



# A super-Earth on the inner edge of the habitable zone of GJ 625

A. Suárez Mascareño  
J. I. González Hernández  
R. Rebolo

# HADES RV (2012 / - )

HARPS-N@TNG / APACHE / Catania APT-2

80 Stars

140 Nights

+3500 Spectra / Thousands of photometric exposures

3 Published new planets (+2 on the way +1 confirmation)

5 Refereed publications (+3 on the way)

+ More to come



# GJ 625

M2 V

V 10.17

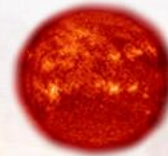
$0.30 \pm 0.05 M_{\odot}$

$0.31 \pm 0.07 R_{\odot}$

$3499 \pm 68 K$

$0.013 \pm 0.06 L/L_{\odot}$

$\log R_{\text{hk}} -5.5 \pm 0.2$



21 ly away  
Top 100 closest stars

# GJ 625

151 HARPS-N Spec  
108 APT-2 Nights (BVRI)  
41 APACHE Nights

+

42 HIRES Spec  
184 SWASP Nights  
36 FRODOSpec Nights ( $H\alpha$ )

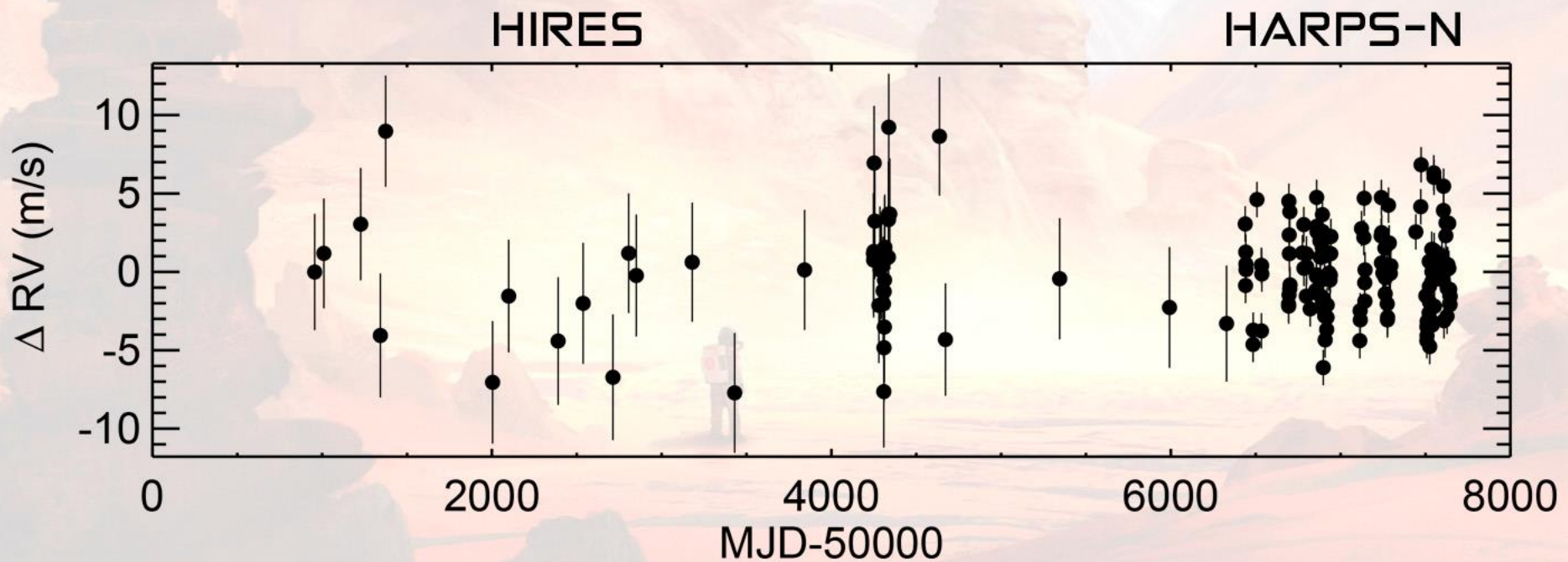
# RV DATA

RMS HARPS-N 2.6 m/s

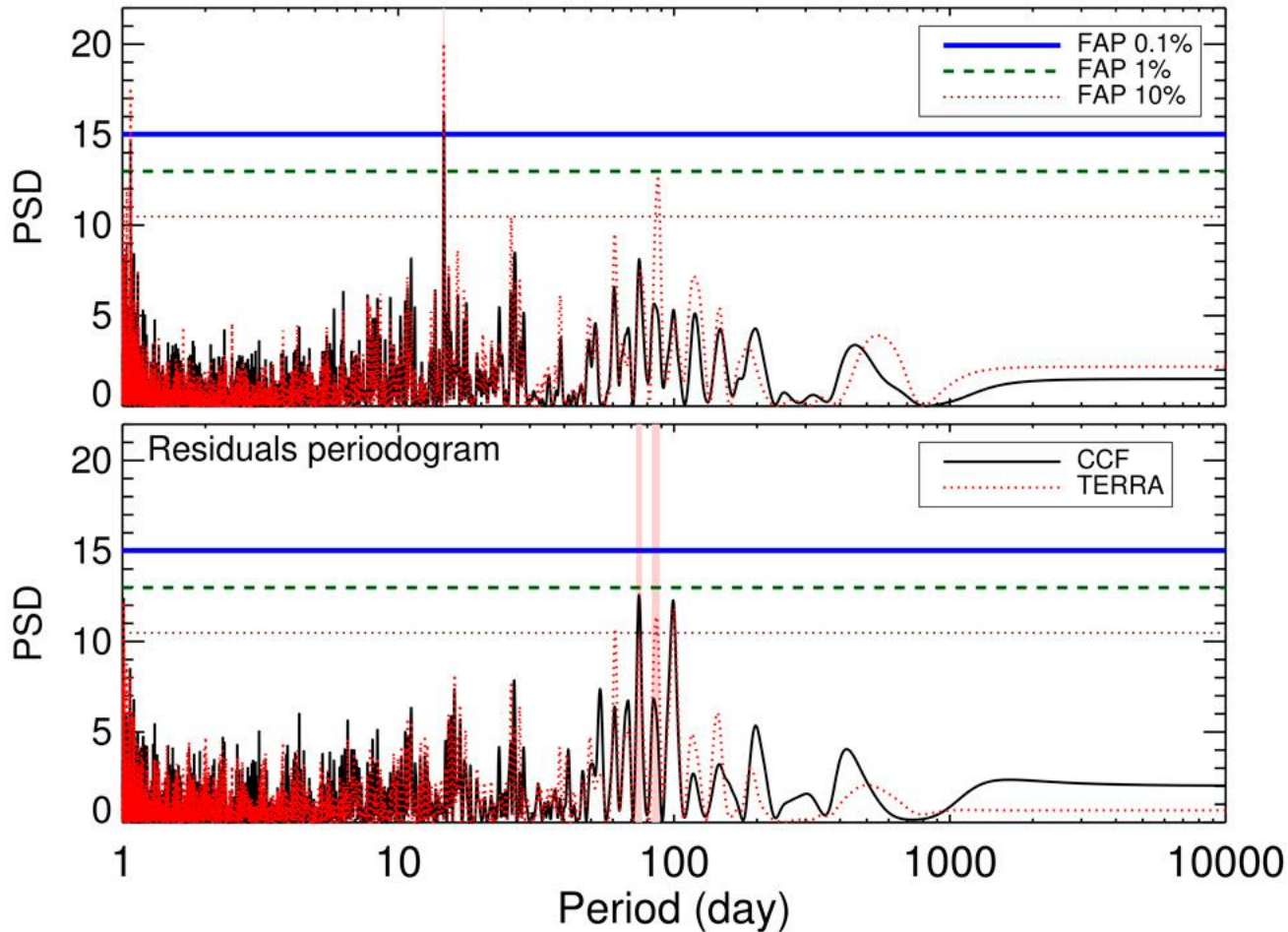
$\sigma_{RV}$  HARPS-N 1.3 m/s

RMS HIRES 4.1 m/s

$\sigma_{RV}$  HIRES 3.6 m/s



# RV DATA



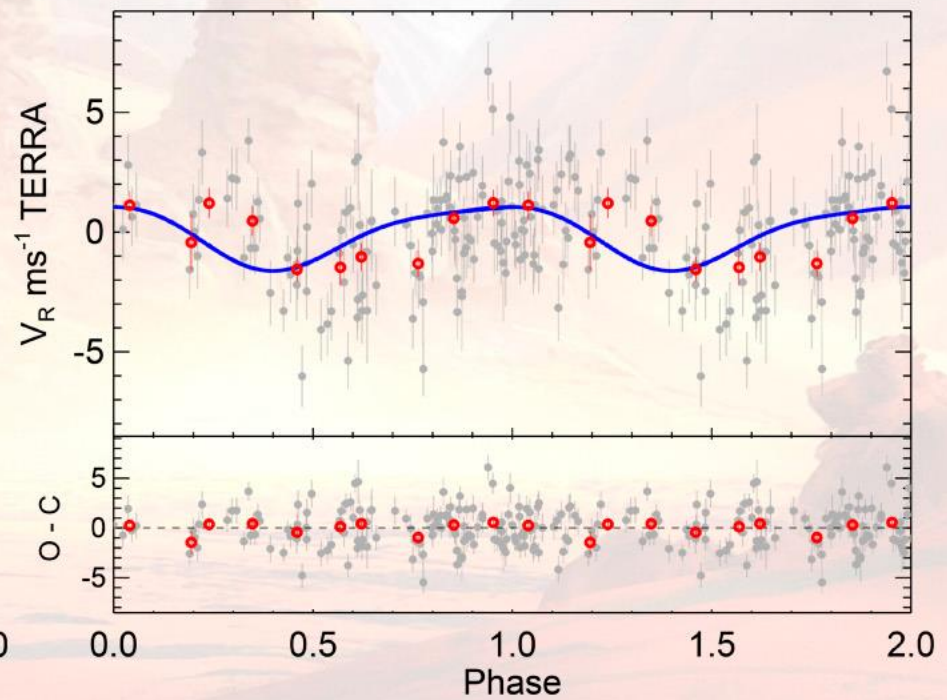
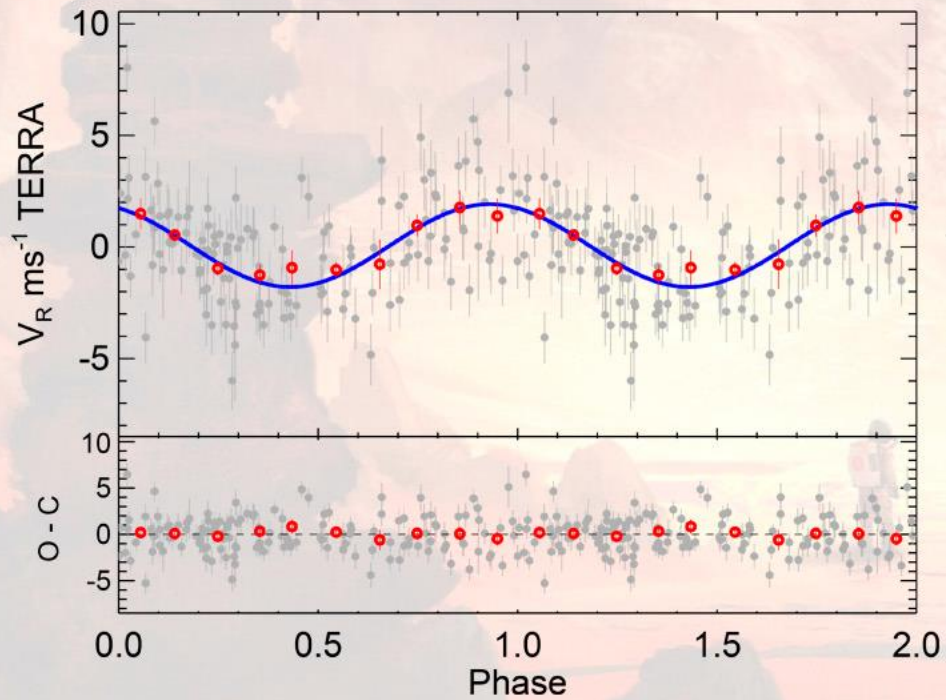
P 14.6 d  
K 1.7 m/s  
FAP < 0.1 %

P 74-100 d  
K 1.5 m/s  
FAP 1 %

# RV DATA

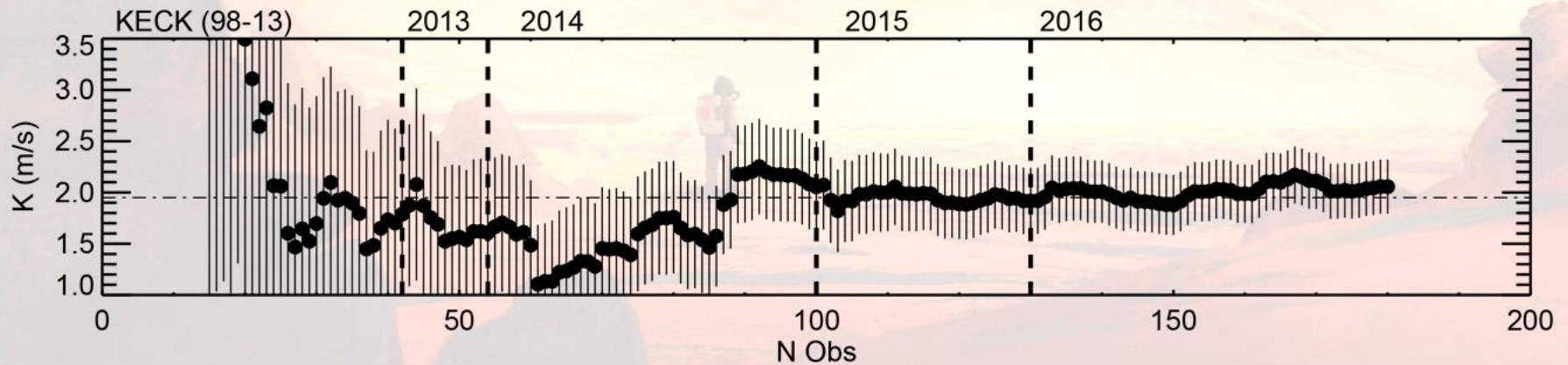
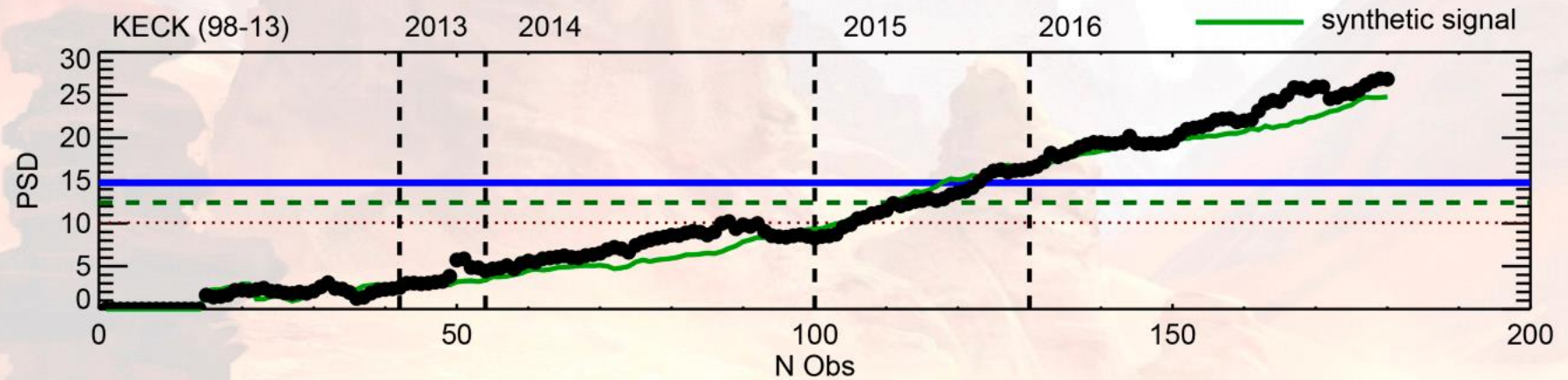
P 14.6 d  
K 1.7 m/s  
FAP < 0.1 %

P 74-100 d  
K 1.5 m/s  
FAP 1 %



# RV DATA

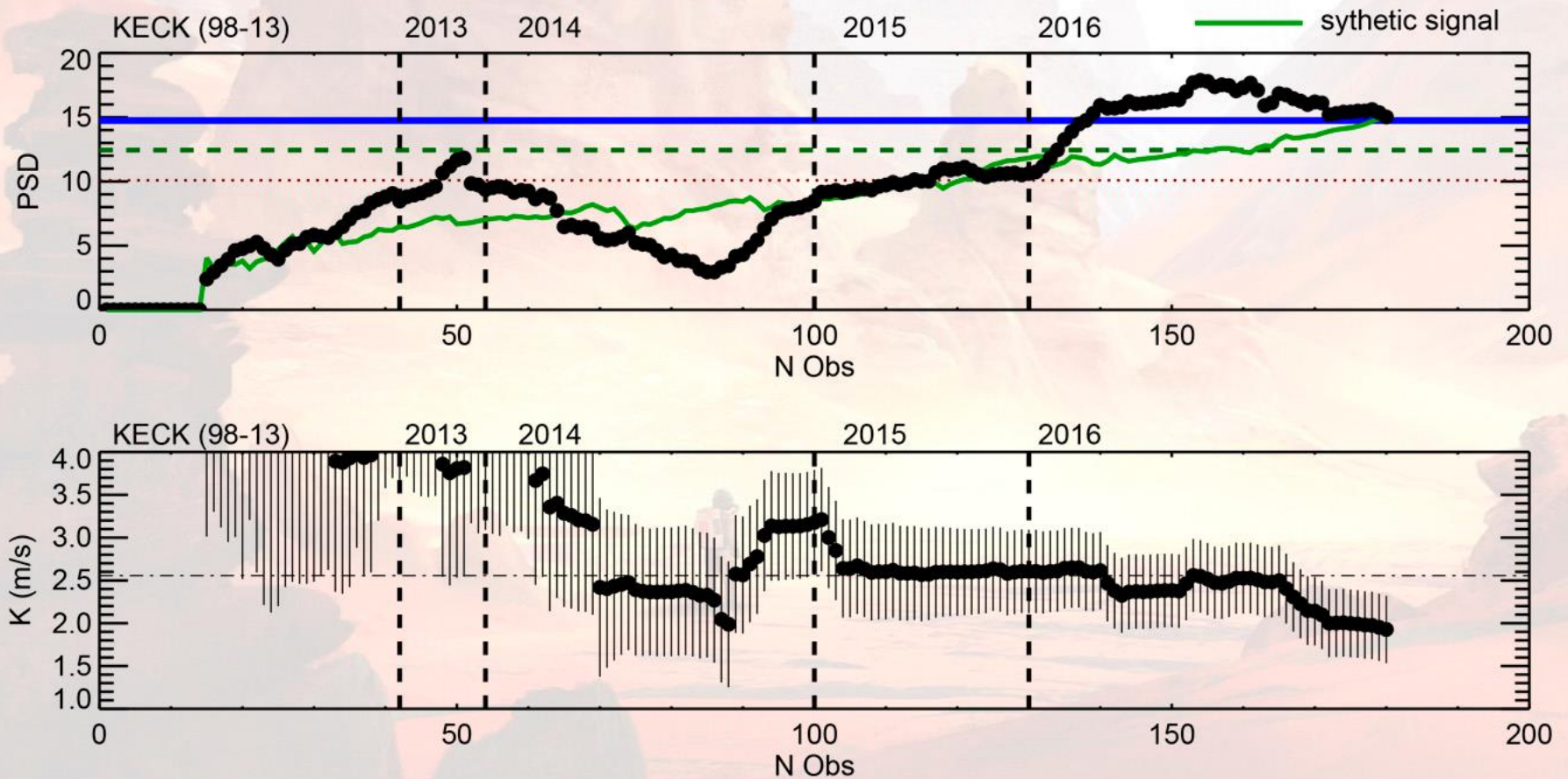
14.6 d Stable over long time-span





# RV DATA

74-100 d Unstable over long time-span



# Activity Proxies

## Spectroscopic

FWHM 82 d

BIS

Ca HK 74 d / 1.7 (3.2) yr

Ha 85 d / 3.4 yr

## Photometric

ATP-2 B 74 d

APT-2 V 74 d

APT-2 R 74 d

APT-2 I

APACHE

SWASP 76 d / 37 d

# Activity Proxies

14.6 d -- No significant activity vs RV correlation  
74-85 d -- Weak activity vs RV correlation

Parameter	Raw data	14.6 d signal	74 d signal	85 d signal
$S_{MW}$ vs $V_R CCF$	0.08 ( $1\sigma$ )	-0.05 ( $<1\sigma$ )	0.14 ( $2\sigma$ )	
$S_{MW}$ vs $V_R TERA$	0.09 ( $1\sigma$ )	-0.01 ( $<1\sigma$ )		0.13 ( $2\sigma$ )
$H_\alpha$ vs $V_R CCF$	-0.08 ( $1\sigma$ )	-0.08 ( $1\sigma$ )	0.02 ( $<1\sigma$ )	
$H_\alpha$ vs $V_R TERA$	0.01 ( $<1\sigma$ )	-0.03 ( $<1\sigma$ )		0.05 ( $<1\sigma$ )
FWHM vs $V_R CCF$	0.23 ( $2\sigma$ )	0.14 ( $1\sigma$ )	0.22 ( $2\sigma$ )	
FWHM vs $V_R TERA$	0.15 ( $2\sigma$ )	0.06 ( $<1\sigma$ )		0.14 ( $2\sigma$ )
BIS vs $V_R CCF$	0.04 ( $<1\sigma$ )	0.05 ( $<1\sigma$ )	0.06 ( $<1\sigma$ )	
BIS vs $V_R TERA$	-0.01 ( $<1\sigma$ )	0.01 ( $<1\sigma$ )		-0.01 ( $<1\sigma$ )

# Summary

1 Planet - 14.6 d

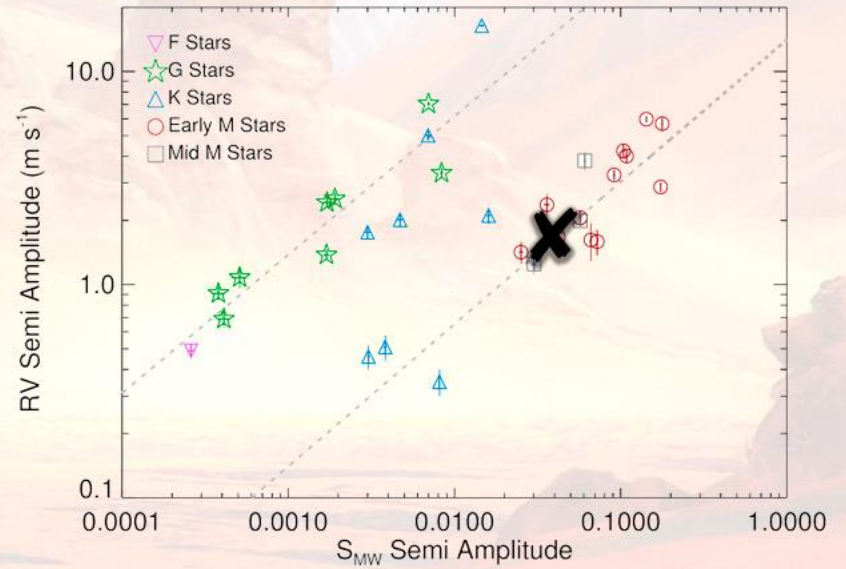
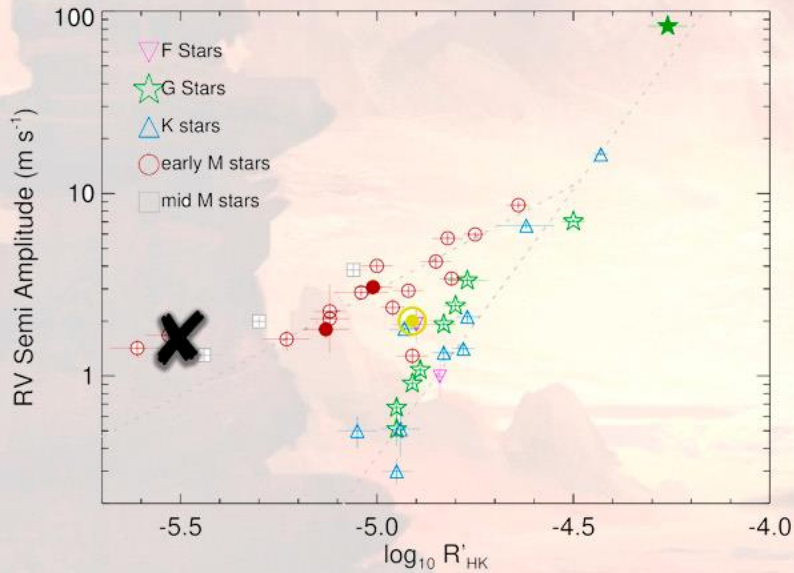
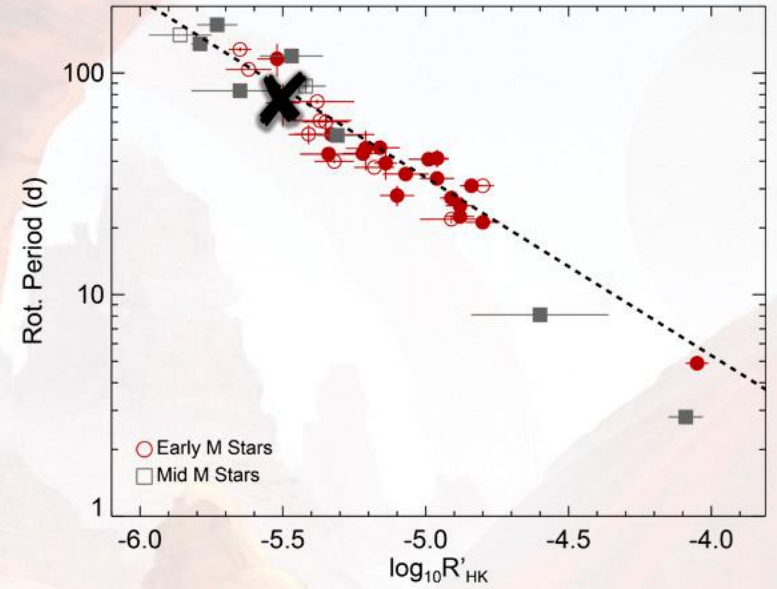
Rotation - 74-85 d

Mag. Cycle - 3 yr

# Activity vs Rotation

## Activity vs RV semi-amplitude

## Smw semi-amplitude vs RV semi-amplitude



# GJ 625 b

min. Mass  $2.82 \pm 0.51 M_{\oplus}$

Period  $14.628 \pm 0.013$  d

Semi major Axis  $0.07836 \pm 0.00005$  AU

ecc  $0.13 \pm 0.12$

Seff  $2.05 \pm 0.90$

ESI  $< 0.85$

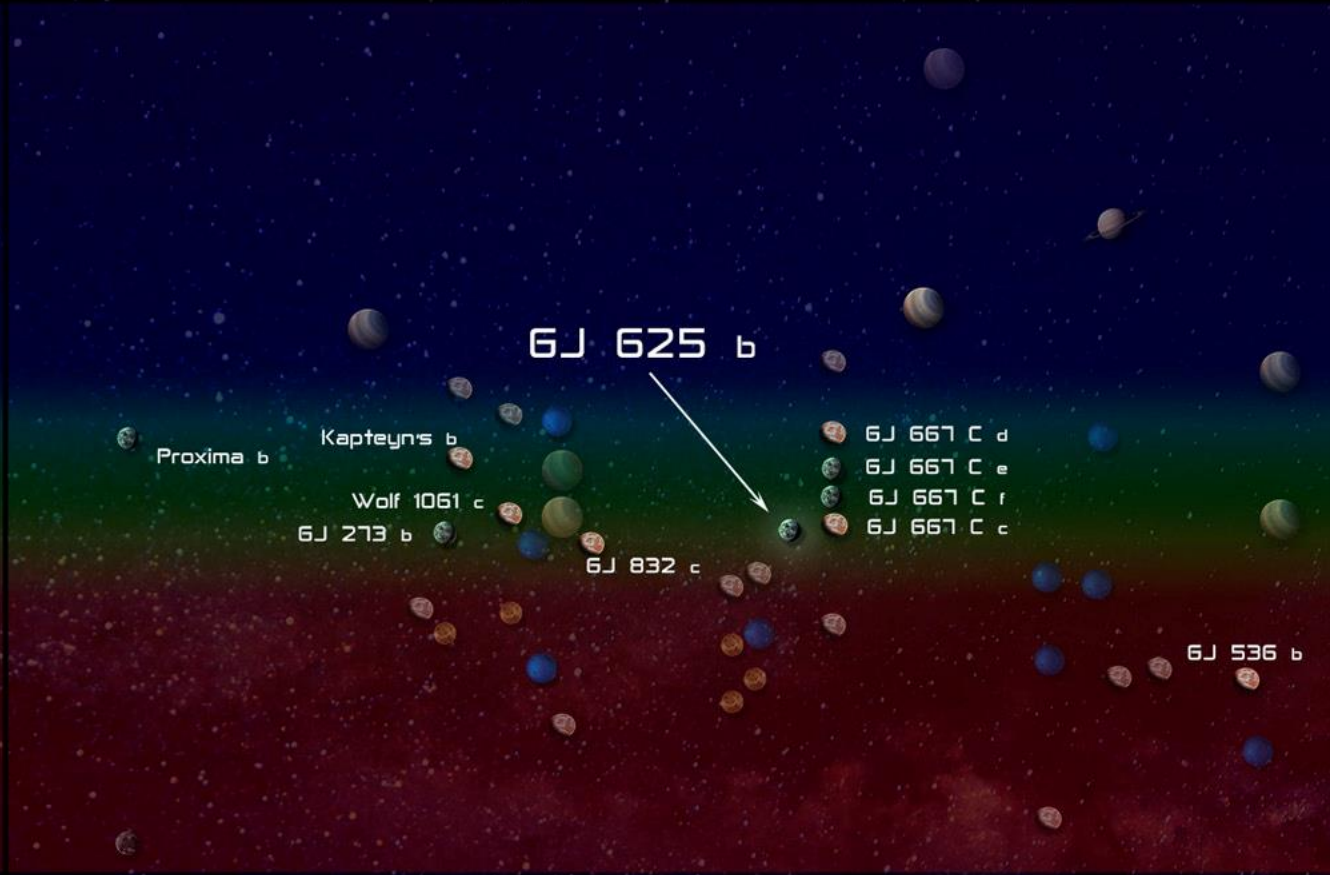


# THE PLANETS OF THE SOLAR NEIGHBOURHOOD

THE SOLAR SYSTEM

COLD

WARM



5 10 15 20 25 30

LIGHT YEARS

Data from Exoplanet.eu

6J 625 b - 2.8 Me - Suárez Mascareño, A -- 2017  
 6J 536 b - 5.4 Me - Suárez Mascareño, A -- 2017

6J 667 C d,e,f -- 5.1 Me, 2.1 Me, 2.1 Me -- Anglada Escudé, G -- 2013  
 Kapteyn's b - 4.8 Me - Anglada Escudé, G -- 2014  
 Proxima b - 1.3 Me - Anglada Escudé, G -- 2016  
 6J 273 b - 2.9 Me - Astudillo Del Moral, N -- 2017  
 6J 667 C c - 3.8 Me - Bonfils, X -- 2011  
 6J 862 c - 5.0 Me - Wittenmayer, R -- 2014  
 Wolf 1061 c - 4.3 Me - Wright, D -- 2015



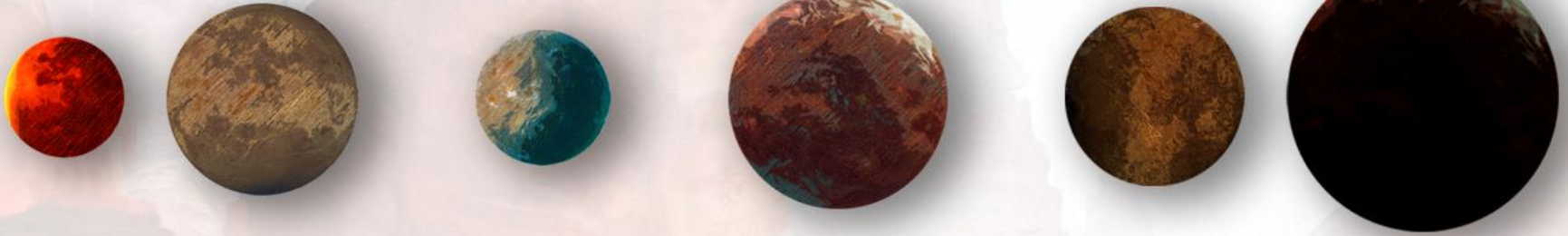
A vibrant, stylized illustration of a desert planet. The scene is dominated by warm, orange and red tones. In the foreground, a person in a white spacesuit with a red backpack stands on a sandy, rocky terrain. The background features towering, layered rock formations and a large, pale, circular celestial body in the sky. The overall atmosphere is one of a harsh yet beautiful alien environment.

**IF habitable**

Probably

**Desert Planet**

# HADES Discoveries



6J 3998 b

$M > 2.47 \text{ Me}$

$P = 2.65 \text{ d}$

$a = 0.029 \text{ AU}$

$\text{ESI} < 0.35$

Affer et al. 2016

6J 3998 c

$M > 6.26 \text{ Me}$

$P = 13.74 \text{ d}$

$a = 0.089 \text{ AU}$

$\text{ESI} < 0.55$

Suárez Mascareño et al. 2017

6J 625 b

$M > 2.80 \text{ Me}$

$P = 14.63 \text{ d}$

$a = 0.078 \text{ AU}$

$\text{ESI} < 0.85$

Perger et al. Submitted

6J 3942 b

$M > 7.20 \text{ Me}$

$P = 6.91 \text{ d}$

$a = 0.061 \text{ AU}$

$\text{ESI} < 0.35$

6J 15 A b

(Confirmed)

Later today

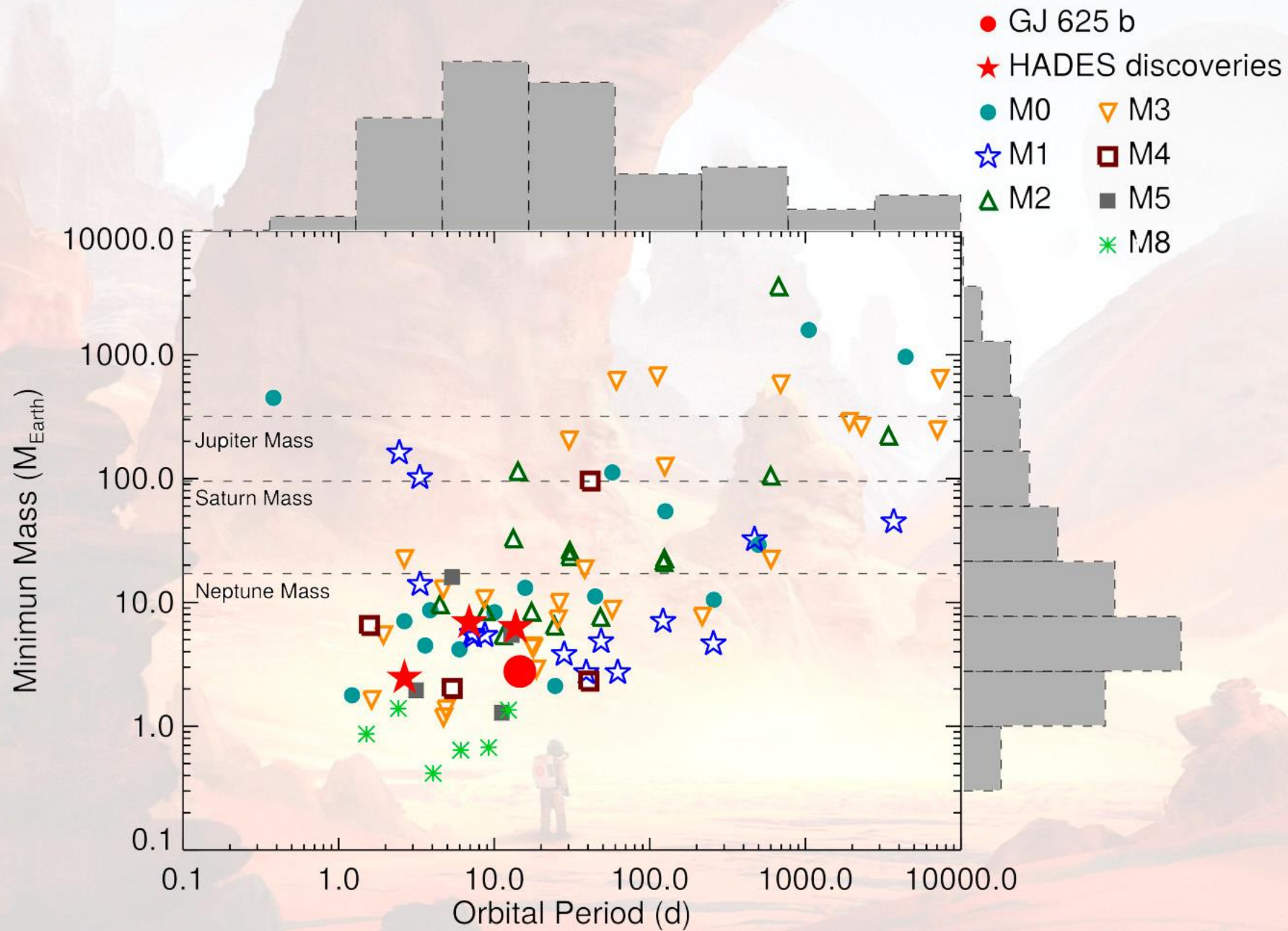
Pinamonti et al. to be submitted

6J 15 A c

Later today

+ Stellar properties, stellar activity  
and simulations

Perger et al. 2017  
Maldonado et al. 2017  
Scandariato et al. 2017  
Suárez Mascareño et al. In preparation



# Next

## Back to HARPS-N

Keep monitoring 6J 625, 6J 3998, 6J 3942, 6J 15 A

Confirm promising candidates

## Photometric follow-up

Search for transits

Keep monitoring stars

**New exciting results on the way!**

# Thanks for the attention!

## HADES RV Programme with HARPS-N at TNG V

A super-Earth on the inner edge of the habitable zone of the nearby M dwarf 6J 625

A. Suárez Mascareño  
J. I. González Hernández  
R. Rebolo  
S. Velasco  
B. Toledo-Adrón  
L. Affer  
M. Perger  
G. Micela  
I. Ribas  
J. Maldonado  
G. Letto  
R. Zanmar Sanchez  
G. Scandariato  
M. Damasso  
A. Sozzetti  
M. Esposito  
E. Covino  
A. Maggio  
A. F. Lanza  
S. Desidera  
A. Rosich  
A. Bignamini  
R. Claudi  
S. Benatti  
F. Borsa  
M. Pedani  
E. Molinari  
J. C. Morales  
E. Herrero  
M. Lafarga



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