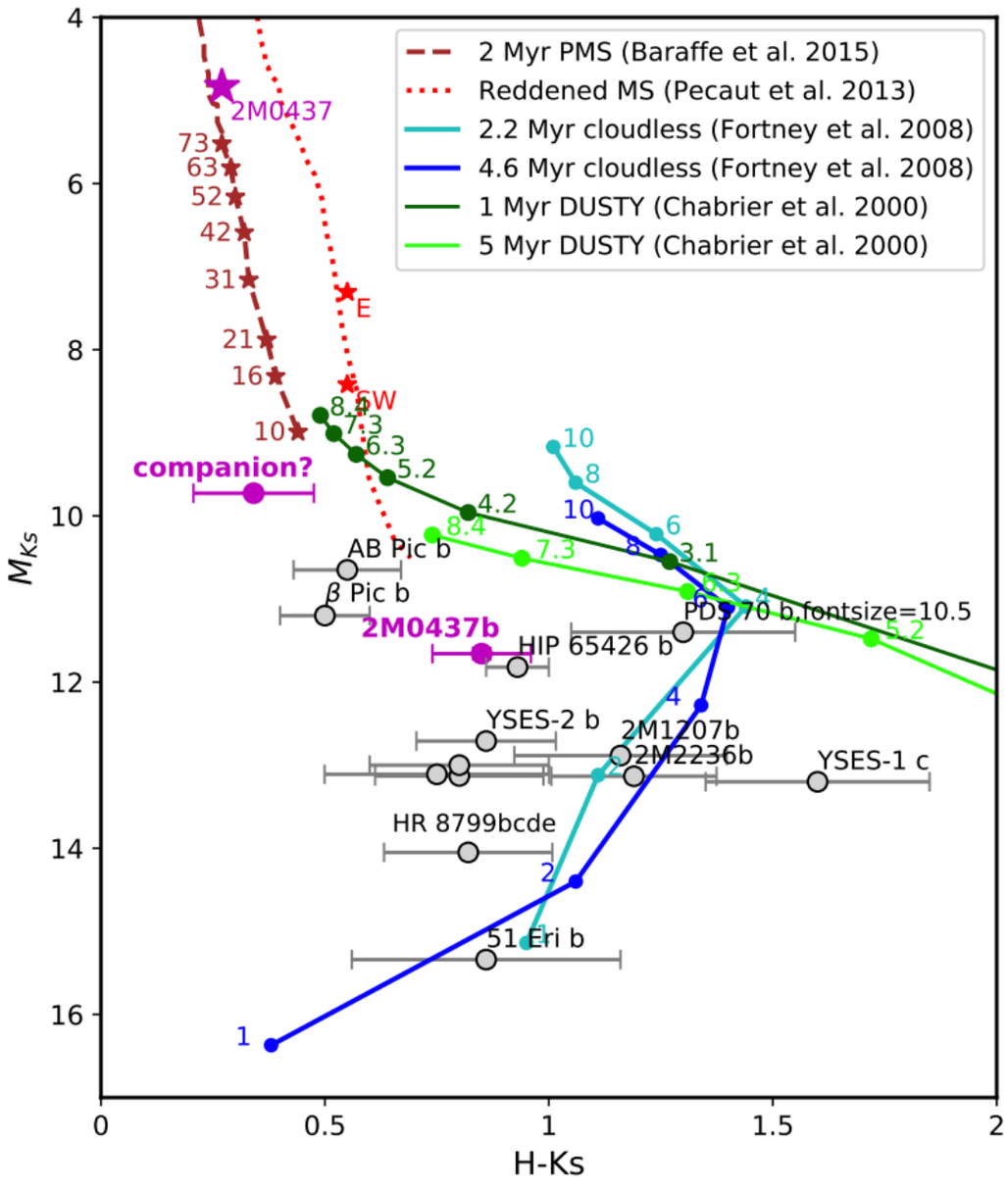
2-5Myr

[Fe/H]=0.01 (spectroscopic)

No excess, but periodic dimming (K2)



Target



2M0437b: new companion in Taurus *(Gaidos et al. 2022)*

Star: 0.15-0.18$M_\odot$

2-5Myr

[Fe/H]=0.01 (spectroscopic)

No excess, but periodic dimming (K2)

A very low-mass exoplanet!

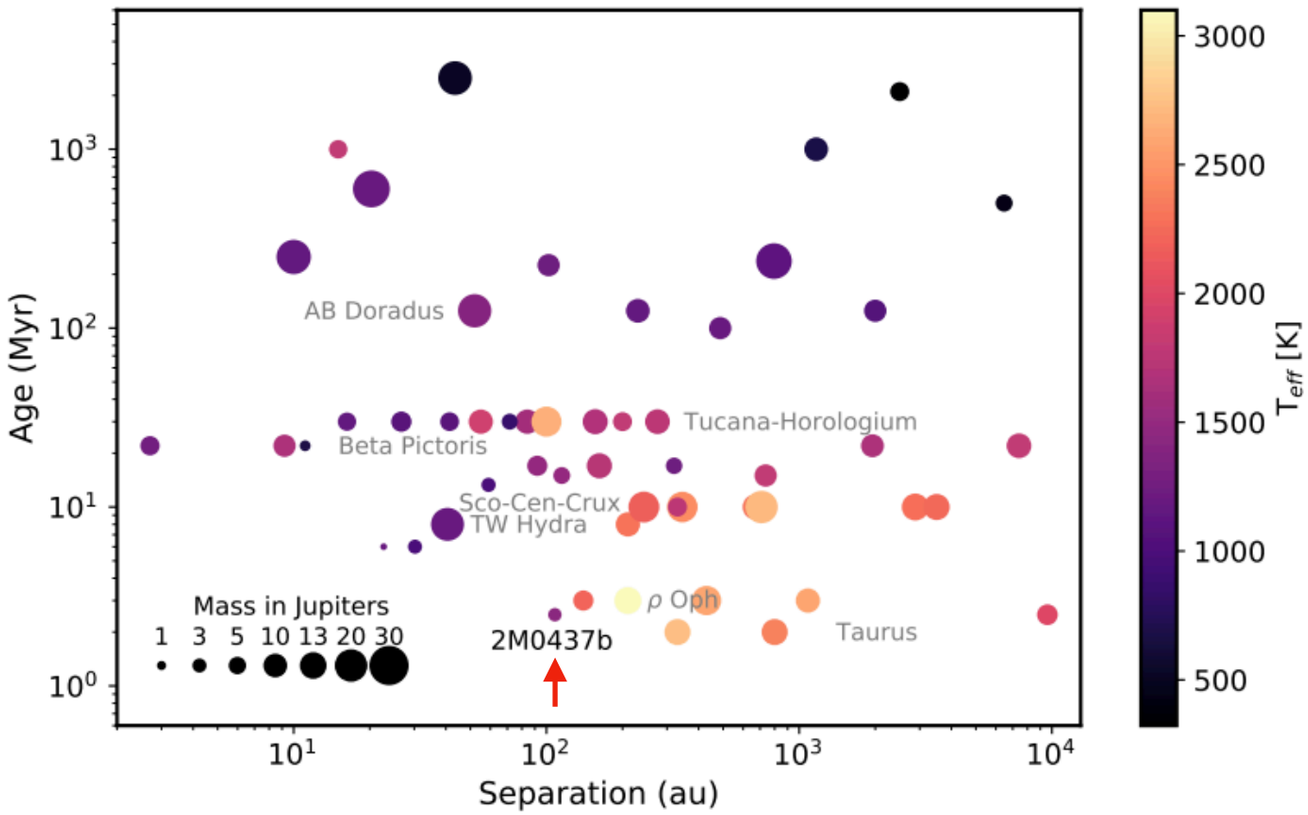
M_b=1-5M_{Jup}, q=0.6-3.3%

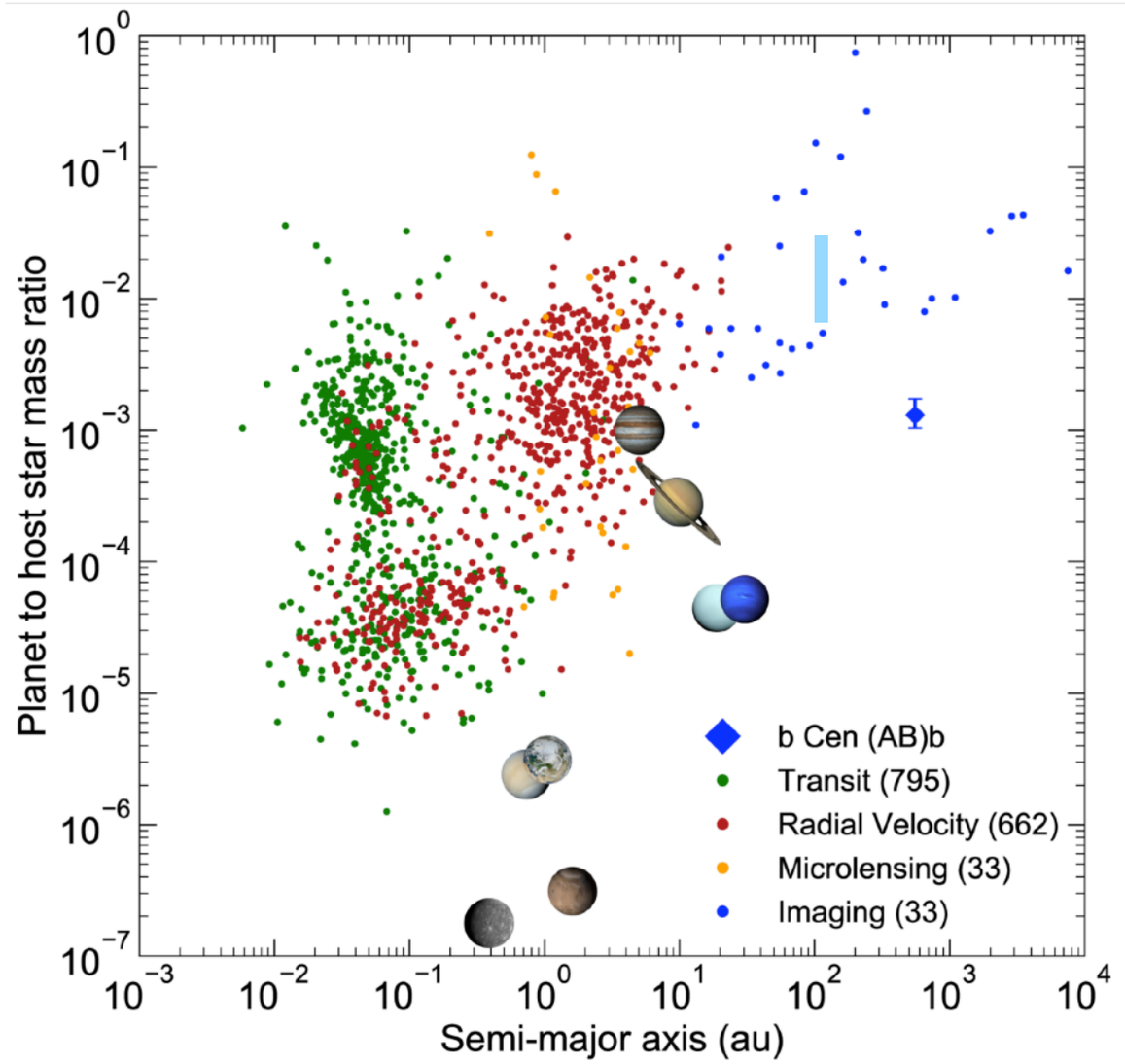
ρ=0.9”= 115au

L-type object

Faint ! (K=17.2mag, ΔK=6.8mag)

Target


Age (Myr)
10^3
10^2
10^1
10^0
AB Doradus
Tucana-Horologium
Beta Pictoris
Sco-Cen-Crux
TW Hydra
Mass in Jupiters
1 3 5 10 13 20 30
2M0437b
ρ Oph
Taurus
10^1
10^2
10^3
10^4
Separation (au)
3000
2500
2000
1500
1000
500
T_{eff} [K]


Planet to host star mass ratio
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
b Cen (AB)b
Transit (795)
Radial Velocity (662)
Microlensing (33)
Imaging (33)
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
10^2
10^3
10^4
Semi-major axis (au)

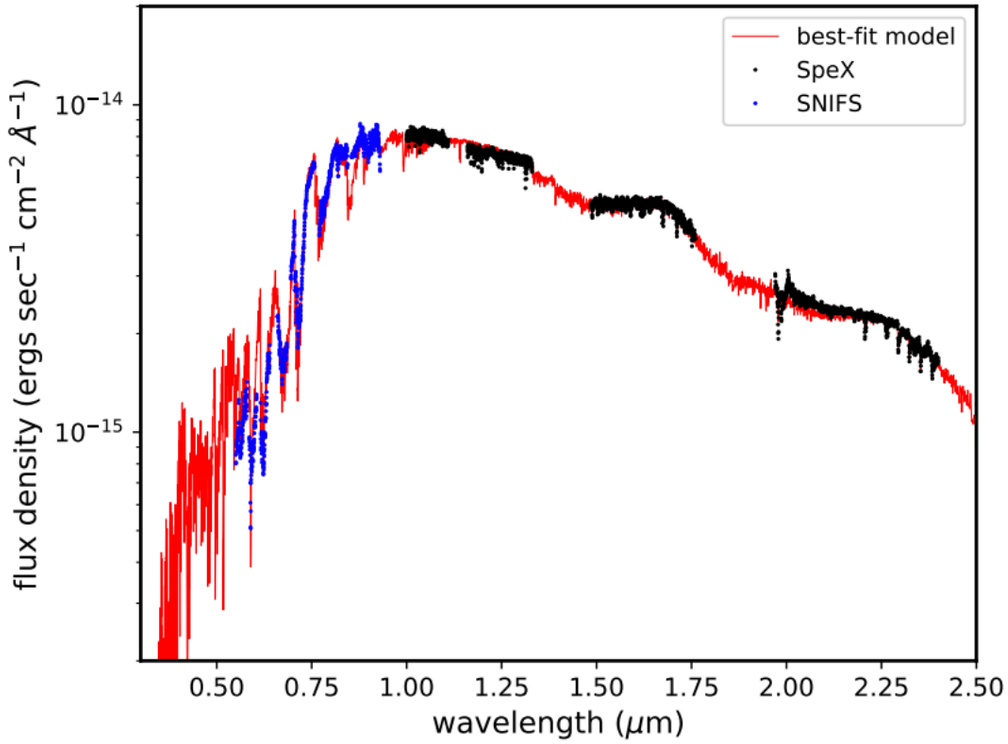
Objectives #1

First spectrum of the companion

- Determination of Teff, log g, R

  log g and Teff ☛ mass, age

- Determination of C/O and Fe/H of b wrt A!



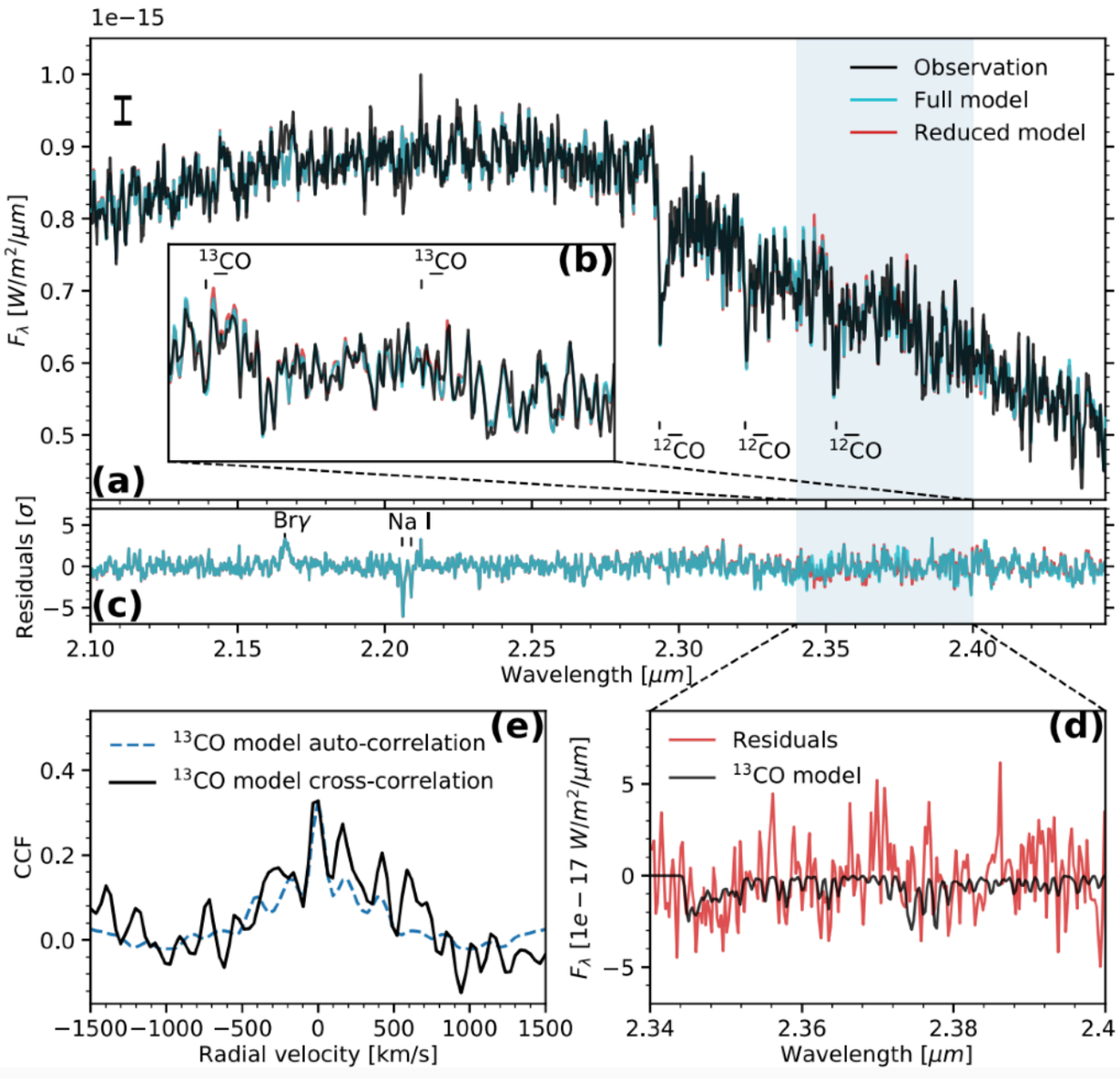
☛ formation mechanism

Objectives #2

Looking for faint Brγ on b

46% of companions <20M_{Jup} accreting (Bowler et al. 2017)

4/5 known PMC < 5Myr are accreting!

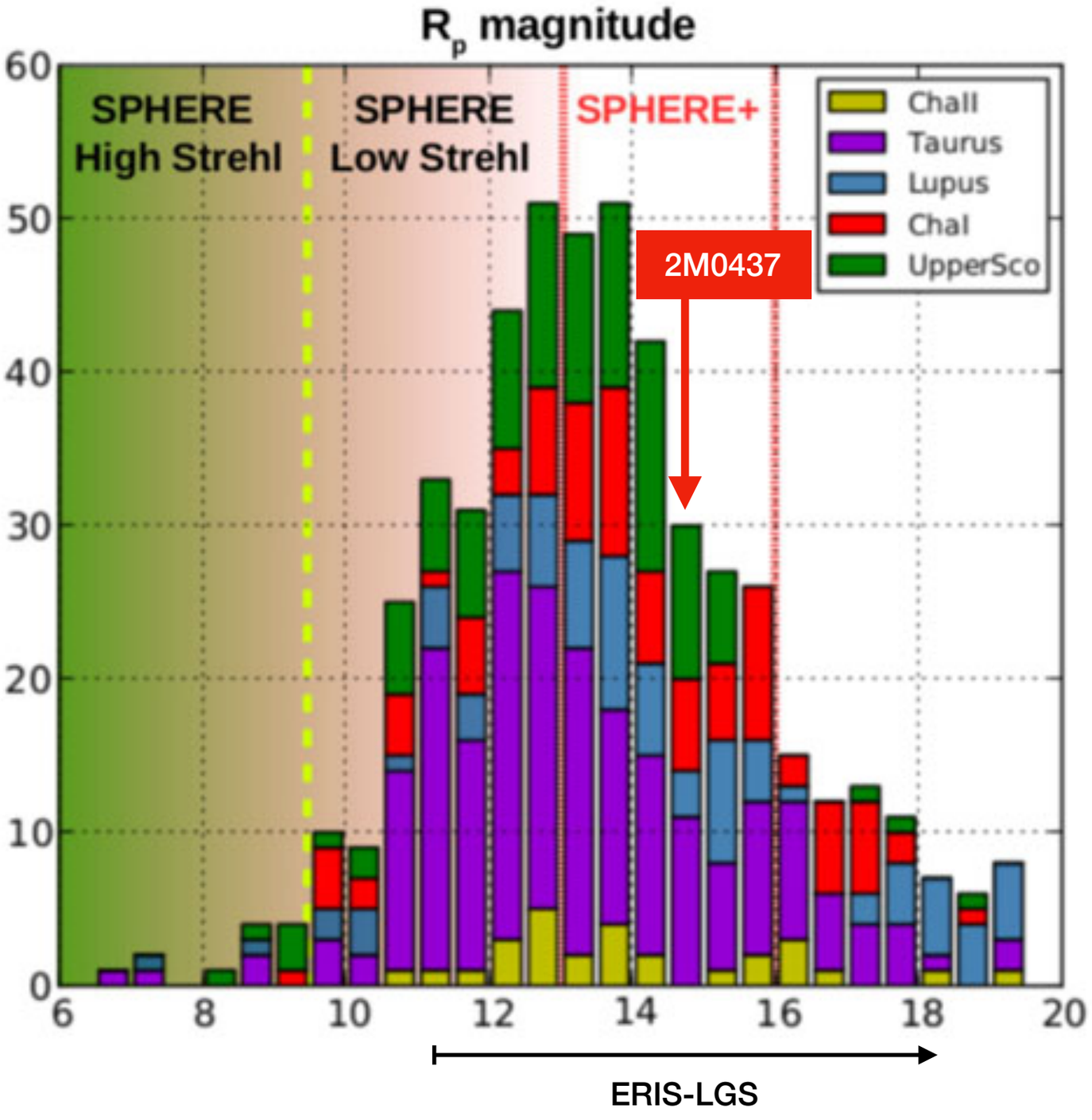


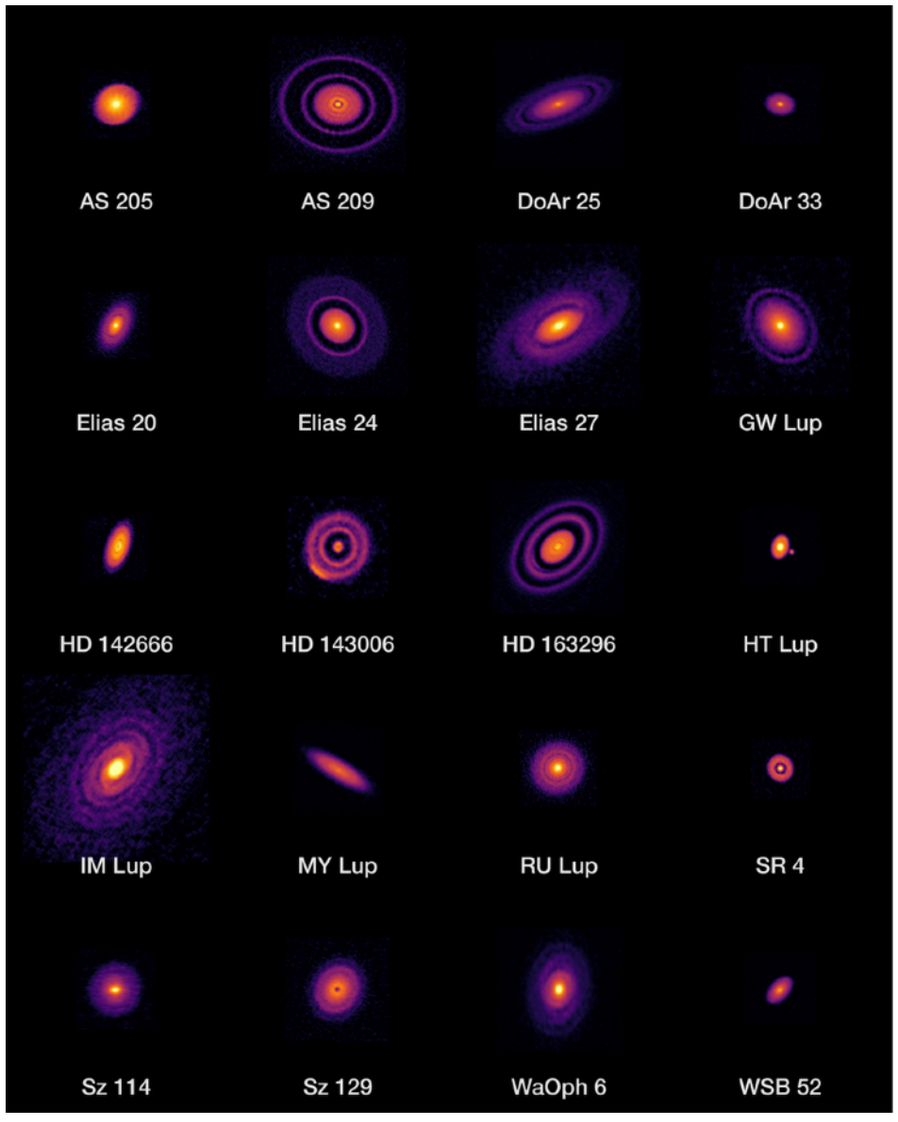
☛ **direct detection of the line (photosphere subtracted)**

☛ **detection « à la PDS70 » using diversity**

Objectives #3

Testing RDI imaging on med-res IFU





- ☛ direct detection of companions
- ☛ molecular mapping
- ☛ disk & blob detection (AB Aur *b*) and spectroscopy (reflectance)

Setup

- LGS (R=14)
- K-low (R=5600)
- 50x100mas spaxels (for S/N purpose)
- 20s exposures (max on A).
- NDIT=280 total to reach S/N=20 on average

Test RDI strategy for 50% of sequence

Ref star (8.1’): 2MASS J04375669+2653050

K=10.5, R=14.2 ,B-R=1.6

Source: K=10.4, R=14.8 ,B-R=1.7

2h06 on source + 29min on ref = 2.6h total?