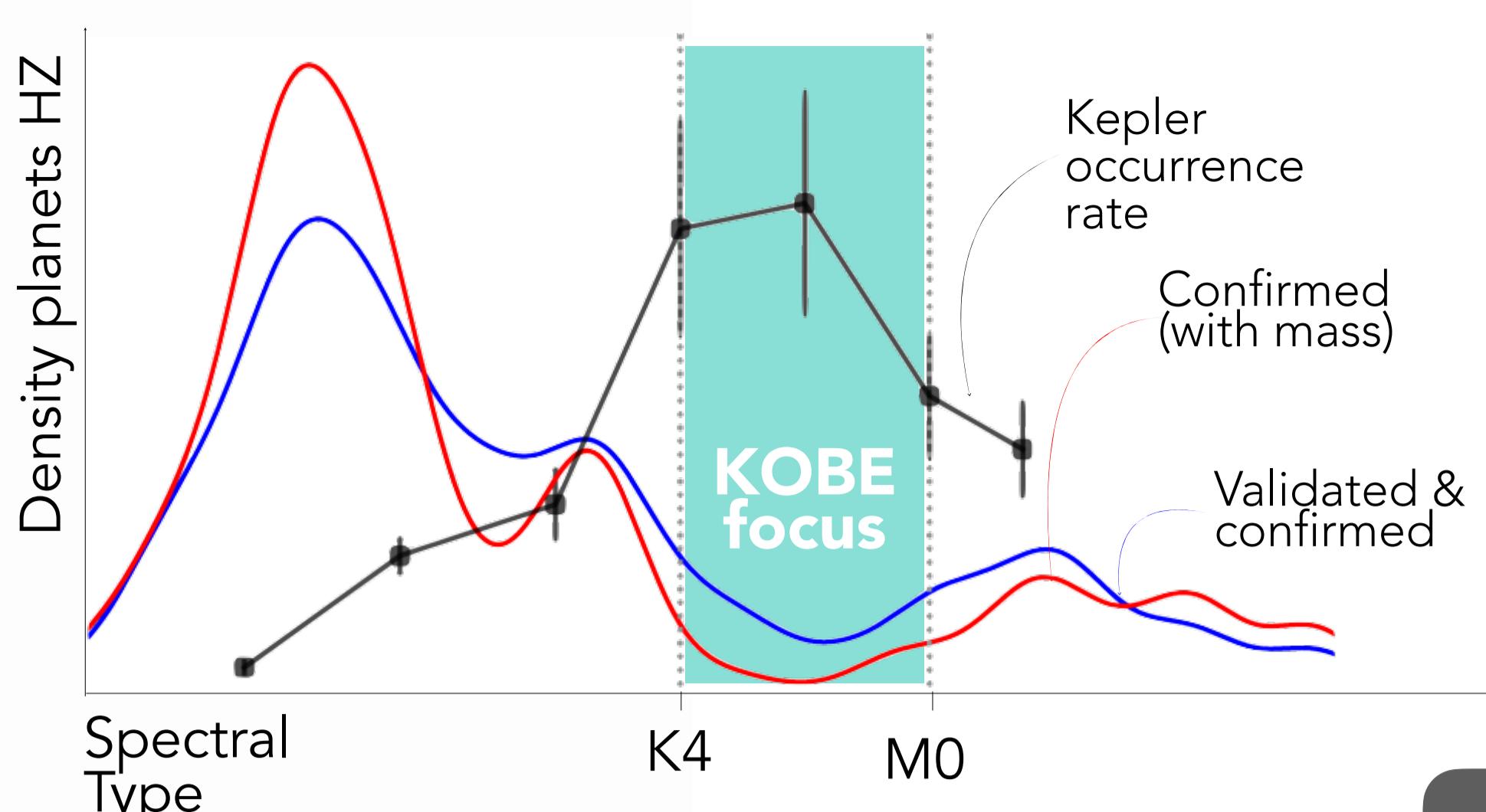


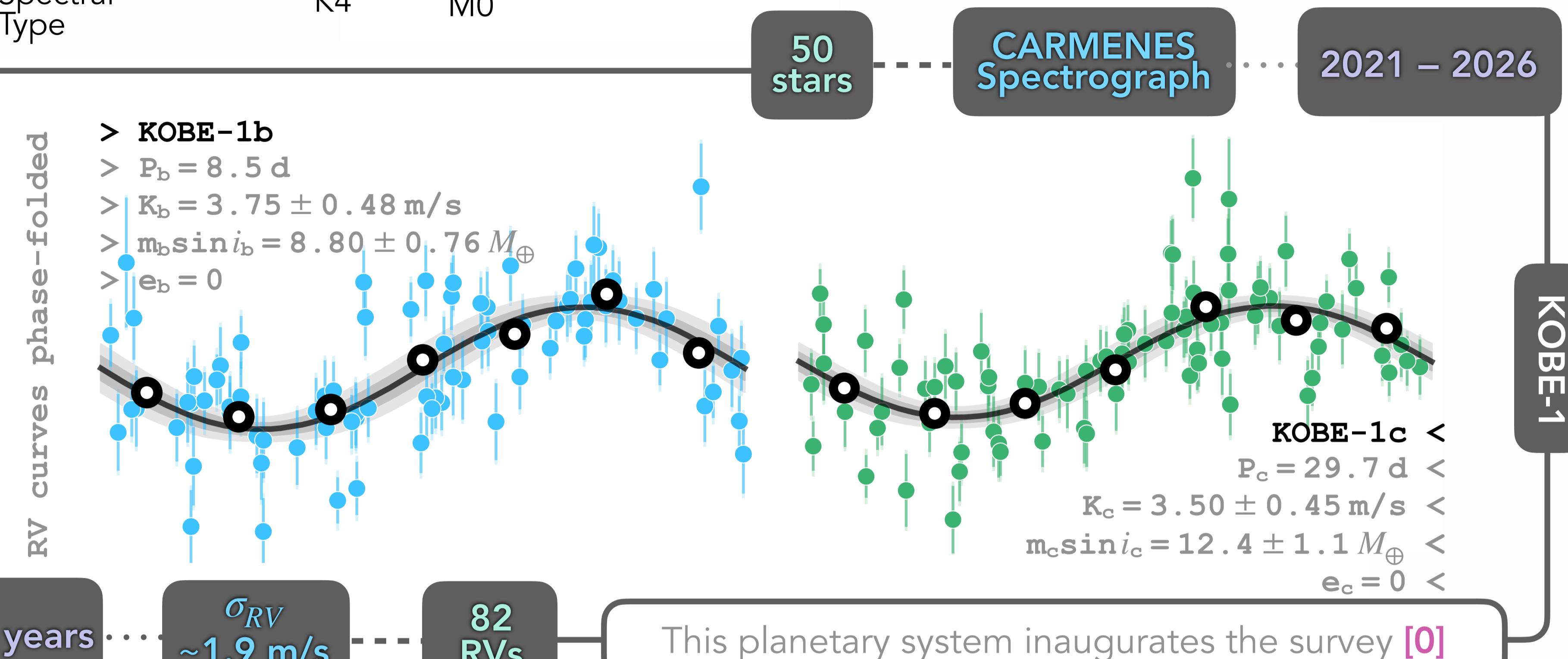
The KOBE experiment

Search for worlds within the **habitable zone** (HZ) of **late K-dwarfs** via Radial Velocities (RV) [1]
This regime is still under-explored compared to G and M dwarfs



Yet, they might be of great interest:

- Very common based on Kepler [2]
- Easier to detect than around G stars
- Better suited for habitability than M stars
 - Less active
 - Day-night cycles



Confirmed planets

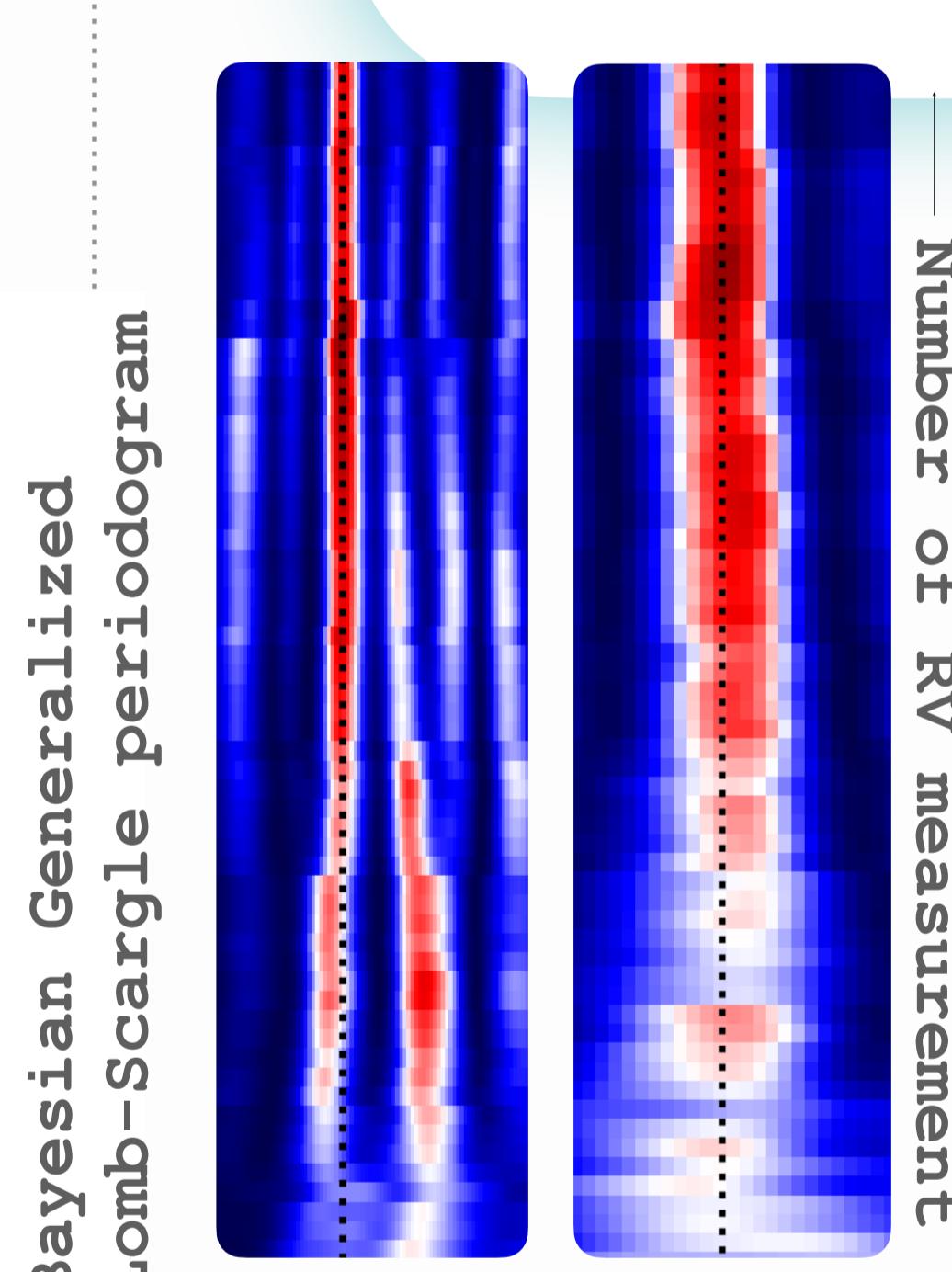
1. Signal & Model Significance

- Two Keplerians with **semi-amplitude significances** $> 7\sigma$
- **Bayes Factor** > 7 for two circular planet as compared to simpler models
- **Signals are consistent over time** during the observations time span

Exoplanet Confirmation Protocol[*]

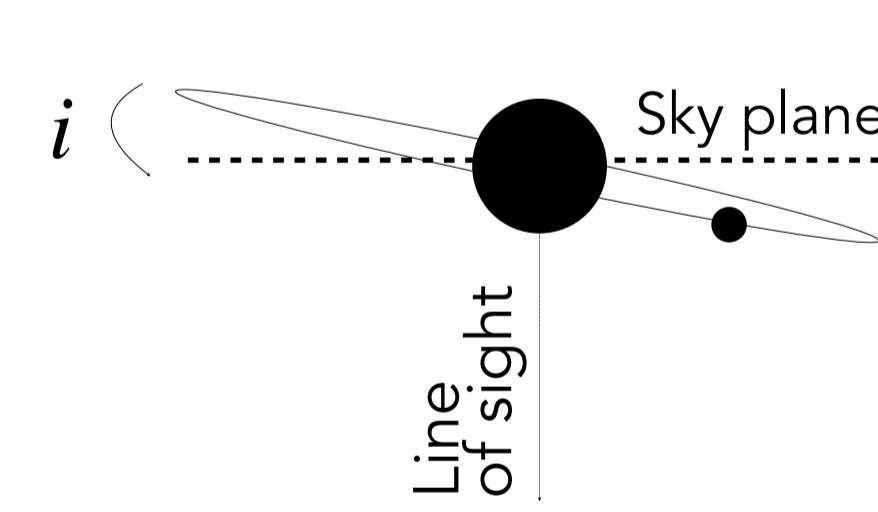
2. Origin of the Signal

- **Other sources are ruled out** with the **spectra** and **Gaia DR3** parameters
- **Activity indicators** suggest quiet star



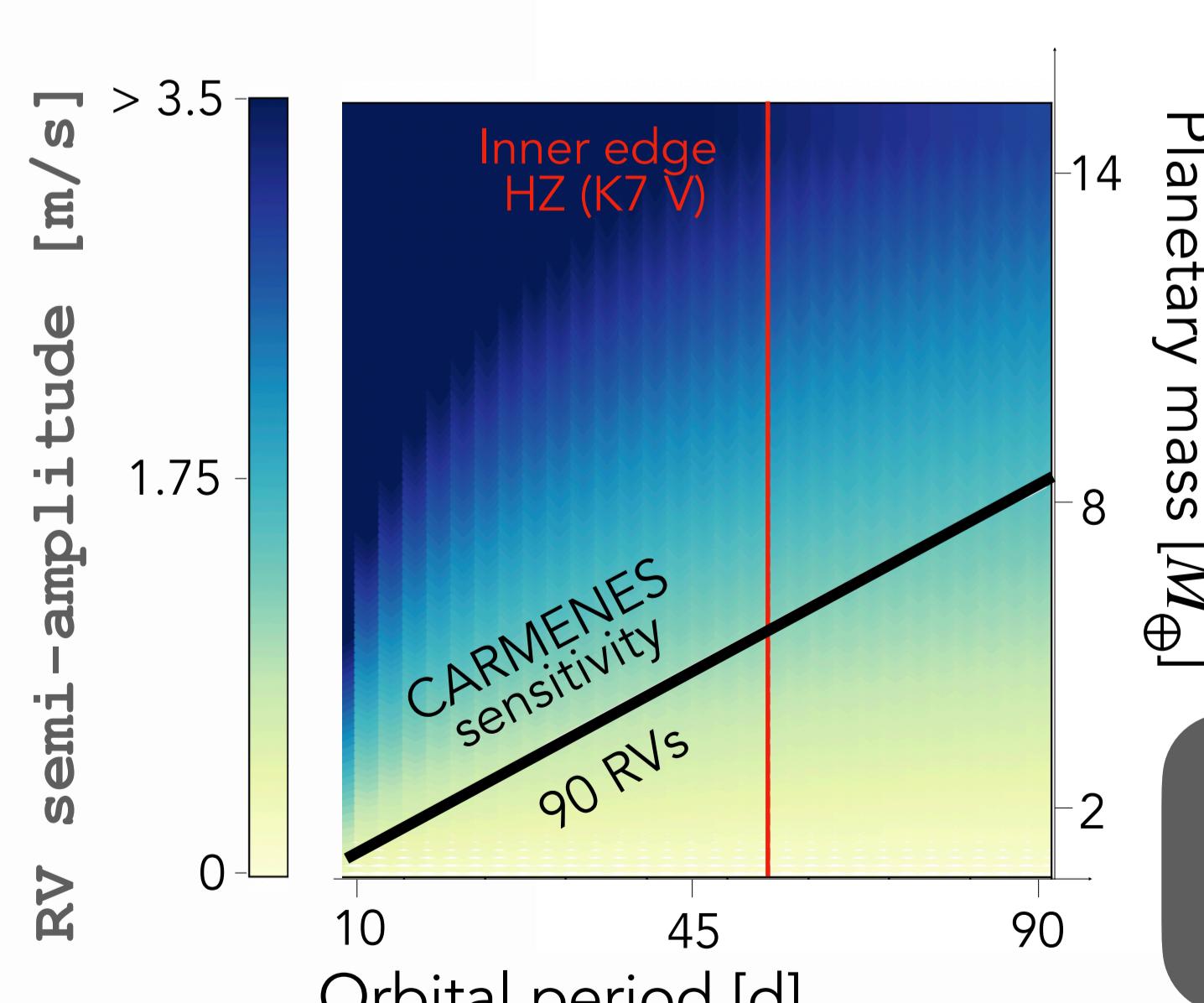
3. Planetary-mass Domain

- Both **absolute masses** are **below 13 M_J** with a probability $> 99.8\%$



Their orbital inclinations would be $i < 0.17^\circ$

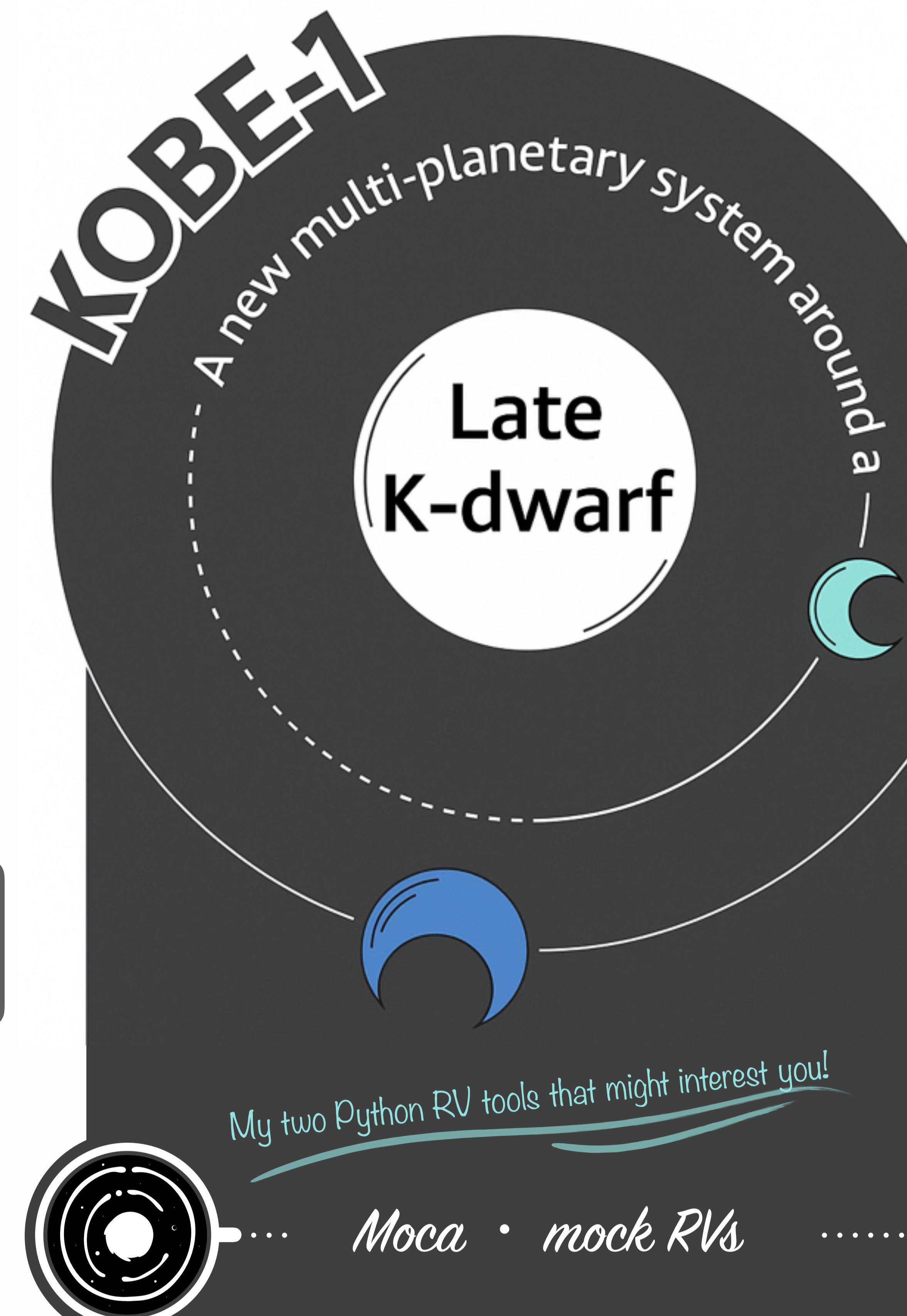
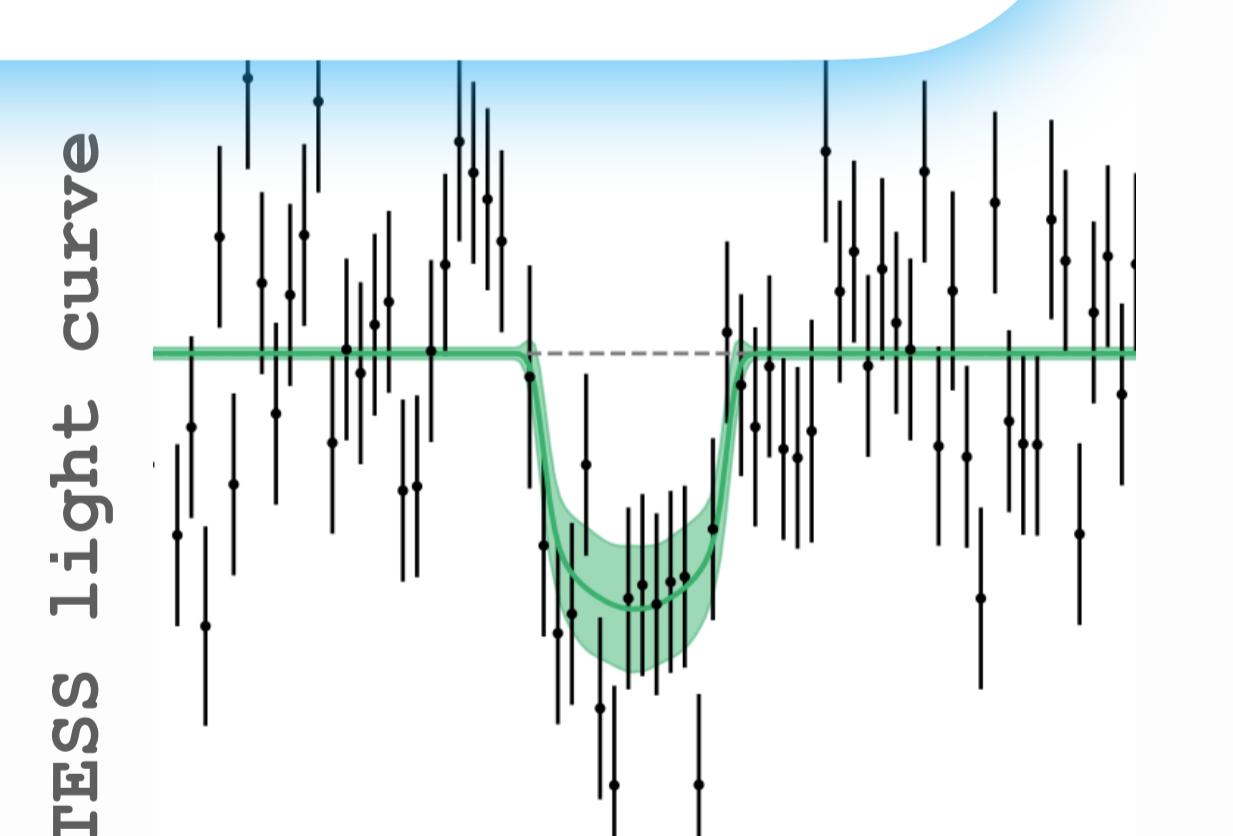
Detecting rocky habitable planets needs of **extremely precise RV** ($< 1 \text{ m/s}$)



Current KOBE sensitivity is down to $5 M_\oplus$ within the HZ of late Ks, but...

Follow-up scheduled with CHEOPS

$1.7 \pm 0.12 R_\oplus$ - Compatible with KOBE-1c ephemeris



My two Python RV tools that might interest you!

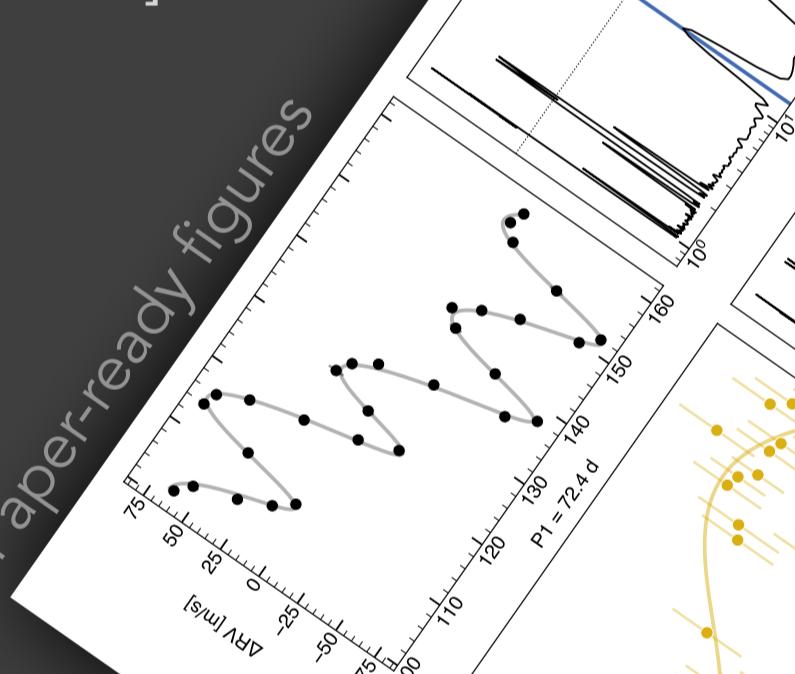
Moca • mock RVs

Simulate RV timeseries, including:

- Different **observing strategies** [Given times, monotonic cadence, blocks]
- Considers **visibility**
- **Weather loss** [Monthly statistics per observatory]
- **Rossiter-McLaughlin effect**
- Stellar **activity** [Different Gaussian Processes per star type]
- Runs RV **analysis** pipeline quantify the detection significance]

Design strategies
Justify proposals
Injection recovery...

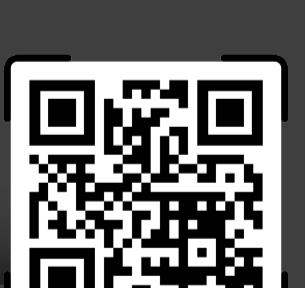
To be published
in GitHub



KOBEsim

Finds the **best observing date** to Confirm / Rule out a signal periodicity [3].

- **Bayesian based** The goal is to increase the Bayes Factor
- **Improves the efficiency** of observations to **detect planets** via RV
 - 30% less RVs needed
 - 50% shorter time span



Ideal to schedule GTO observations

<https://github.com/olgabalsa/KOBEsim>

References

- [0] KOBE-1 [THIS WORK] Balsalobre-Ruza et al. (2025), A&A, 694, A15
- [1] The KOBE experiment Lillo-Box et al. (2022), A&A, 667, A102
- [2] Kepler occurrence rates Kunimoto & Matthews (2020), AJ, 159, 248
- [3] KOBEsim Balsalobre-Ruza et al. (2022), A&A, 669, A18
- [*] ECP To be agreed by the community Contact: jlillo@cab.inta-csic.es

Hey! I am searching for a Postdoc to start by June 2026



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