

A JWST/MIRI view of κ Andromedae b: Refining its mass, age, and physical parameters

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E. Choquet, E. Serabyn, M. Mâlin, P. Tremblin, C. Danielski, P. O. Lagage, A. Boccaletti, B. Charnay, and M. E. Ressler

Godoy et al. A&A, 702, A4 (2025)

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κ Andromedae b

A well known companion, but poorly constraints in its core properties

Main known properties of κ And b:

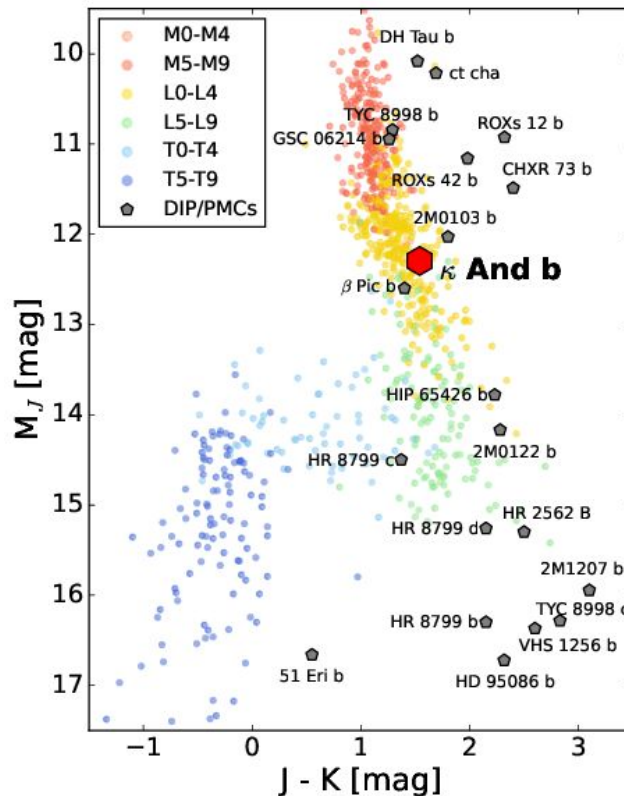
Fast rotator

T_{eff} : 1700 - 2000 K

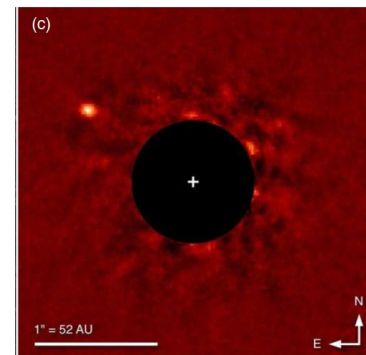
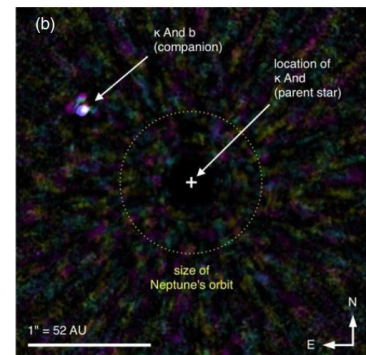
$\log(g)$: 4.0 - 5.0

Age : 10 - 250 Myr

Mass : 13-50 M_{Jup}



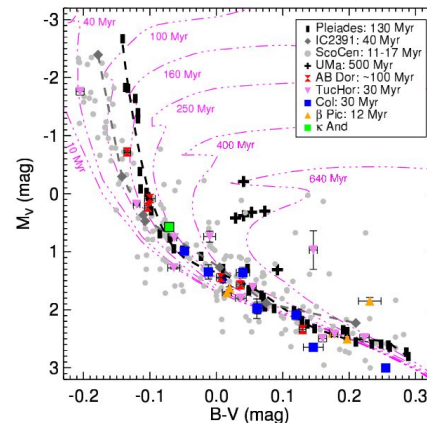
Carson et al. 2013



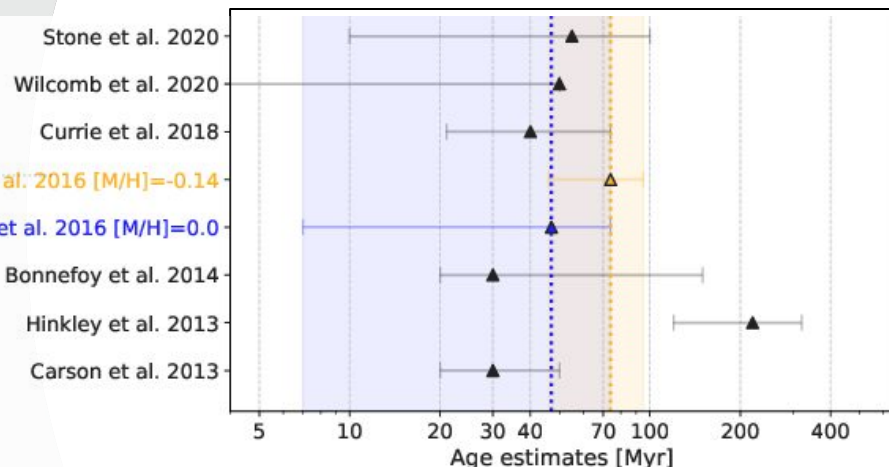
K Andromedae b

The age of K And has been debated for ~10 years

Previous estimates based on: kinematics, stellar evolutionary models, empirical comparison, ...

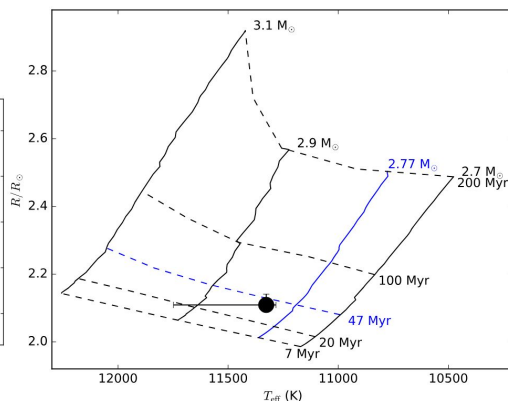
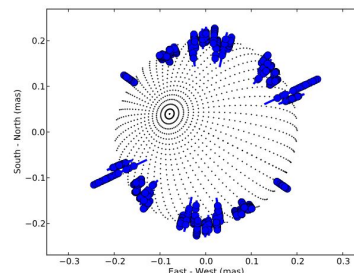


Bonnefoy et al. 2014



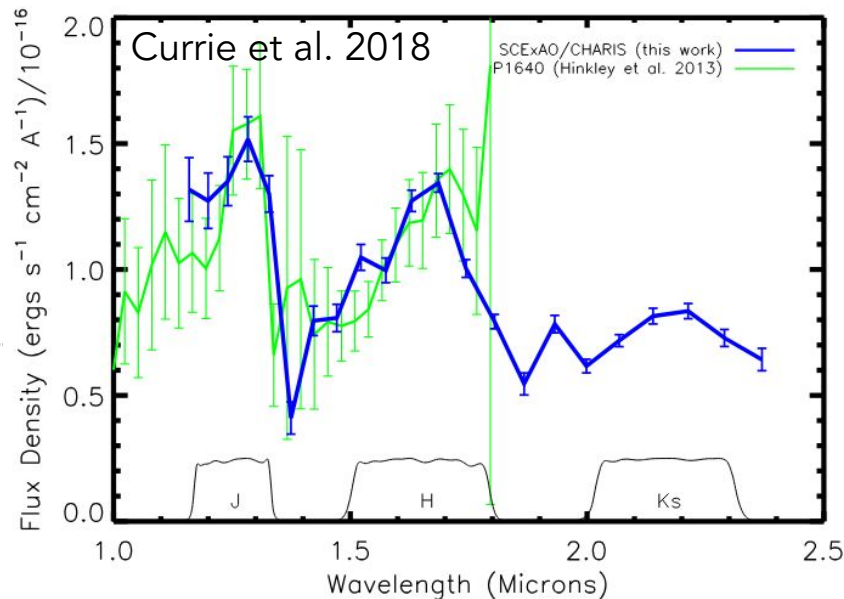
Jones et al 2016
long-baseline optical interferometry
Stellar characterization

Jones et al. 2014



K Andromedae b

Discrepancies in the data due to different calibration strategies



Archival data:

- Photometry: Y, J, H, Ks, Lp, NB4, Mp
- IFS: YJH JHKs
- Low res. spect. : 3-4 microns (Lp)
- Medium res. spect. : Ks band

Photometry

Ks = 14.60 ± 0.40 **J** = 15.86 ± 0.21 *Carson et al. 2013*

vs

Ks = 14.32 ± 0.09 **J** = 16.30 ± 0.30 *Bonnefoy et al. 2014*

K Andromedae b

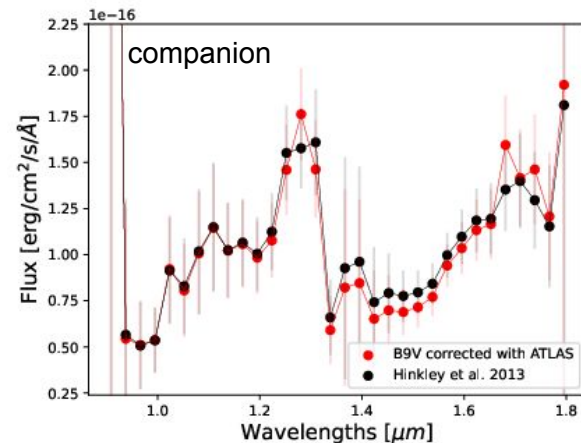
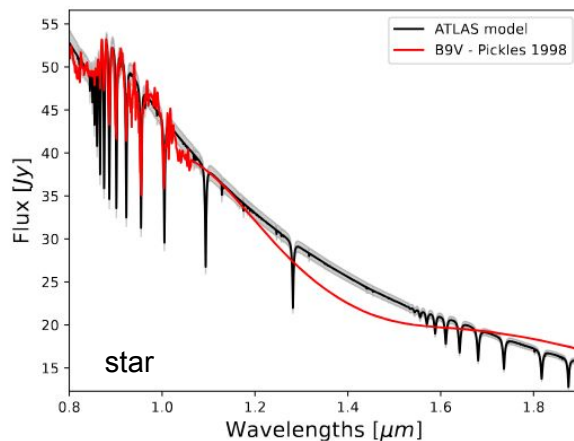
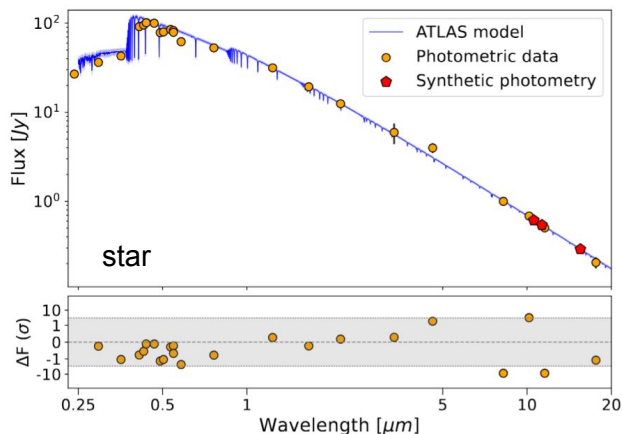
Homogeneous re-calibration of all the data

Example: Hinkley et al. 2013 dataset

K And stellar SED using
 the param. from
 Jones et al. 2016
 - ATLAS spectrum -

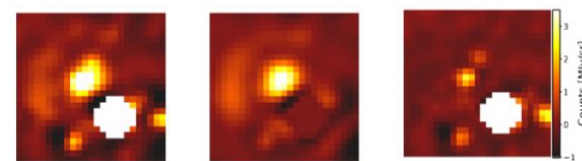
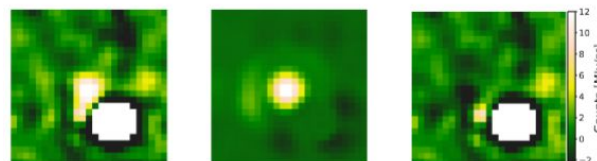
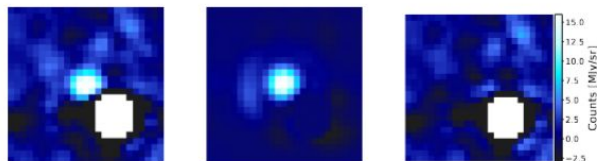
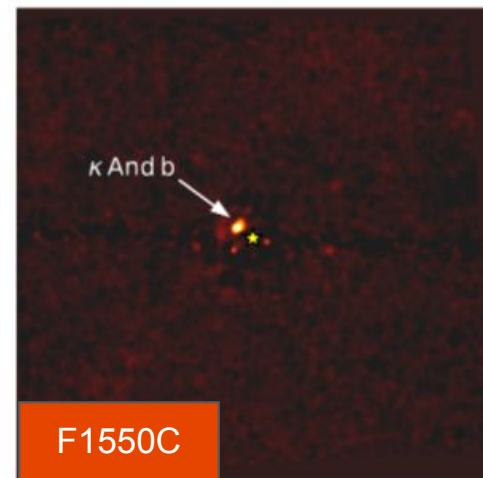
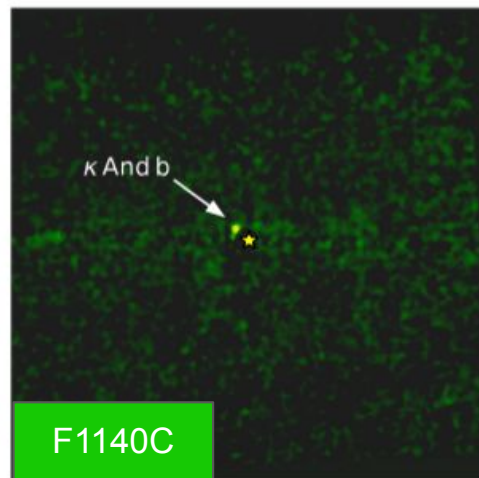
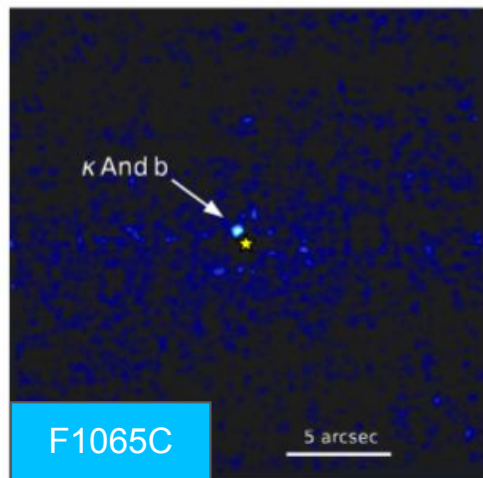
K And stellar template
 from ATLAS vs Pickles
 1998 B9V template (used
 by Hinkley et al. 2013)

Corrected **K** And b
 IFS-YJH data
Hinkley et al. 2013
 vs
Our ATLAS correction



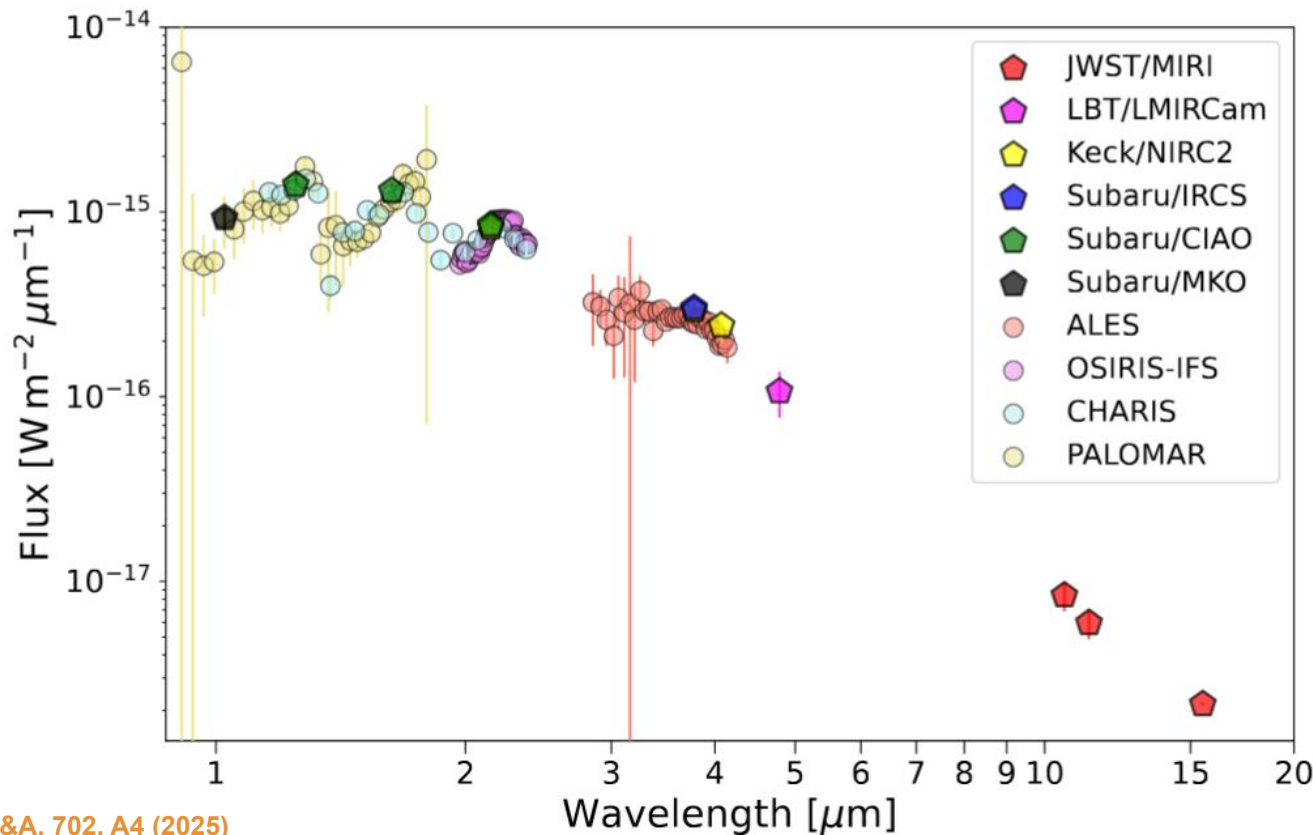
κ Andromedae b

Detection and flux extracted from the companion with new JWST/MIRI observations



K Andromedae b

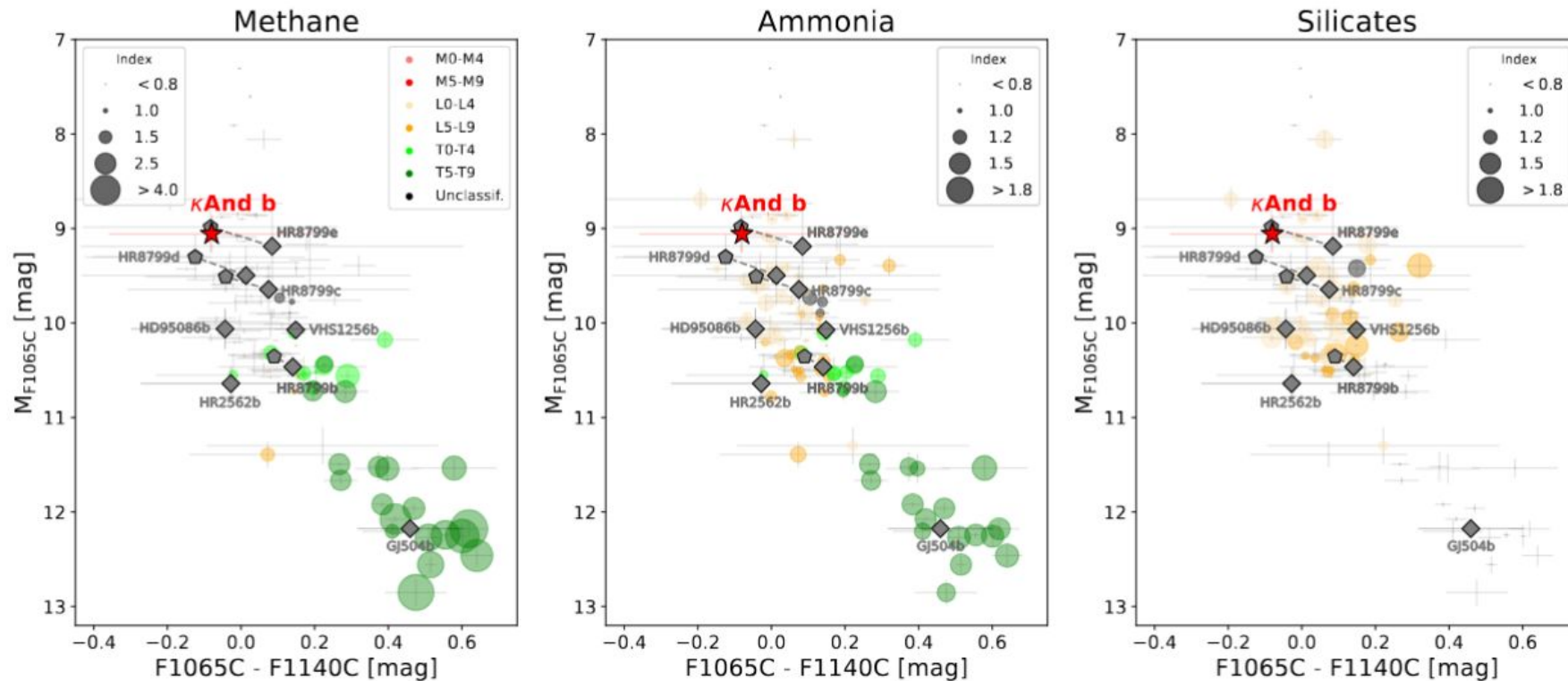
Complete recalibration of the SED from NIR to MIR



Complete SED is essential to establish strong restrictions on fundamental parameters and age

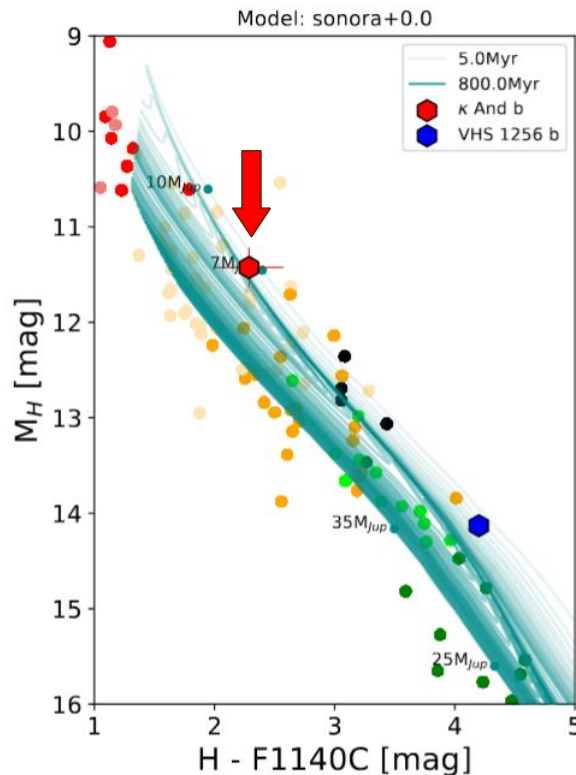
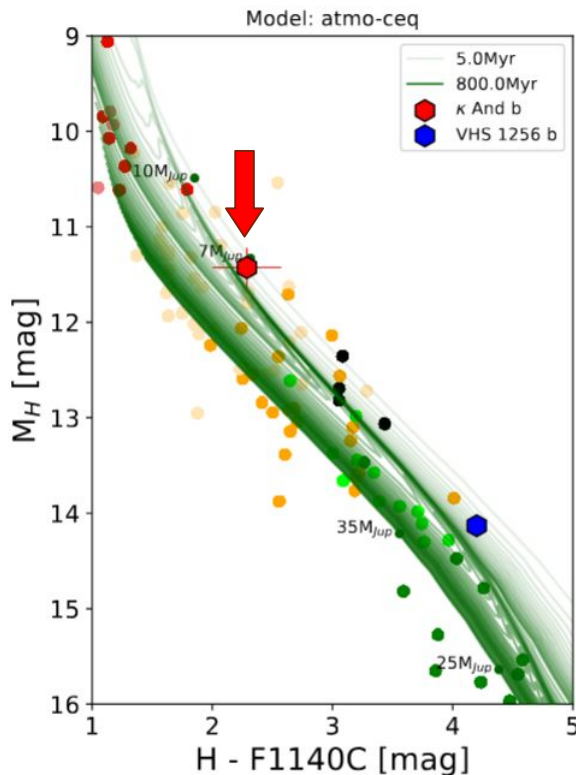
- *Color-magnitude diagrams* : briefly constraints presence of species
- *Evolutionary tracks CMD* : constraint mass and age
- *Atmospheric models* : constrain atmospheric parameters (T_{eff} , $\log g$, radius)
- *Evolutionary tracks + physical parameters* : constrain age and mass

- Color-magnitude diagrams : possible presence of Silicates



K Andromedae b

- Evolutionary tracks CMD : strong constraint in age and mass

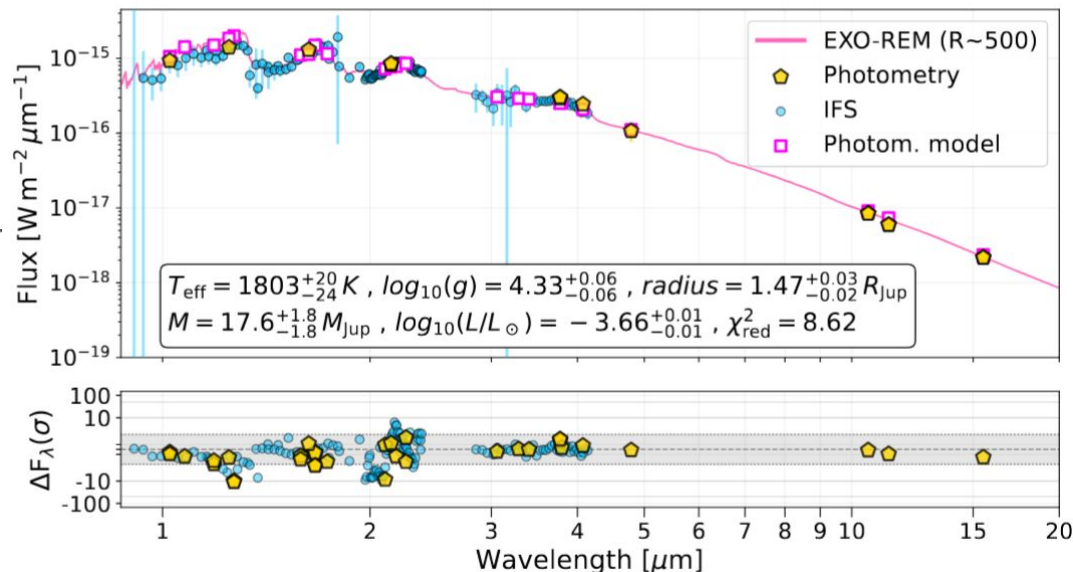


Cloudy models

Age: 50 ± 13 Myr

Mass: $18.1 \pm 4.8 M_{Jup}$

- Atmospheric models* : Strong constraints on T_{eff} , radius, and $\log g$



Combined cloudy models

$T_{\text{eff}}: 1791 \pm 69 \text{ K}$ ← ~20%

Radius: $1.42 \pm 0.06 R_{\text{Jup}}$ ← ~30%

Logg: 4.35 ± 0.07 ← ~70%

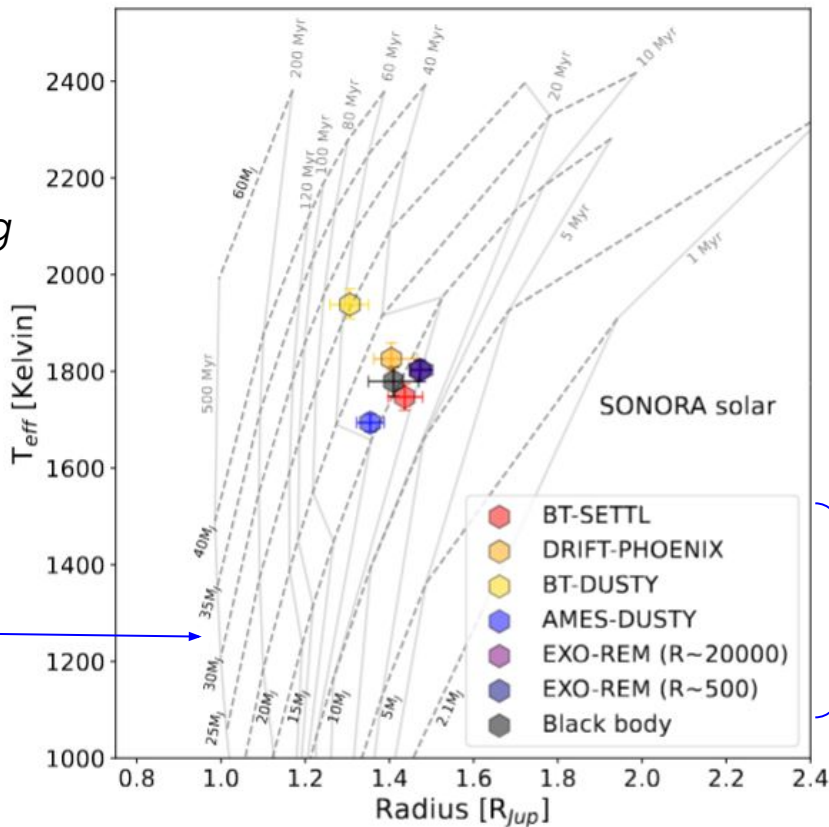
Mass: $17.3 \pm 1.8 M_{\text{Jup}}$ Improv. in precision

Atmospheric fitting investigated with different families of models
(cloudy and cloudless)

K Andromedae b

- *Evolutionary tracks + physical parameters* : Strong constraint in age and mass

*T_{eff} (Y-axis) and
radius (X-axis) from
atmospheric modeling*



Combined cloudy models

Age: 47 ± 7 Myr

Mass: $19 \pm 2 M_{\text{Jup}}$

Evolutionary
track:
Age and mass

Cloudy family

K Andromedae b



Take-Home messages:

- **K** And b has a cloudy atmosphere
- It could have a small amount of silicates
- Age and mass more constrained: 47 ± 7 Myr and $17.3 \pm 1.8 M_{\text{Jup}}$
- Main physical parameter constrained:
Teff 1791 K (~20%), radius $1.42 R_{\text{Jup}}$ (~30%), logg 4.35 (~70%)
- JWST/MIRI: a powerful instrument to improve our knowledge on giant planets and to better characterize their main physical parameters
- Homogeneous recalibrated, complete data now available on VizieR!
Paper: <https://doi.org/10.1051/0004-6361/202554652>
VizieR: [2025A&A...702A...4G \(ADS\)](#)

