

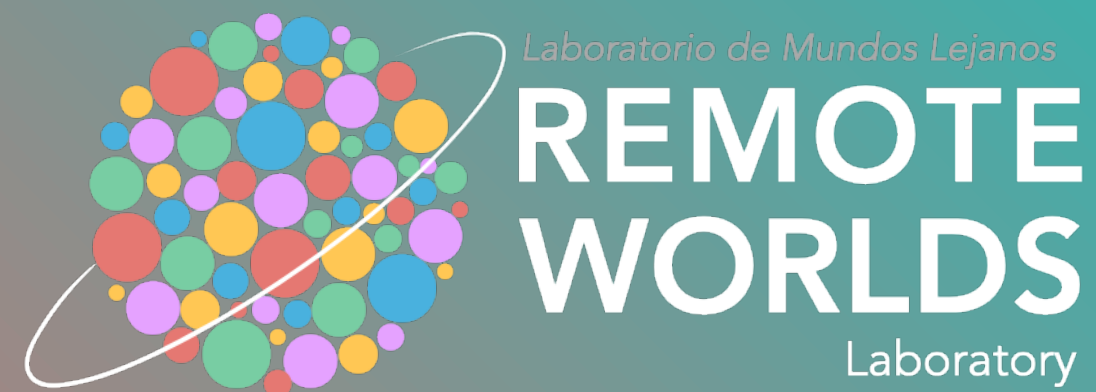
The BE experiment

a blind-search survey 30 years after 51 Peg b

Jorge Lillo-Box

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Centro de Astrobiología (CAB, CSIC-INTA)

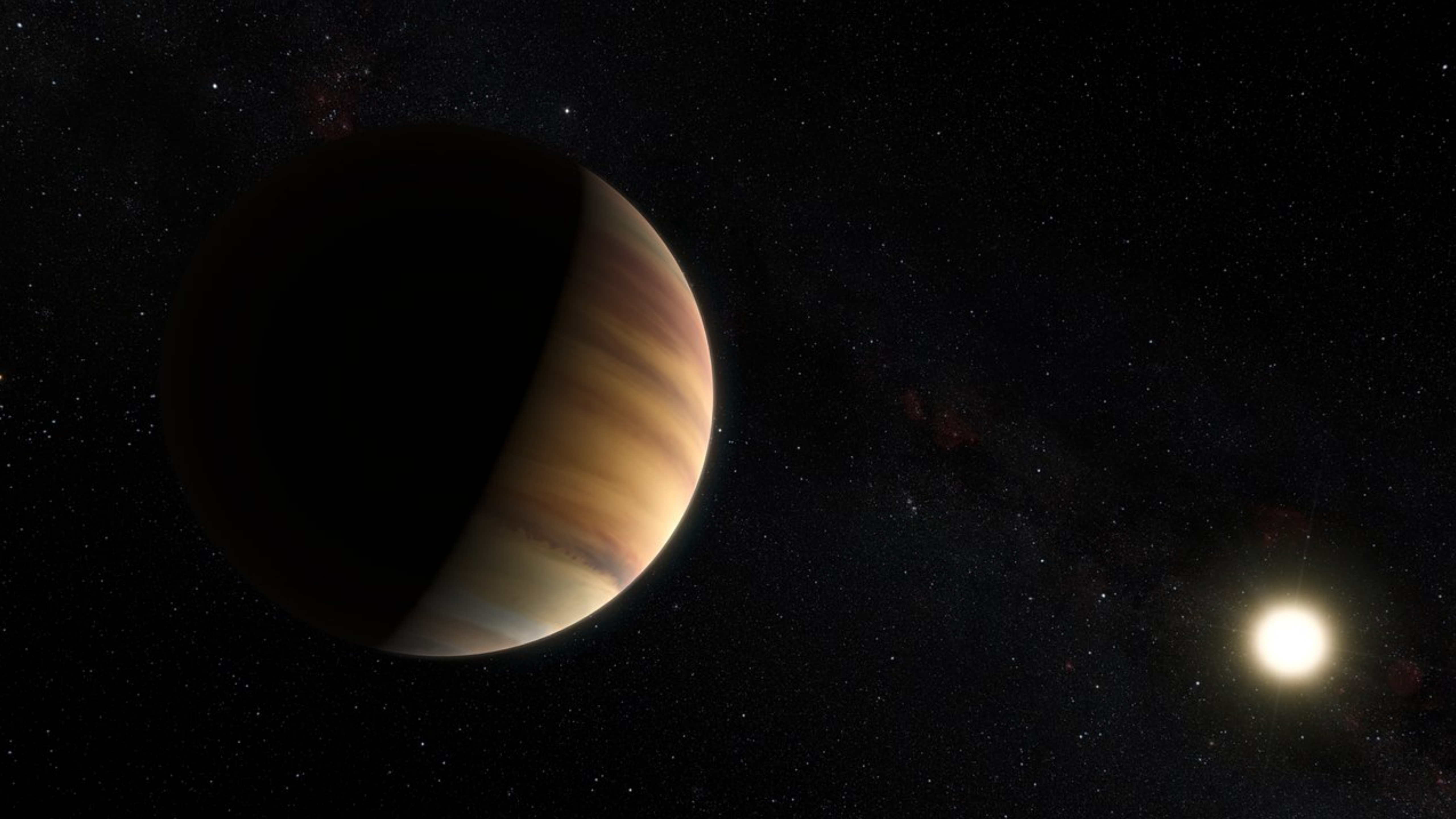




OCTOBER 6TH TO 10TH 2025

51 PEGASI b

COOL GIANT PLANETS
AND THEIR SYSTEMS

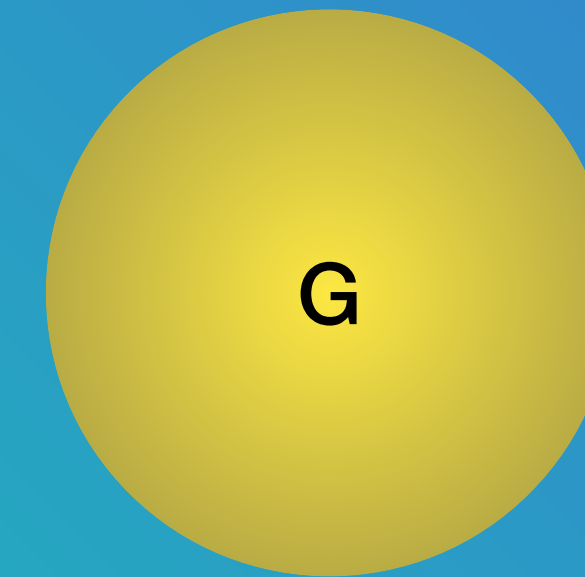
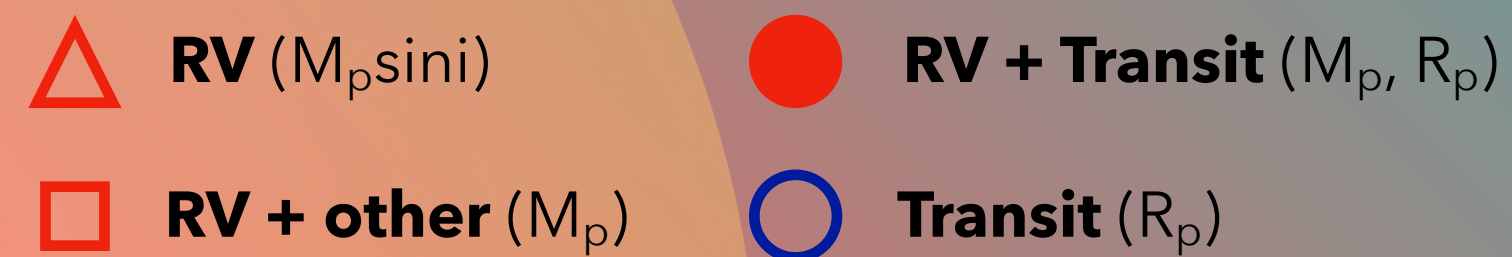
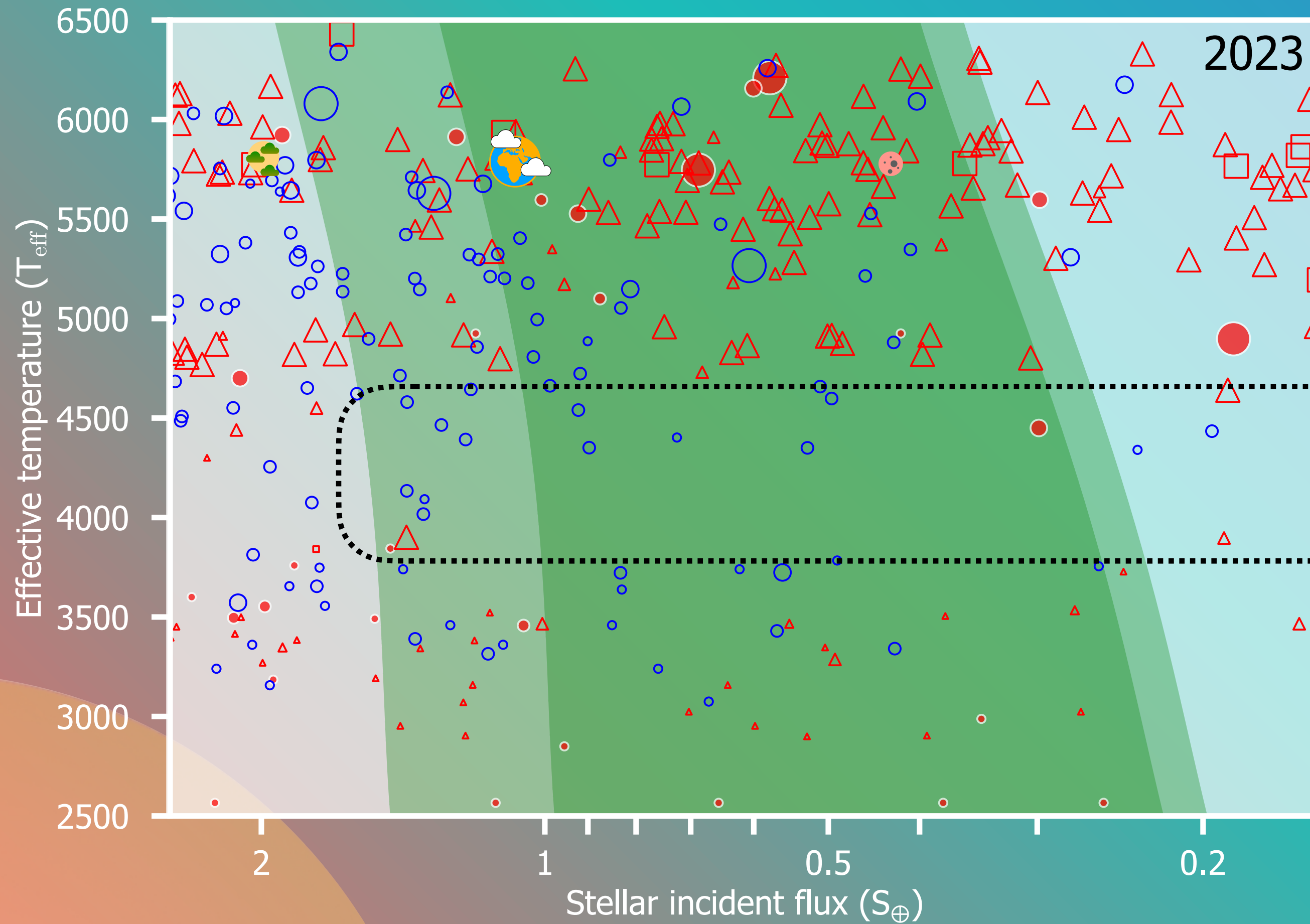


K O B E

K-dwarfs Orbited By habitable Exoplanets

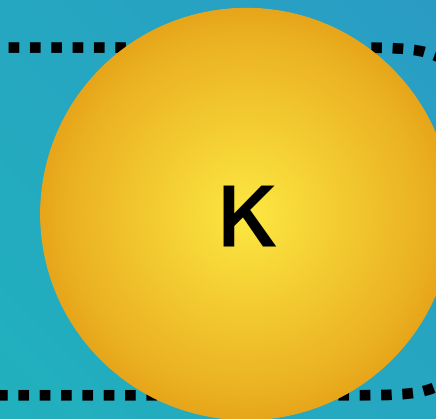
3.5-m telescope
(CARMENES)

K-dwarfs HZ desert



G

A dearth of planets in the habitable zone of late-type K-dwarfs

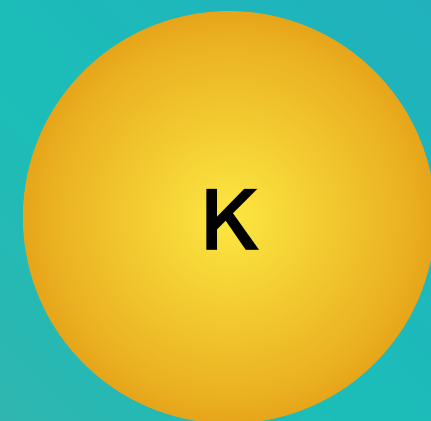


K

¿Observational bias,
consequence of
planetary formation,
or
both?



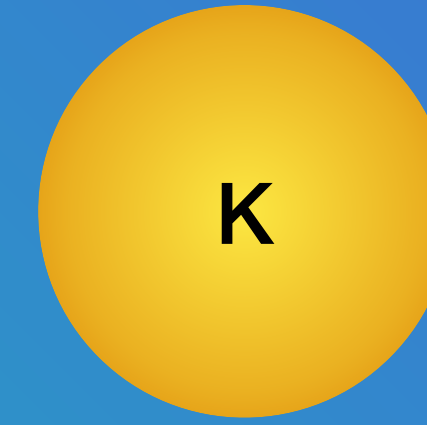
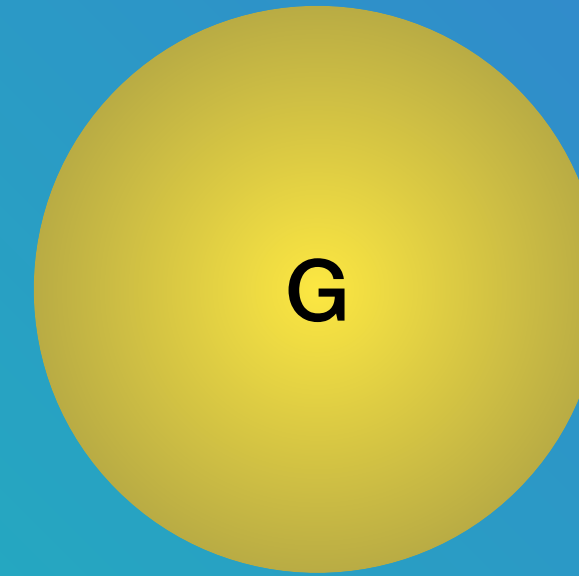
M



DETECTABILITY WISH LIST

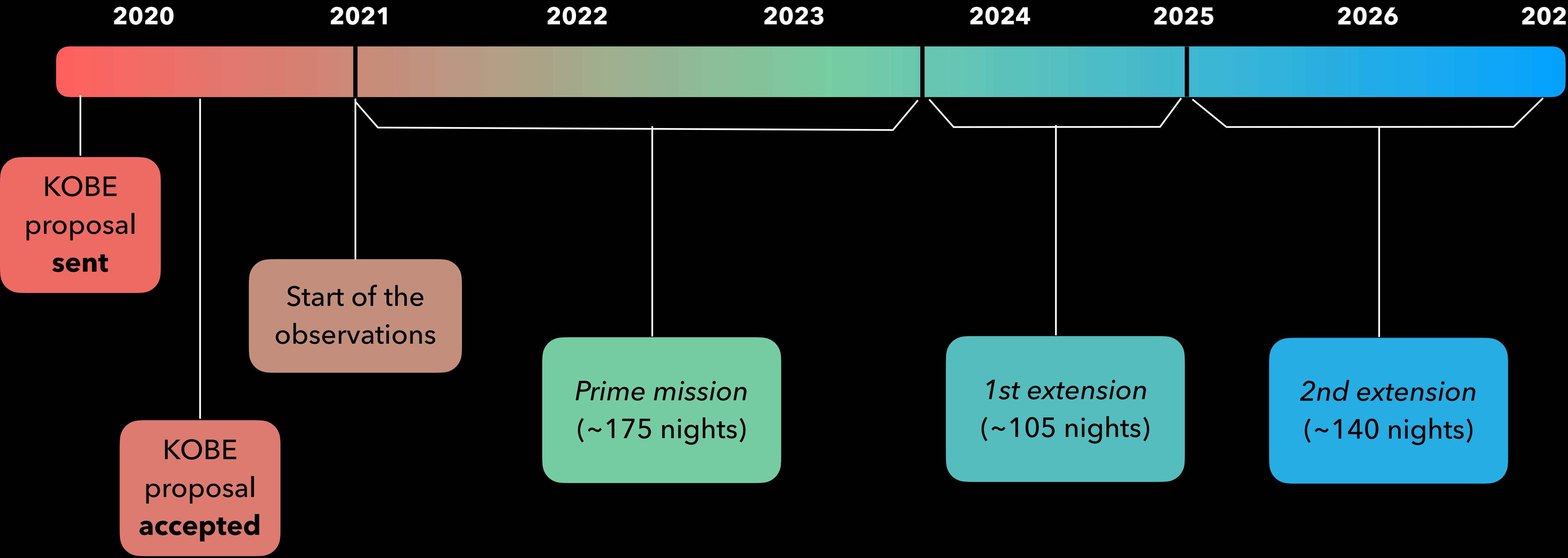
0.4 - 2 au	0.1 - 0.3 au	0.05 - 0.15 au	HZ location close to the star to increase transit probability and direct imaging
0.6-1.7 m/s	2-4 m/s	3.2 - 9 m/s	High RV semi-amplitud within the HZ (values for $m_p = 10 M_{\text{Earth}}$)
Moderate	Low	High	Low stellar activity to reduce stellar jitter
~11yr	~8.5 yr	~3-20 yr	Long and low RV amplitude magnetic cycles
Yes	Moderate	Moderate	Easy determination of stellar parameters (mass, radius, T_{eff} , metallicity)

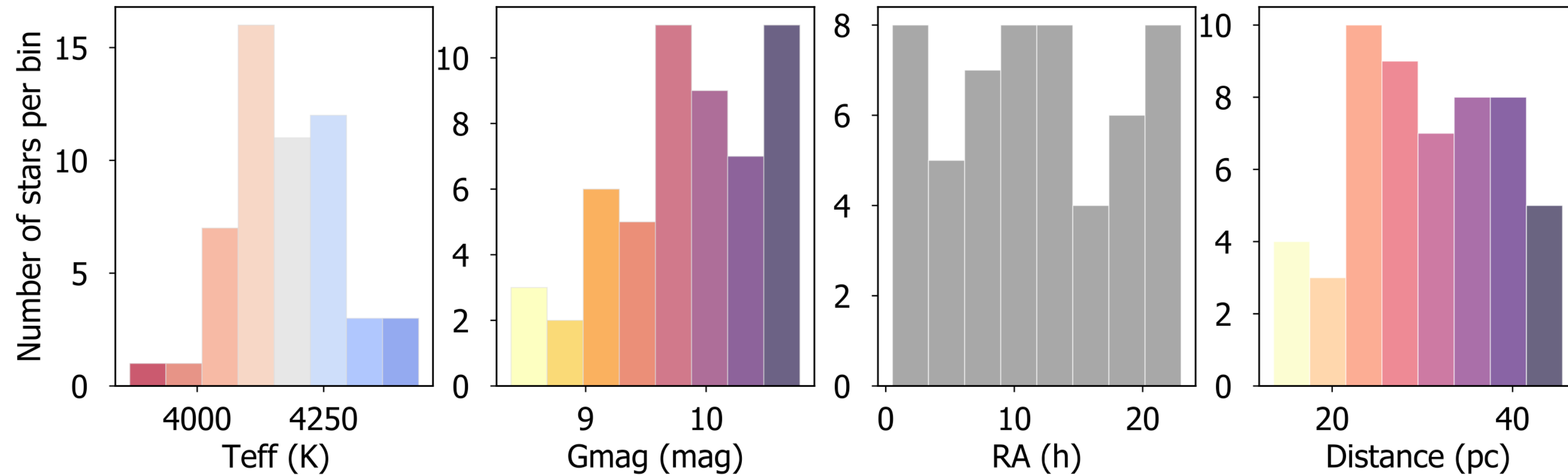
HABITABILITY WISH LIST



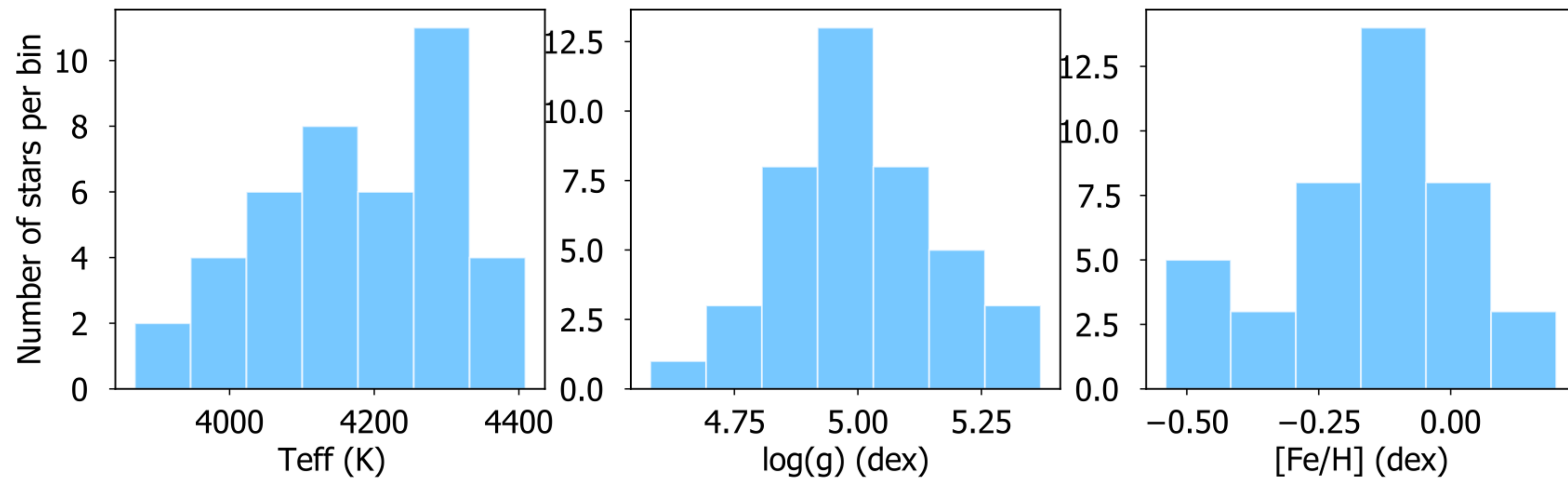
Rocky worlds can reach the habitable zone	✓	✓	✓
No direct impact of stellar flares at the HZ	✓	✓	✗
Low UV and X-ray emission (that can erode the atmosphere or damage life on the surface of the planet)	✓	✓	✗
No tidal locking within the HZ	✓	✓	✗
Small changes in luminosity (e.g., no flaring)	✓	✓	✗
Relatively short pre main-sequence lifetime	✓	✓	✗
Long life spans (to allow life to develop and evolve)	✓	✓	✓

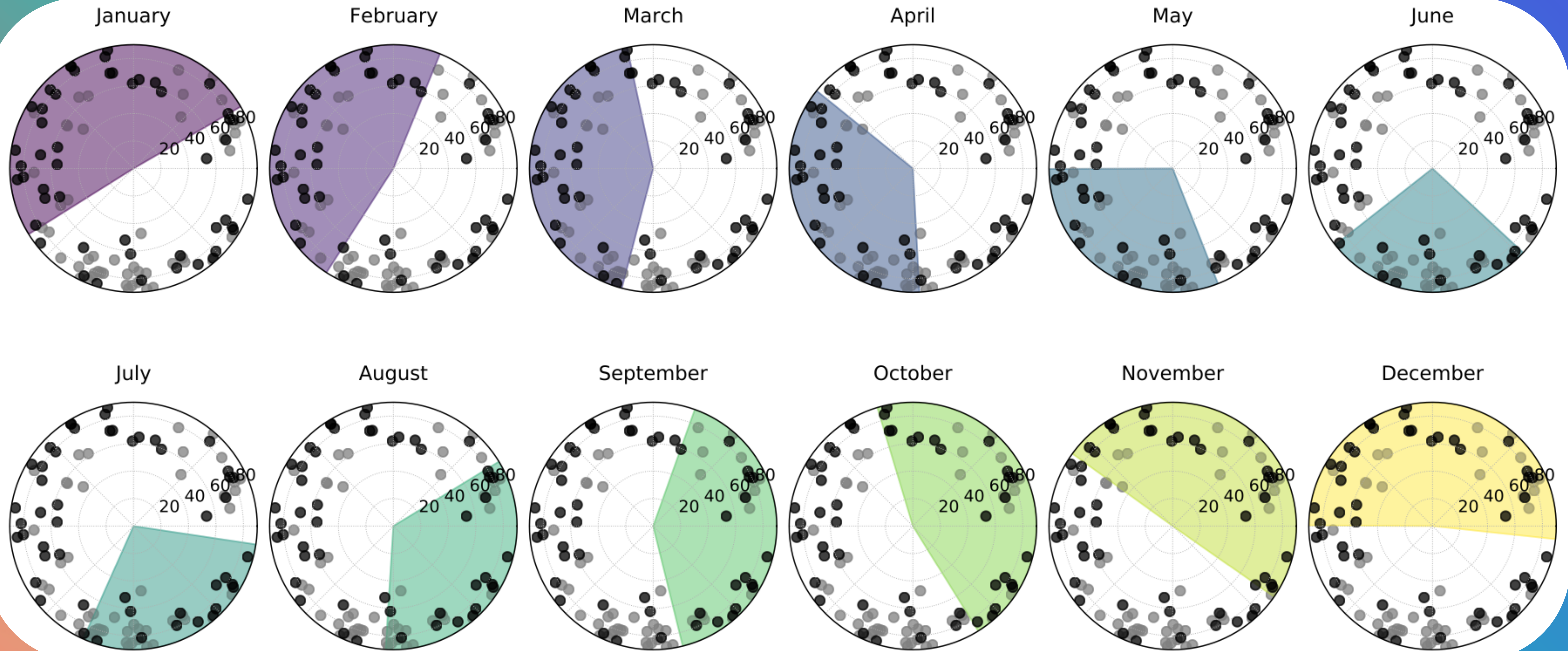
Mid-to-late Kdwarfs are best overall
the **Goldilock habitats** for life to grow,
and the optimum range to detect them all

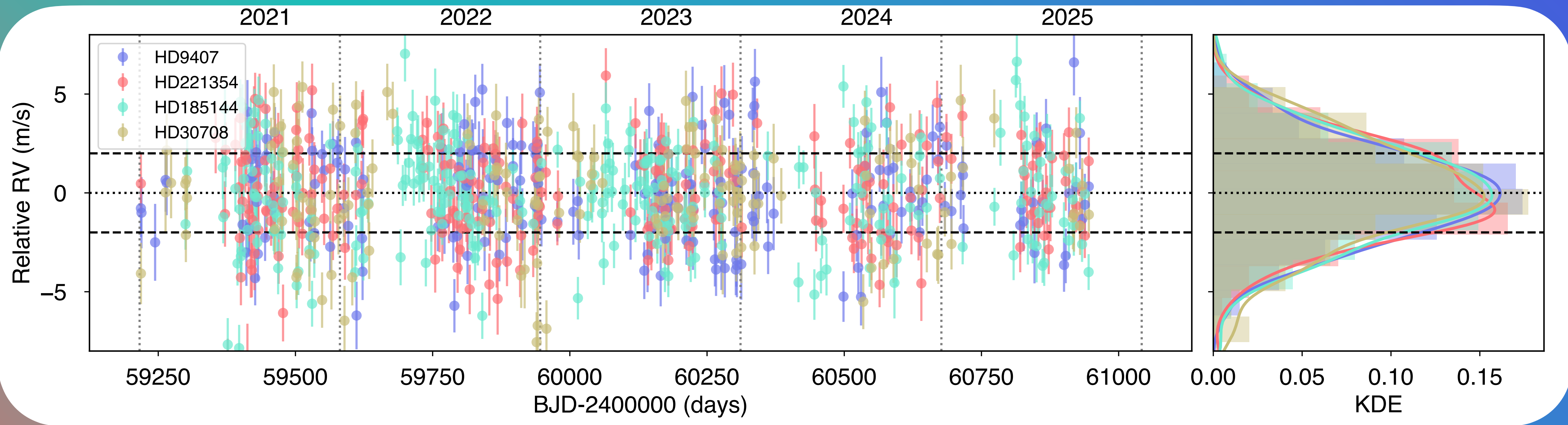




- Targets are closer than 50 pc
- Relatively bright sample
- No metallicity cuts. Final sample is slightly sub-solar average $[\text{Fe}/\text{H}] = -0.07$







- 3-4 RV standards observed every night
- ~ 2.3 m/s scatter in 5 years of survey (after correcting for NZPs)



Looking for postdocs! 🤔

A&A 669, A18 (2023)
<https://doi.org/10.1051/0004-6361/202243938>
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**Astronomy
&
Astrophysics**

KOBESim: A Bayesian observing strategy algorithm for planet detection in radial velocity blind-search surveys[★]

O. Balsalobre-Ruza¹ , J. Lillo-Box¹ , A. Berihuete² , A. M. Silva^{3,4} , N. C. Santos^{3,4} , A. Castro-González¹ , J. P. Faria^{3,4} , N. Huélamo¹ , D. Barrado¹ , O. D. S. Demangeon^{3,4} , E. Marfil¹ , J. Aceituno^{5,6}, V. Adibekyan^{3,4} , M. Azzaro⁵ , S. C. C. Barros^{3,4} , G. Bergond⁵ , D. Galadí-Enríquez⁵ , S. Pedraz⁵, and A. Santerne⁷

Development of an algorithm (**KOBESim**) to improve the efficiency of observations, pursuing candidate periods through a predictive Bayesian inference analysis (**Balsalobre-Ruza et al., 2023**, A&A, 669, 18)

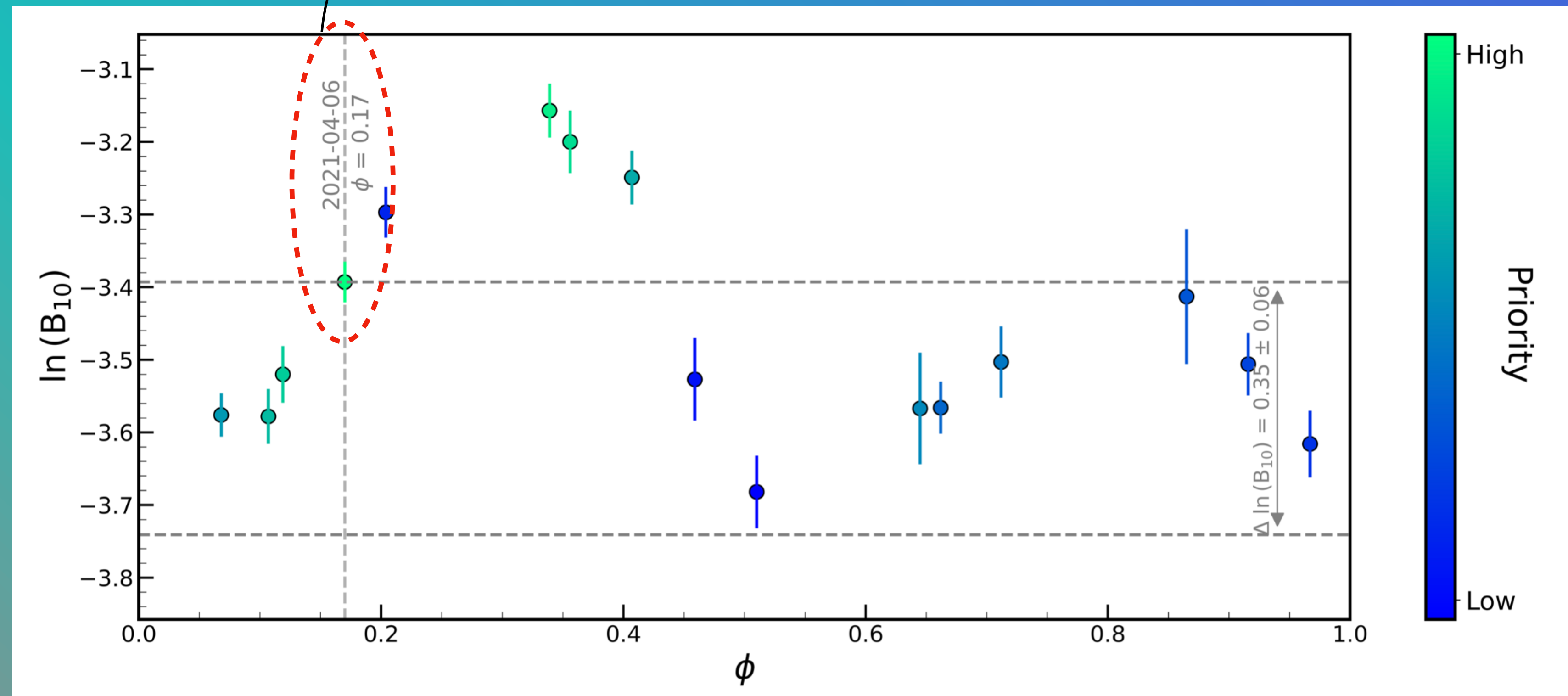


<https://github.com/olgabalsa/KOBESim>



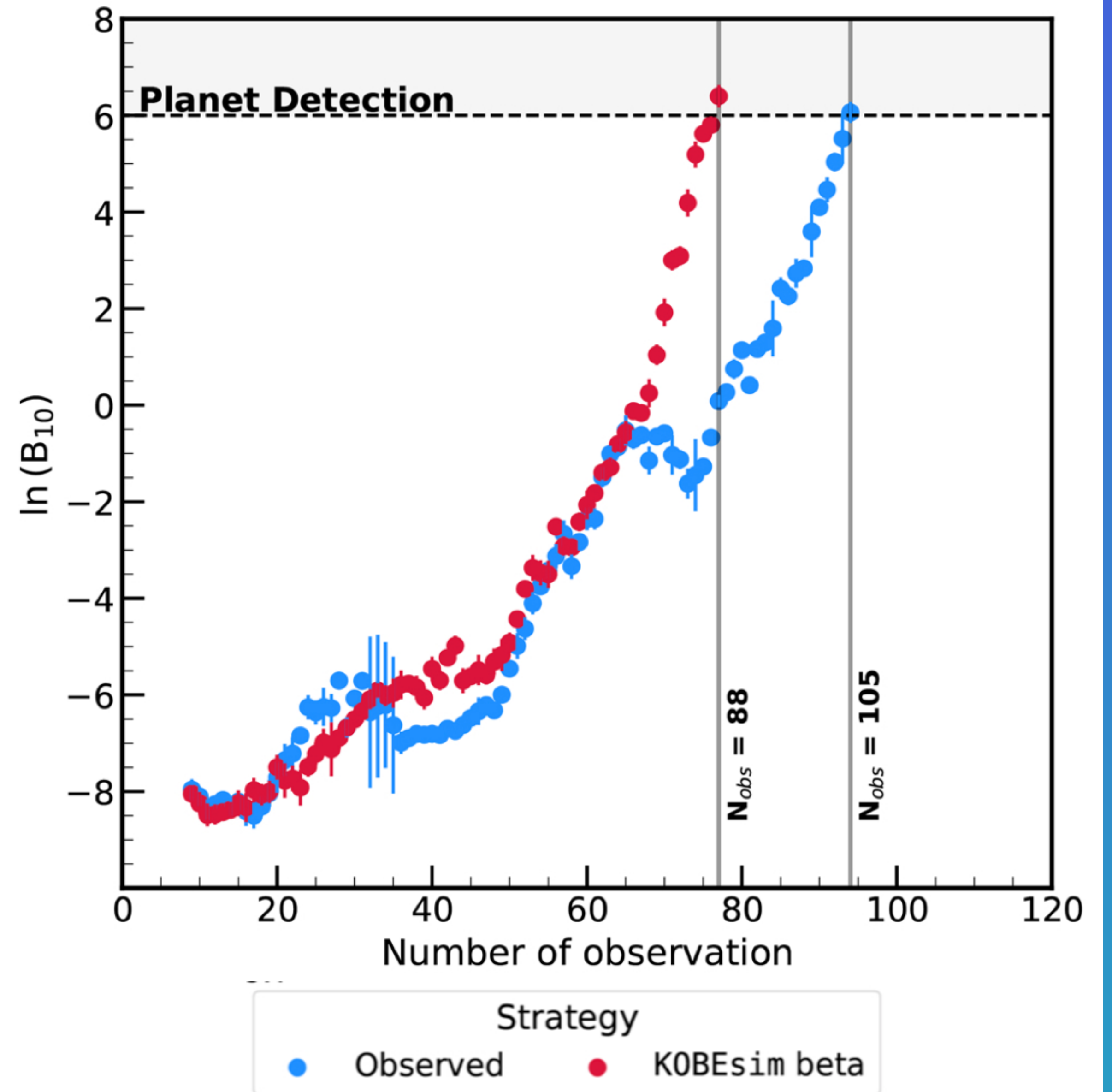
Balsalobre-Ruza et al. (2023)

By observing this proposed date, we will increase the log-evidence by +0.35 and keep a good candence



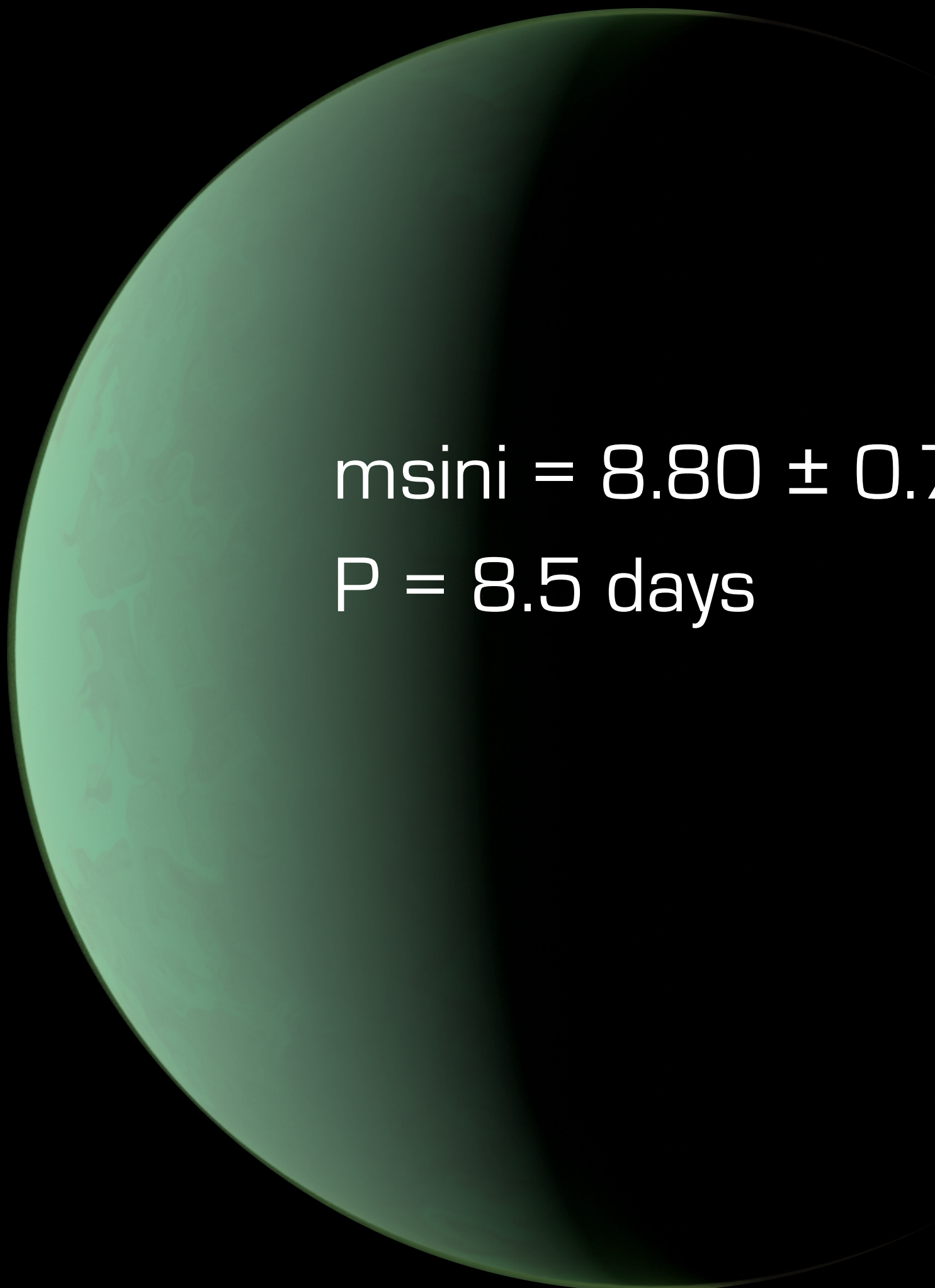


Balsalobre-Ruza et al. (2023)

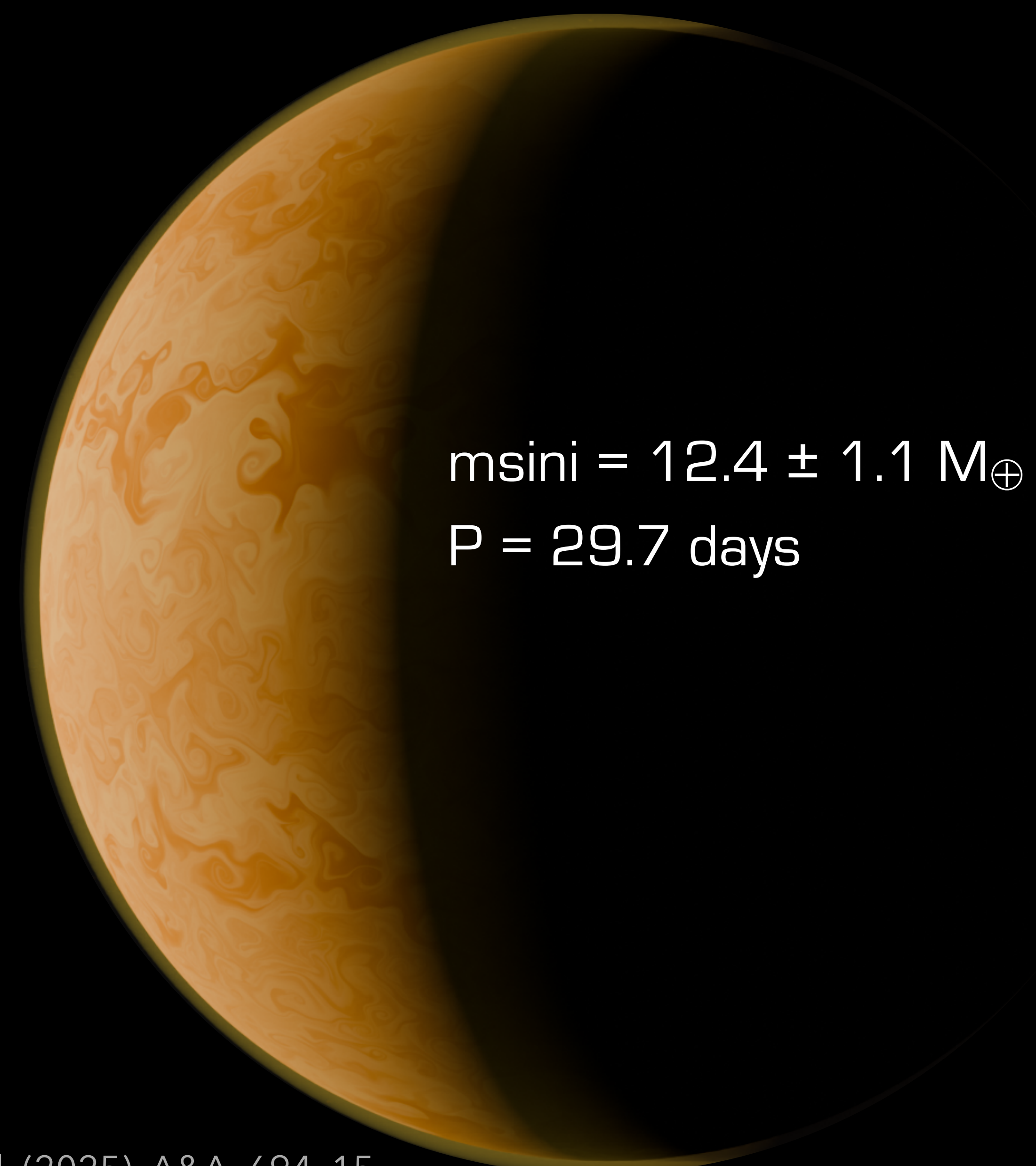


KOBE-I b

KOBE-I c



$m_{\text{JIT}} = 8.80 \pm 0.76 M_{\oplus}$
 $P = 8.5 \text{ days}$

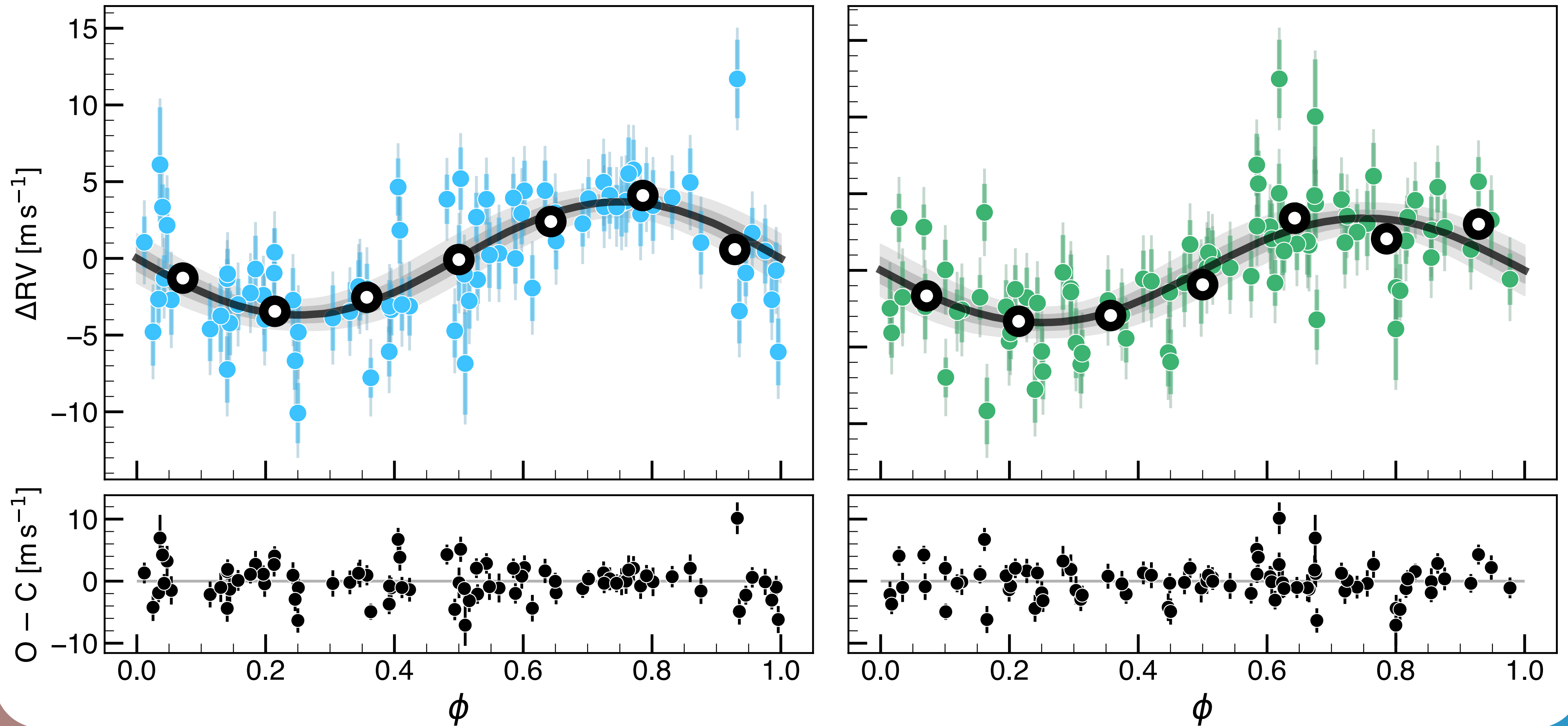


$m_{\text{JIT}} = 12.4 \pm 1.1 M_{\oplus}$
 $P = 29.7 \text{ days}$

KOBE-1: the first KOBE planetary system

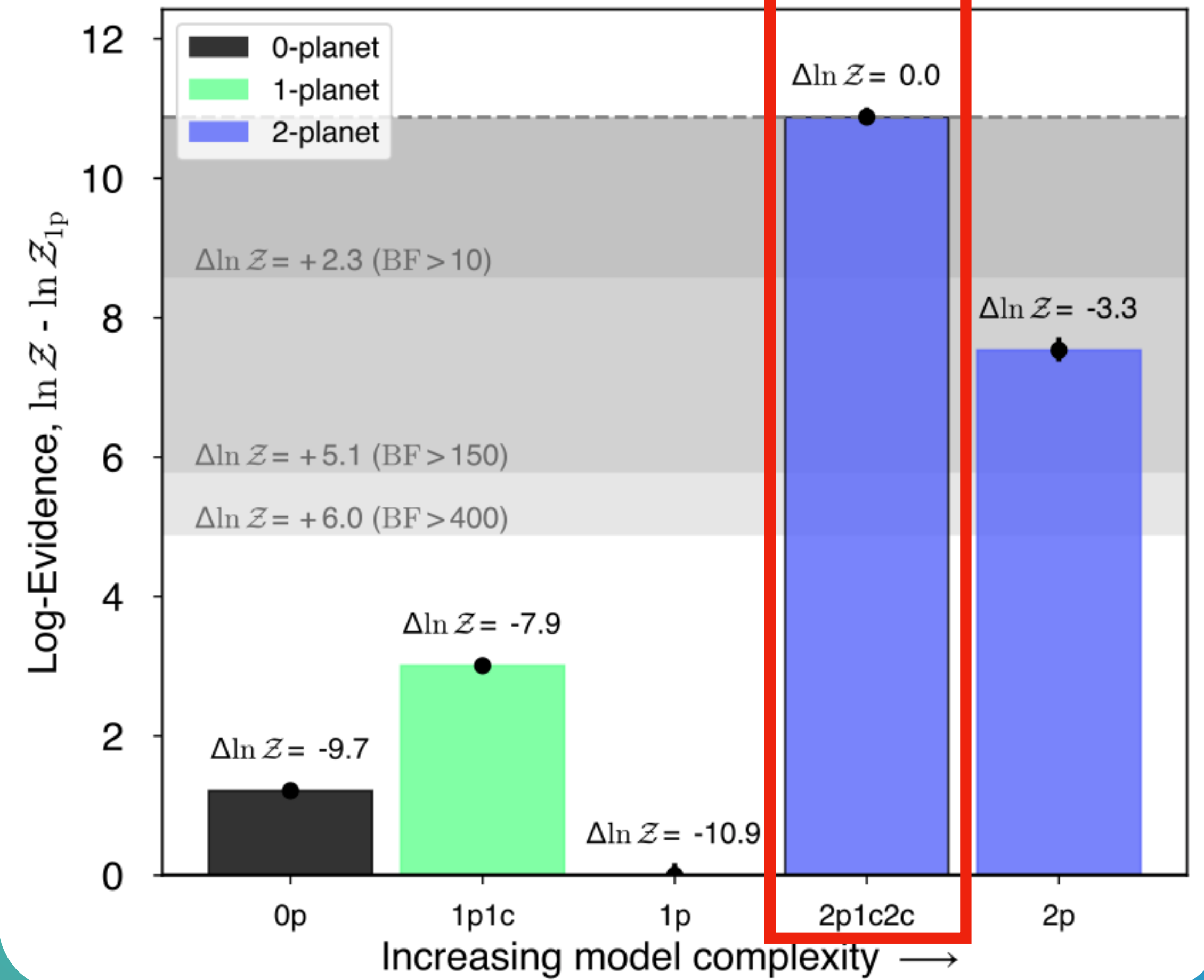
Two new planets orbiting a quiet K7 V

RVs extracted with
s-BART
(Silva et al., 2024)



KOBE-1: the first KOBE planetary system

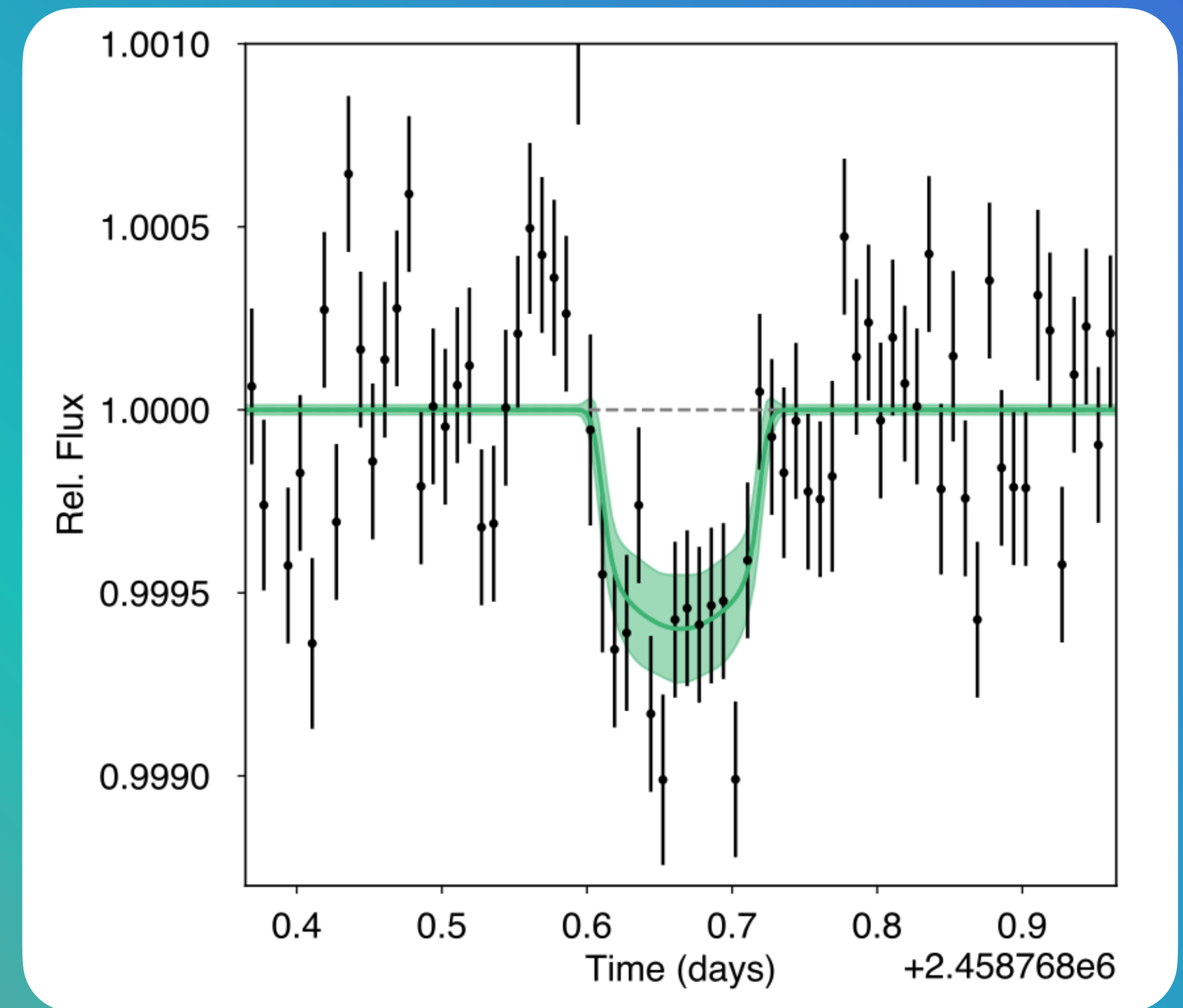
Two new planets orbiting a quiet K7 V



KOBE-1: the first KOBE planetary system

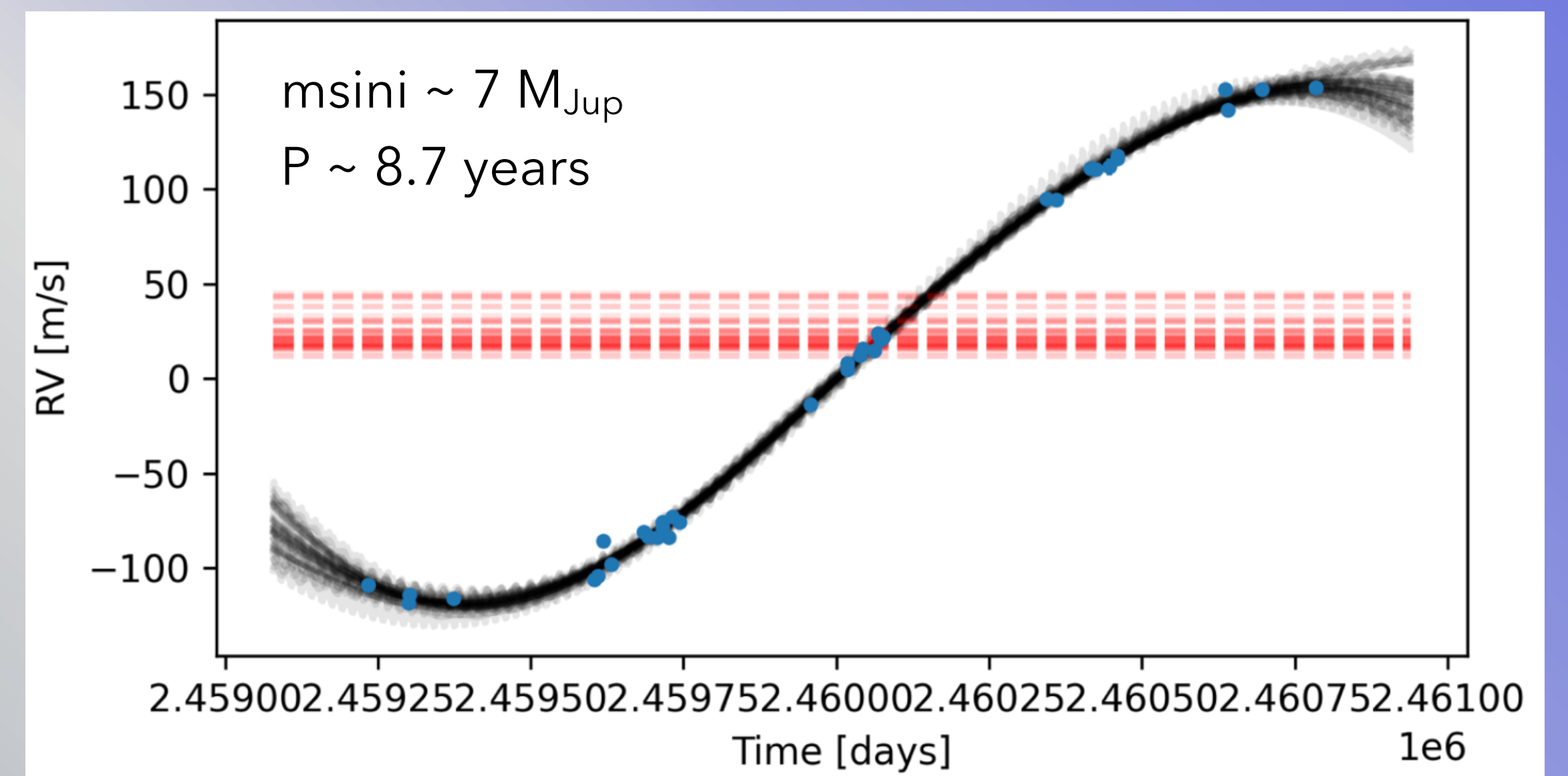
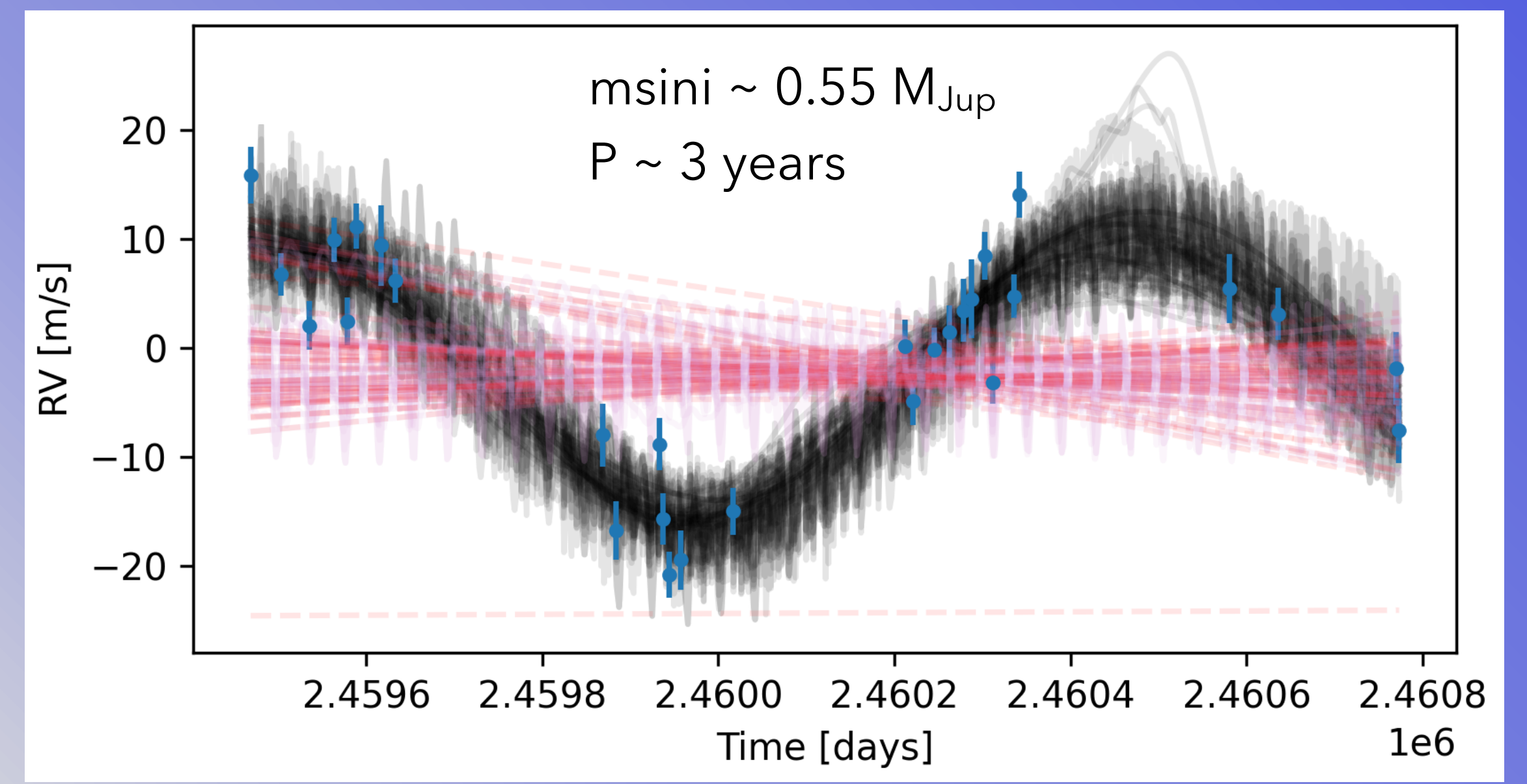
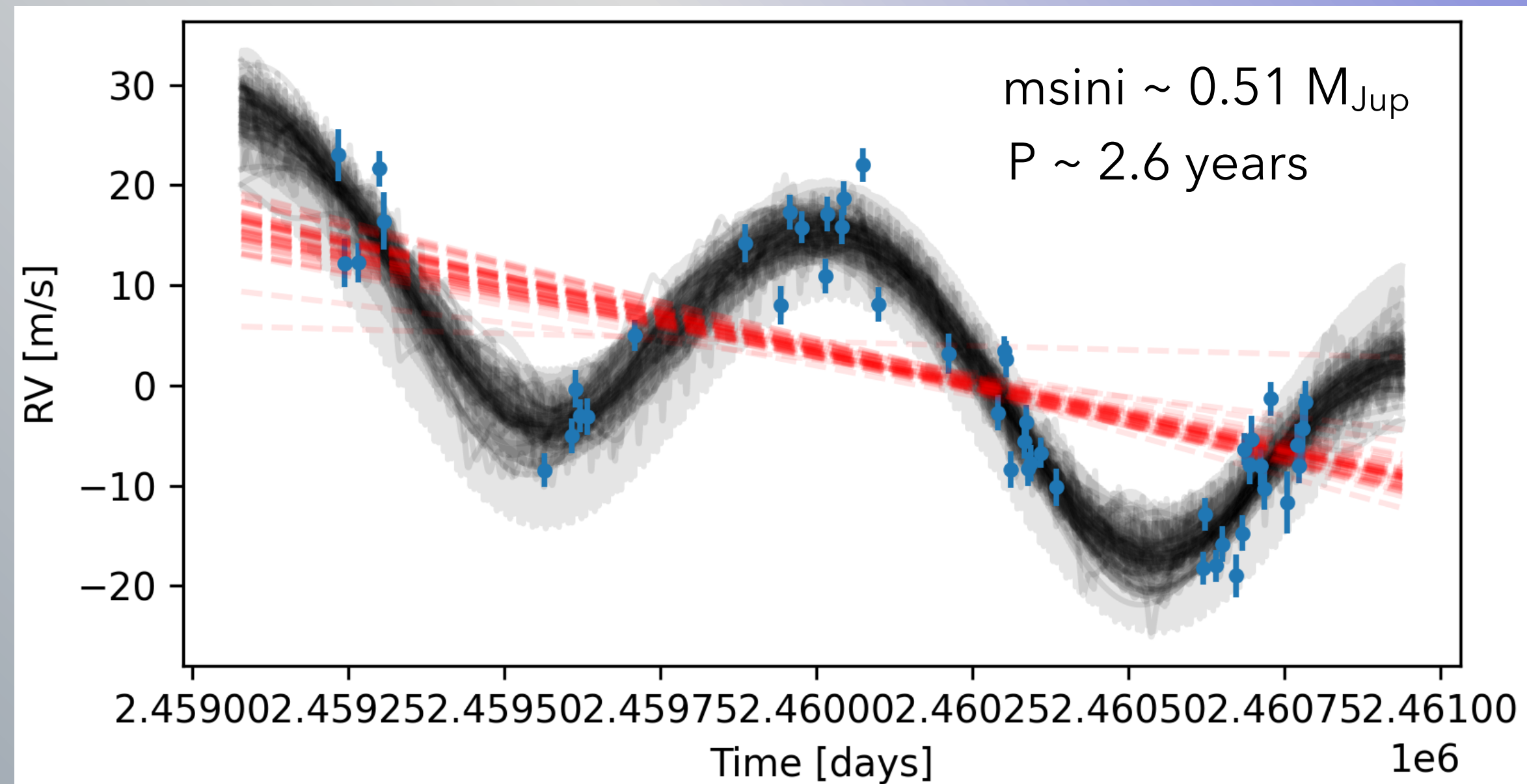
Two new planets orbiting a quiet K7 V

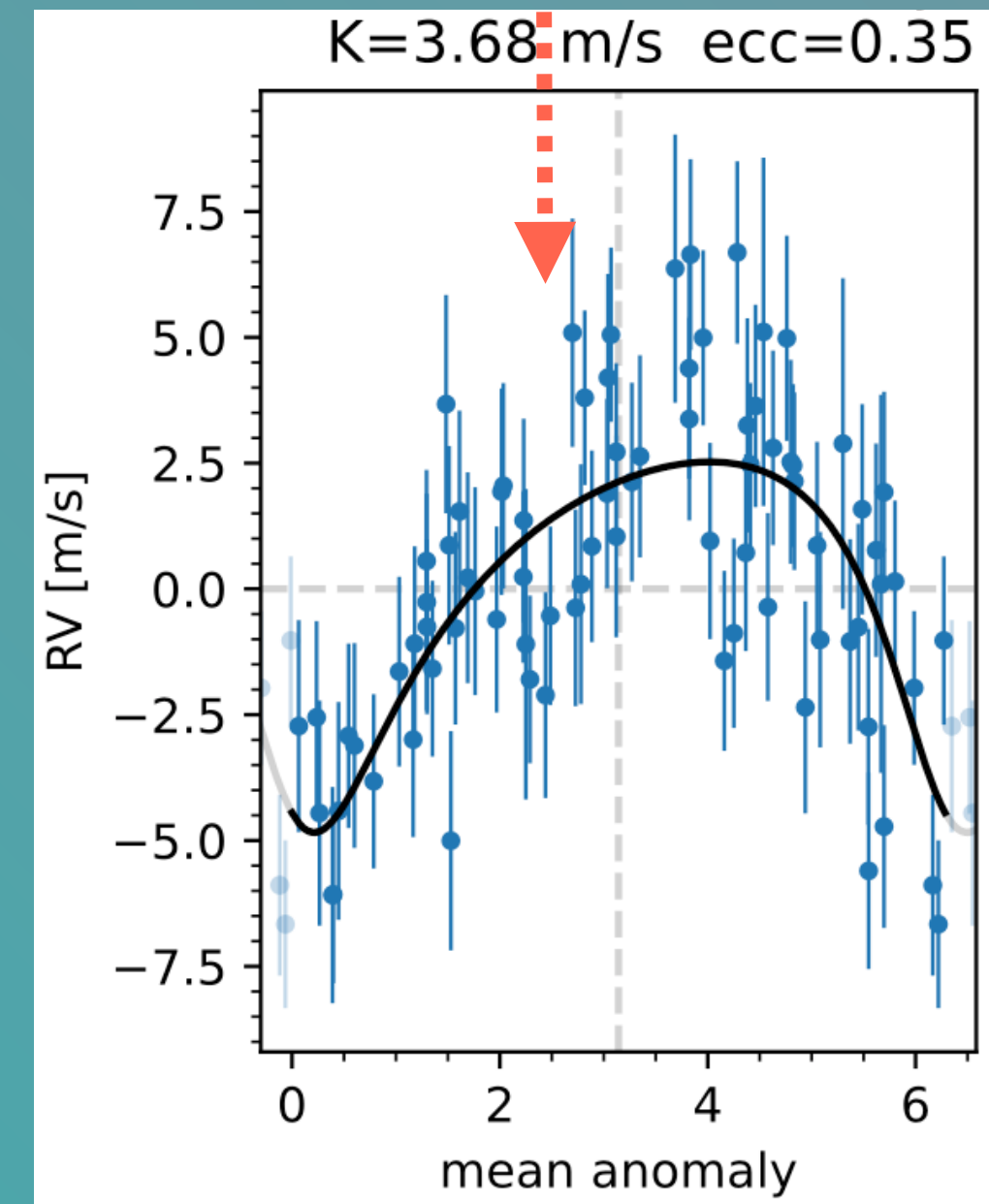
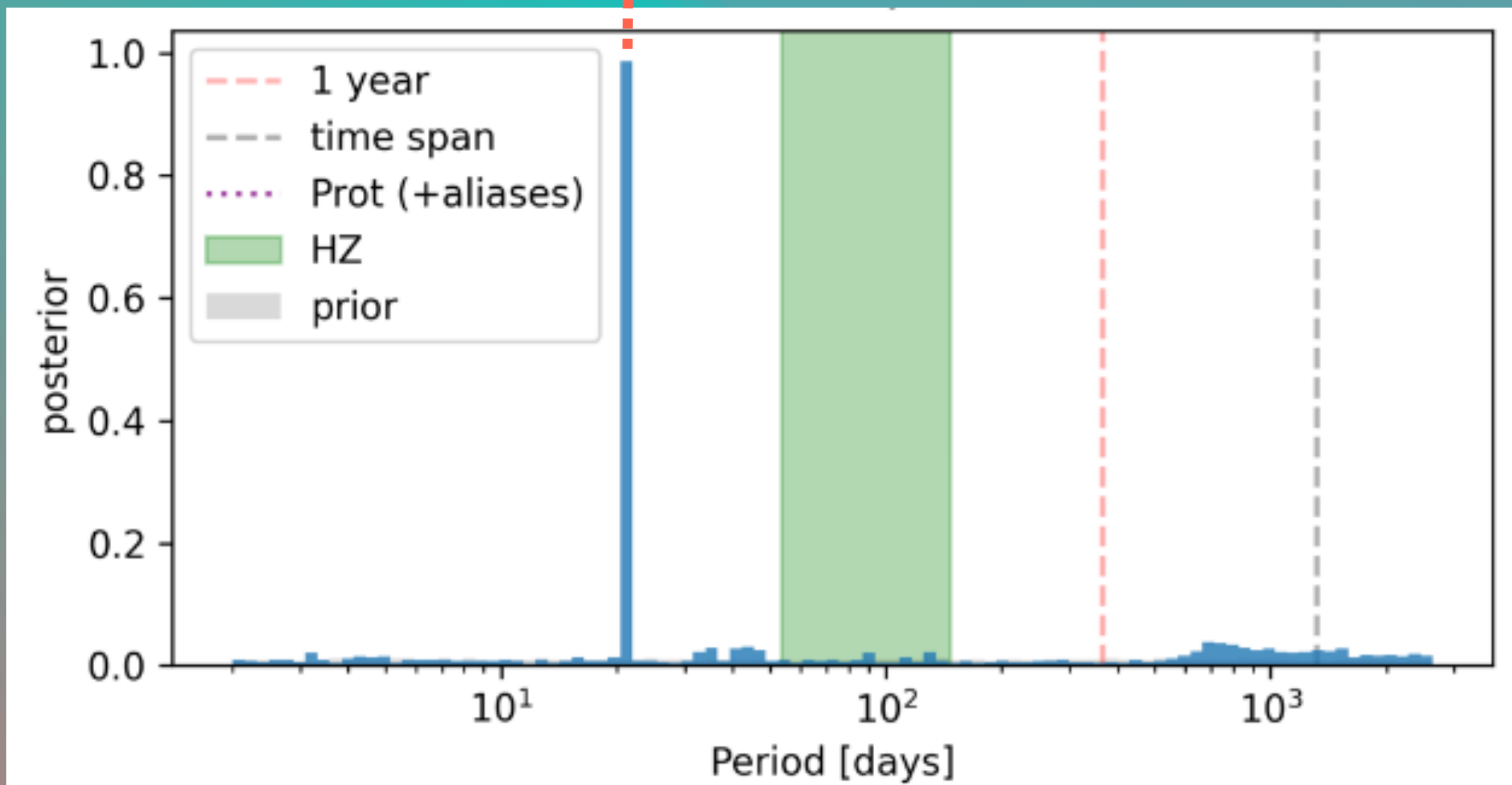
Potential transit signal of KOBE-1c in TESS data



Balsalobre-Ruza et al. (2025), A&A, 694, 15

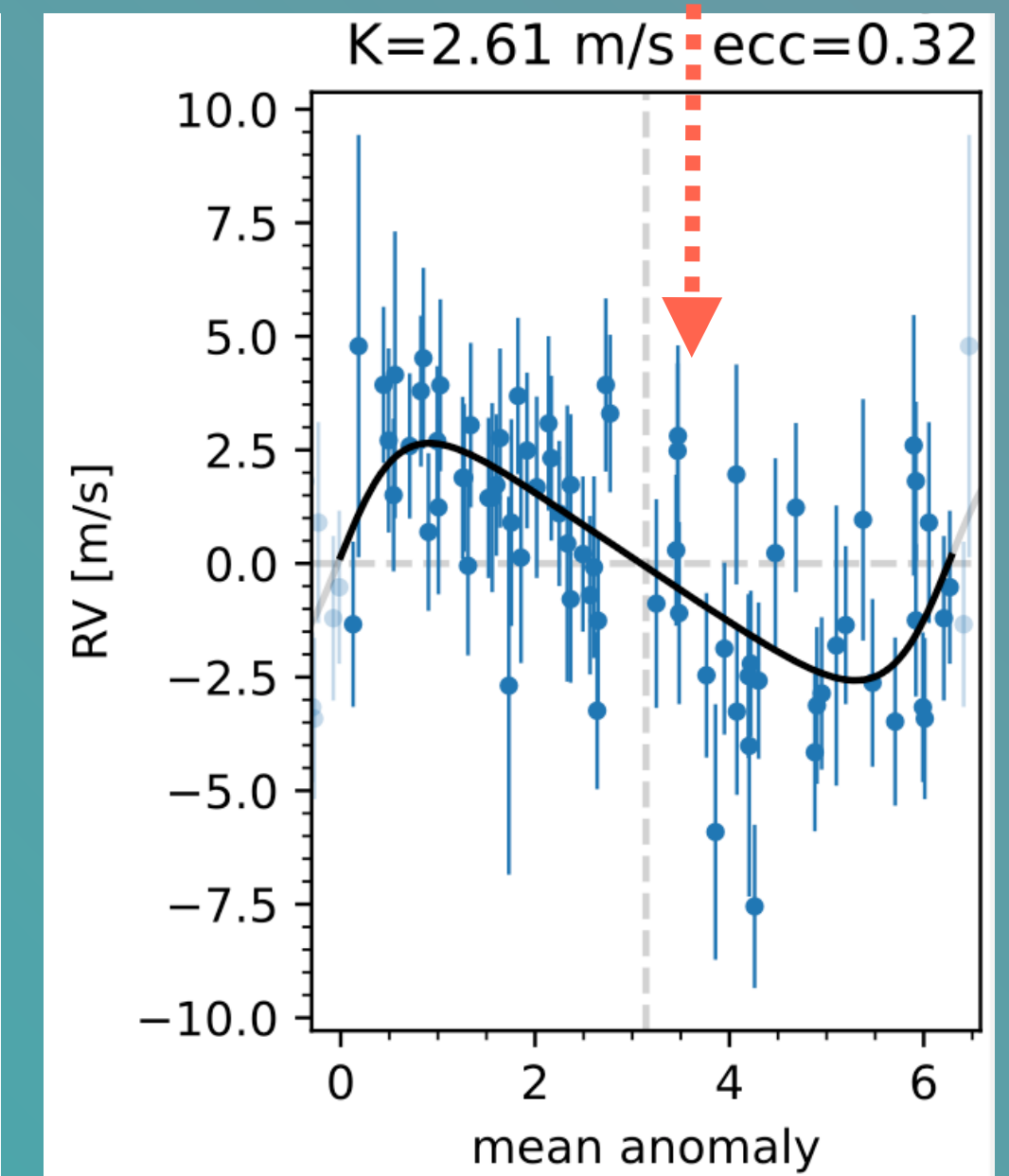
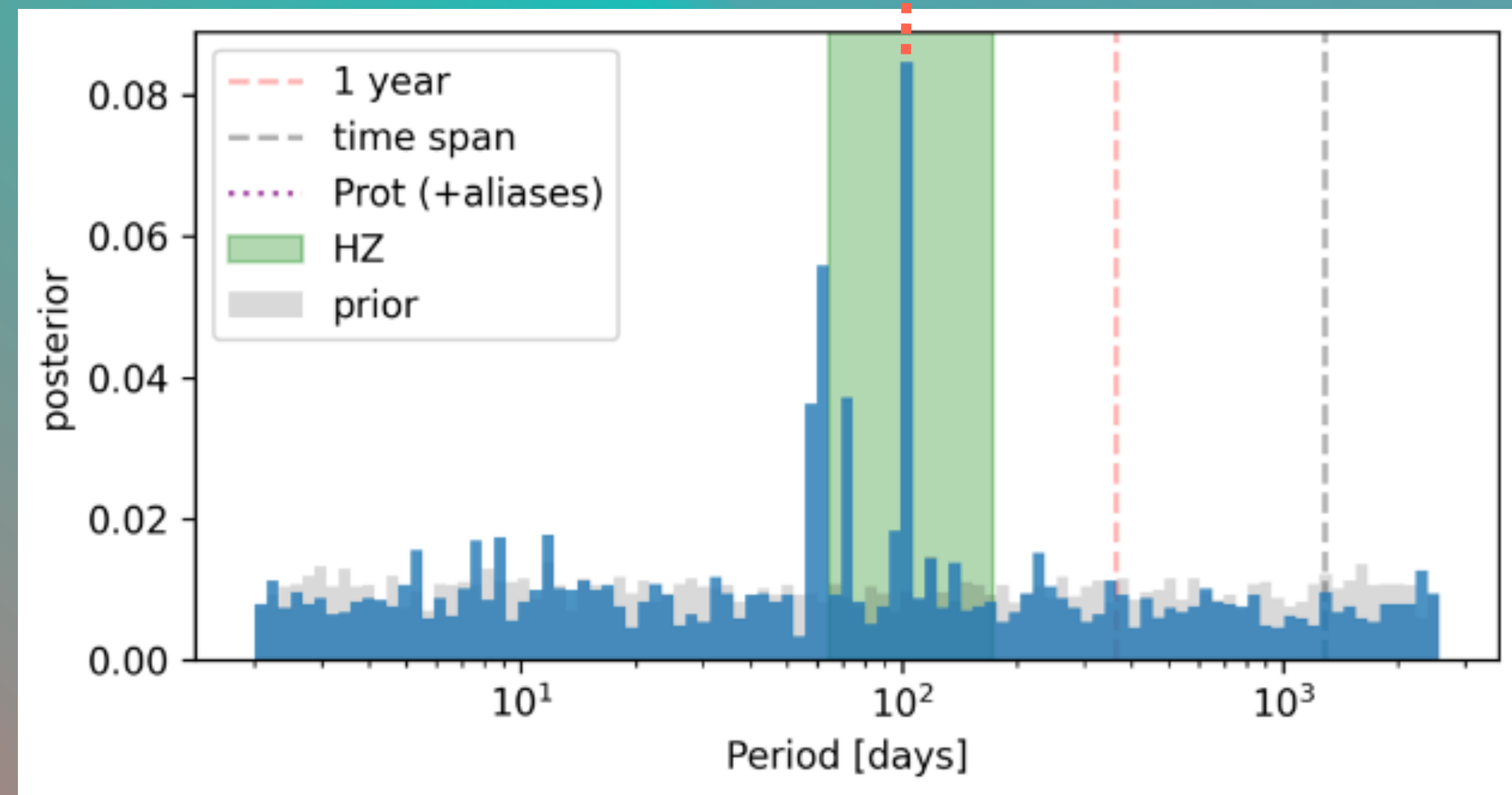
Cool giant candidates in the KOBE survey

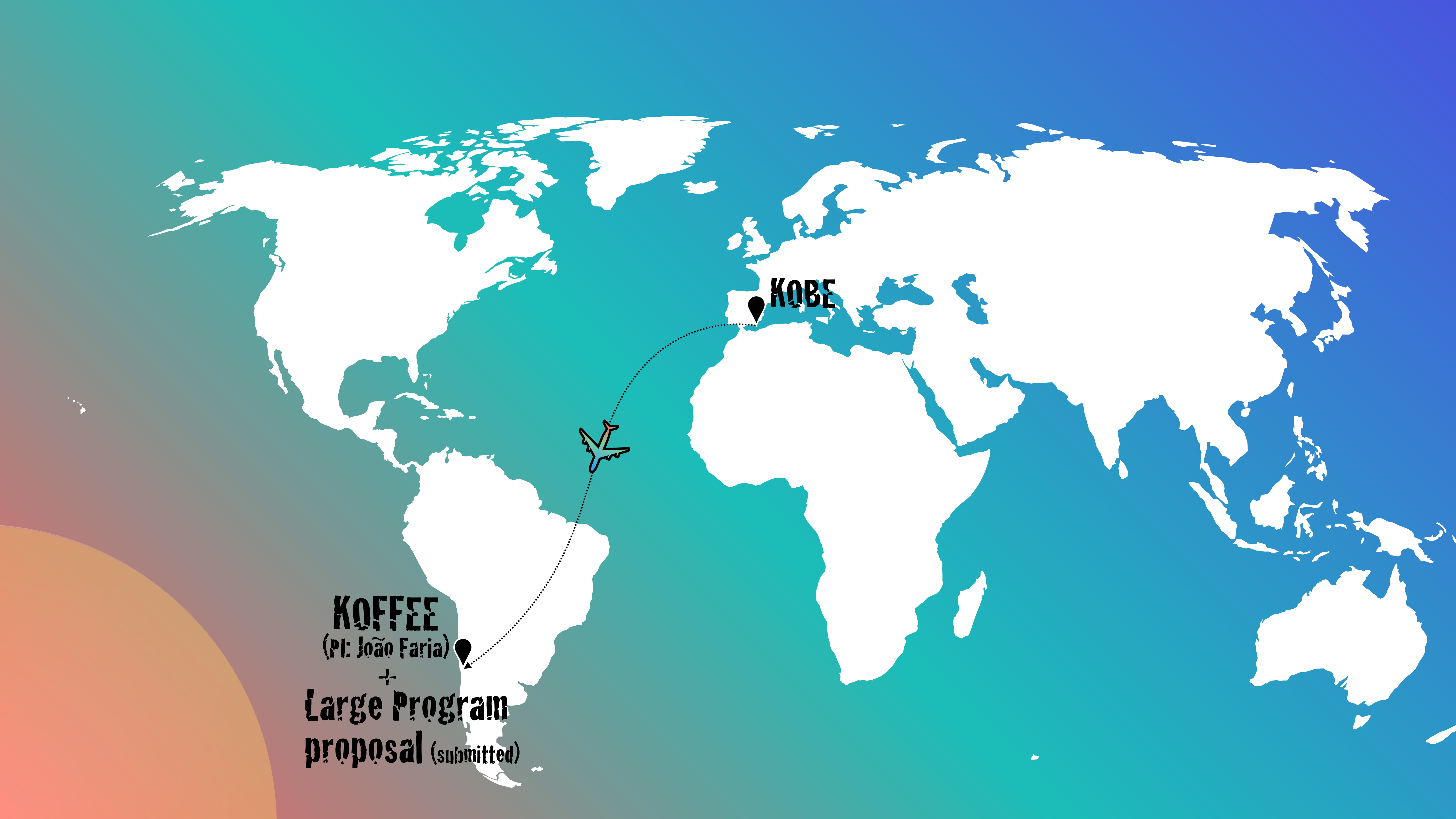




Short-period
planetary-mass
signals

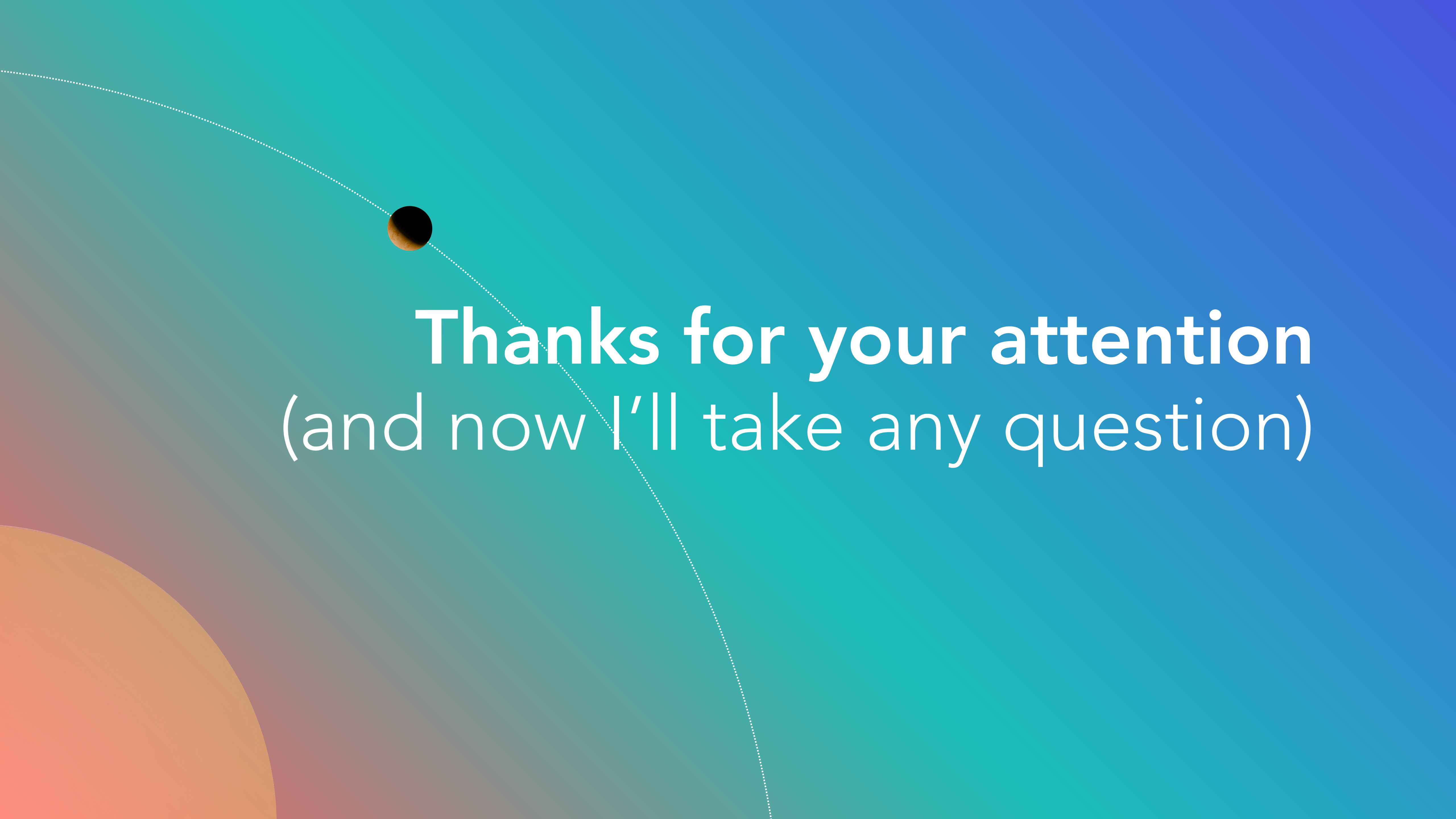
Habitable-zone
candidate signals





KOFFEE
(Pl: João Faria)
+
**Large Program
proposal** (submitted)

KOBE



Thanks for your attention
(and now I'll take any question)

