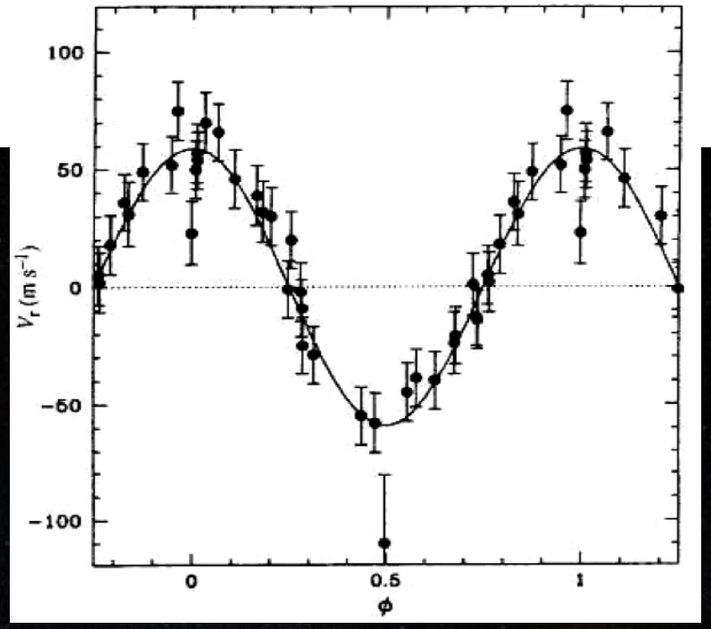
Search for small planets
in
hot-Jupiter systems

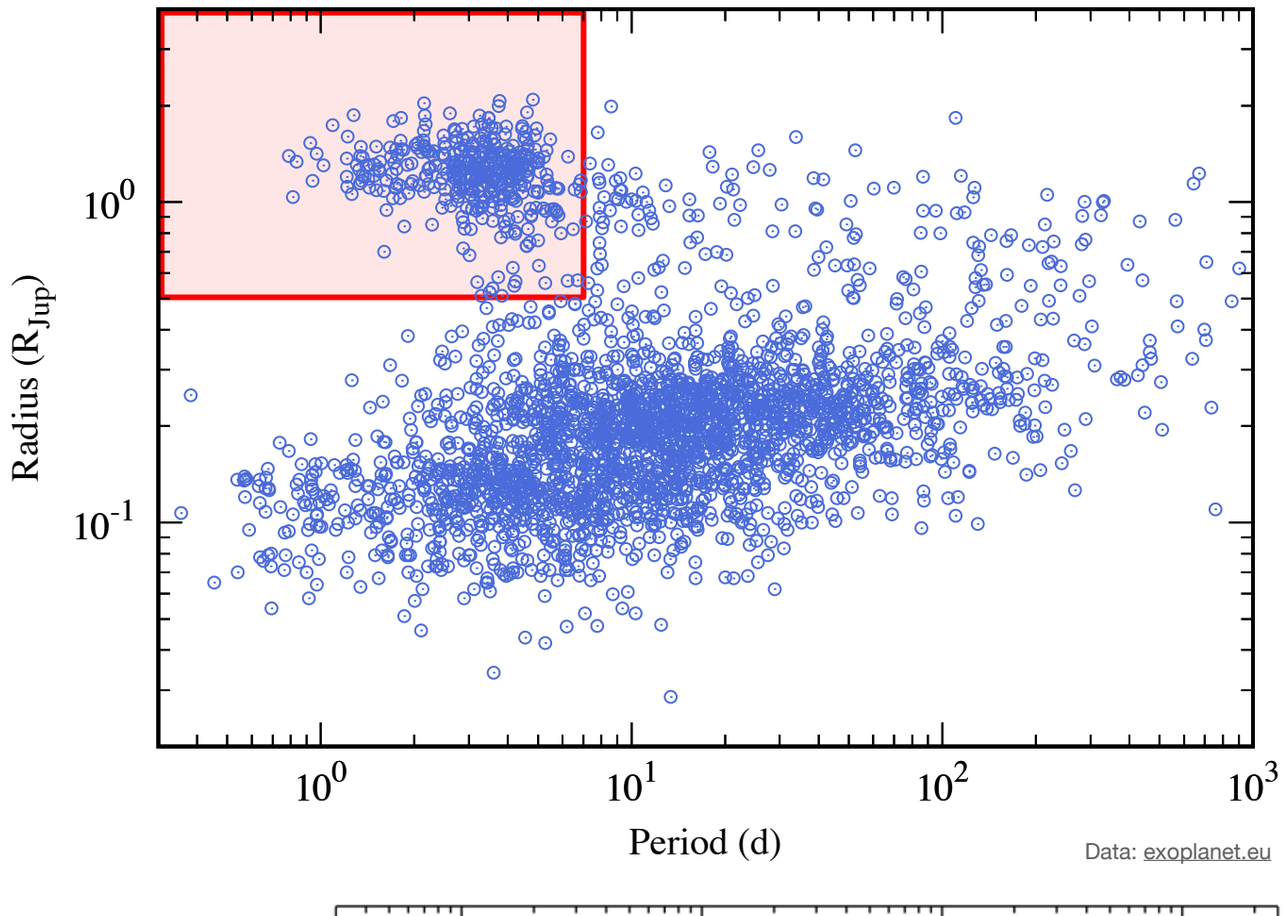
Gracjan Maciejewski
Nicolaus Copernicus University

This research has been supported by the National Science Centre, Poland through grant no. 2016/23/B/ST9/00579.

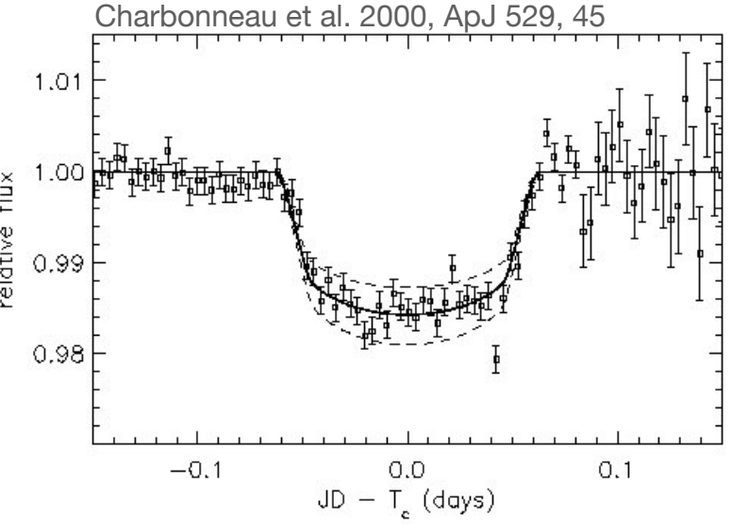
Hot Jupiters

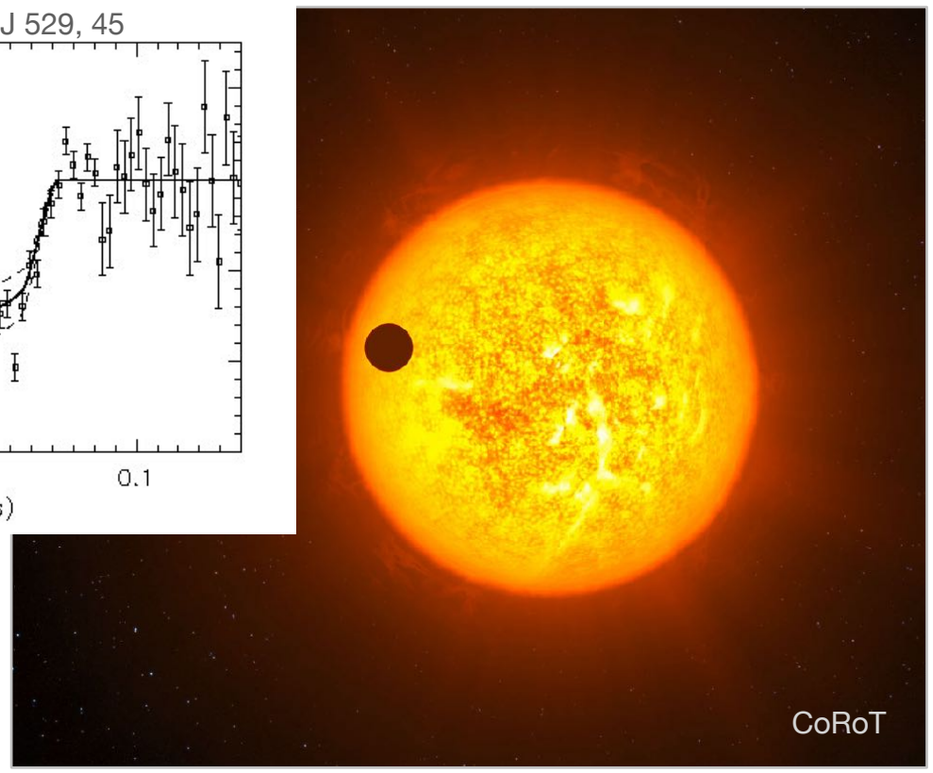
Mayor & Queloz. 1995, Nature. 378, 355

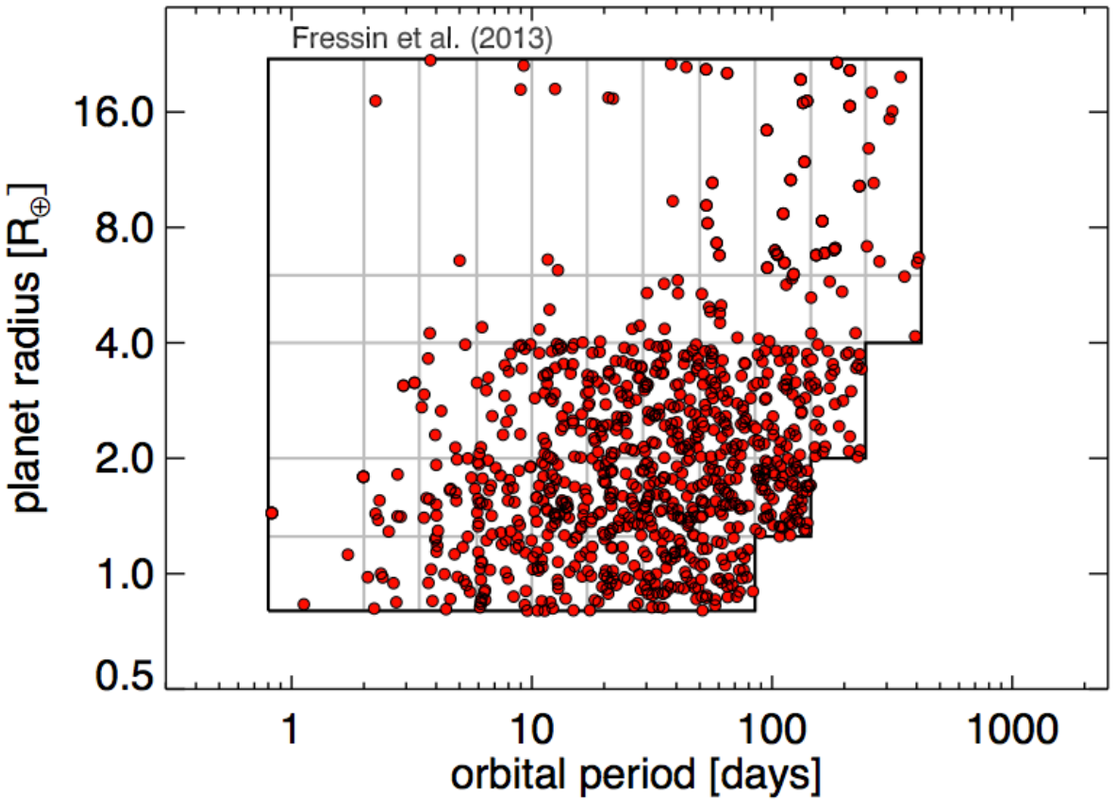




Charbonneau et al. 2000, ApJ 529, 45







Steffen et al. 2016, PNAS, 109, 7982

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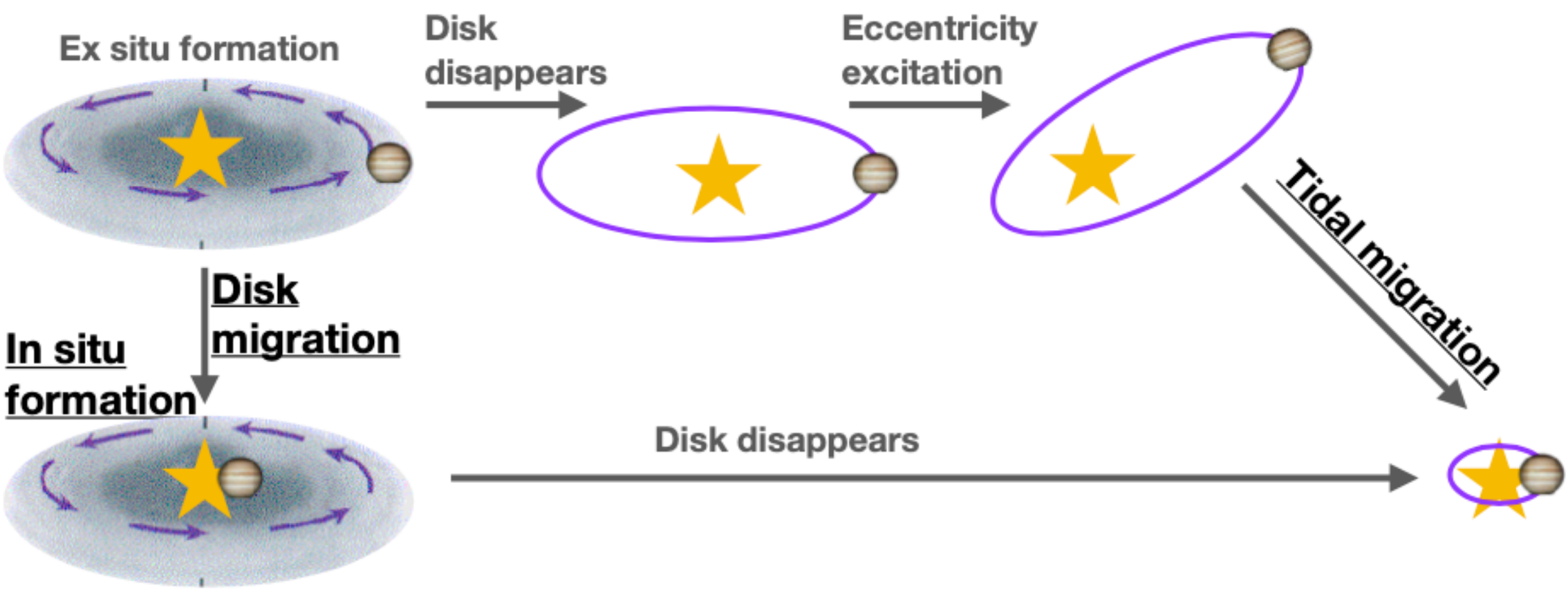
Hot Jupiters



Dawson & Johnson, 2018, ARA&A, 56, 175

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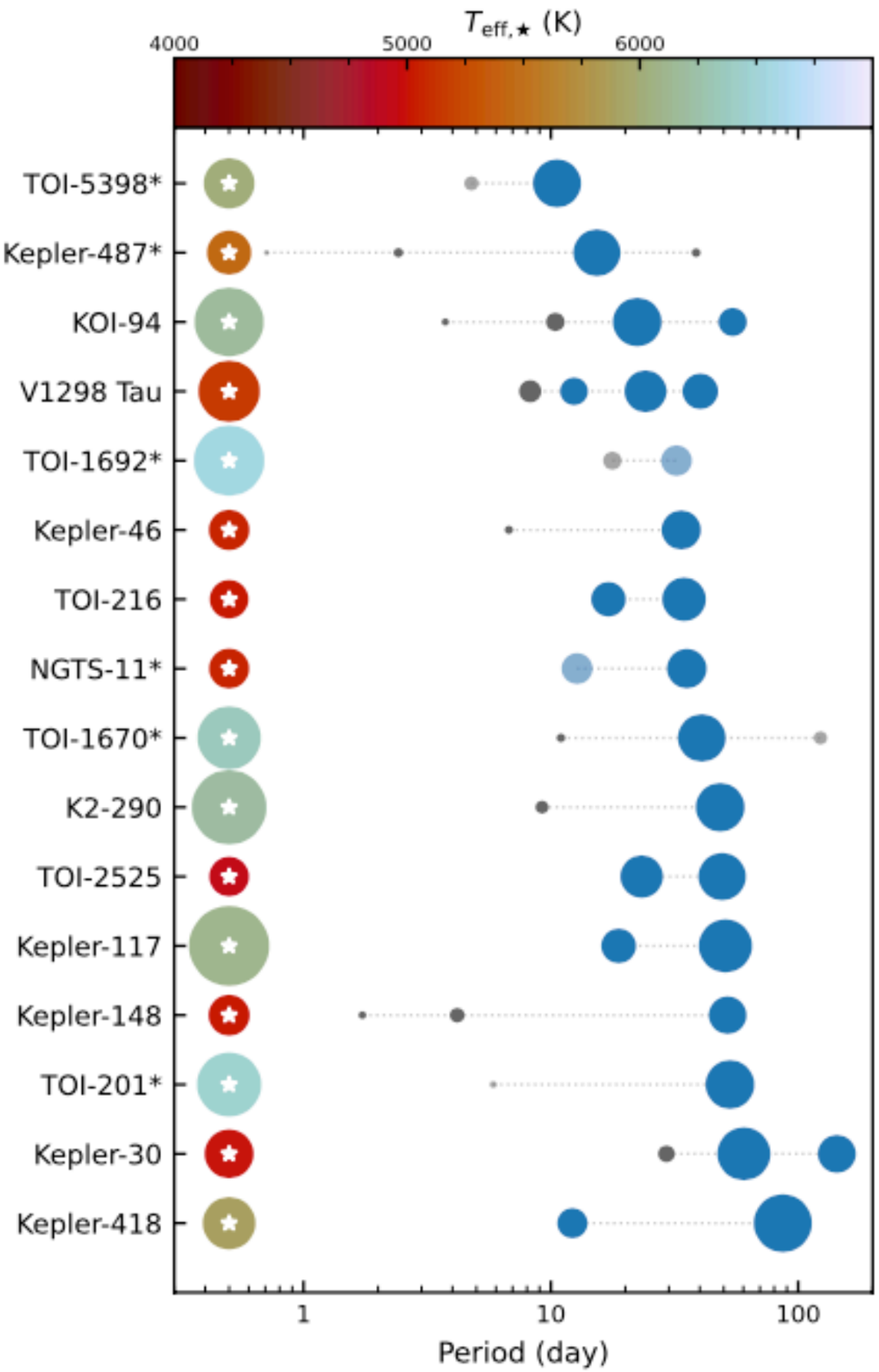
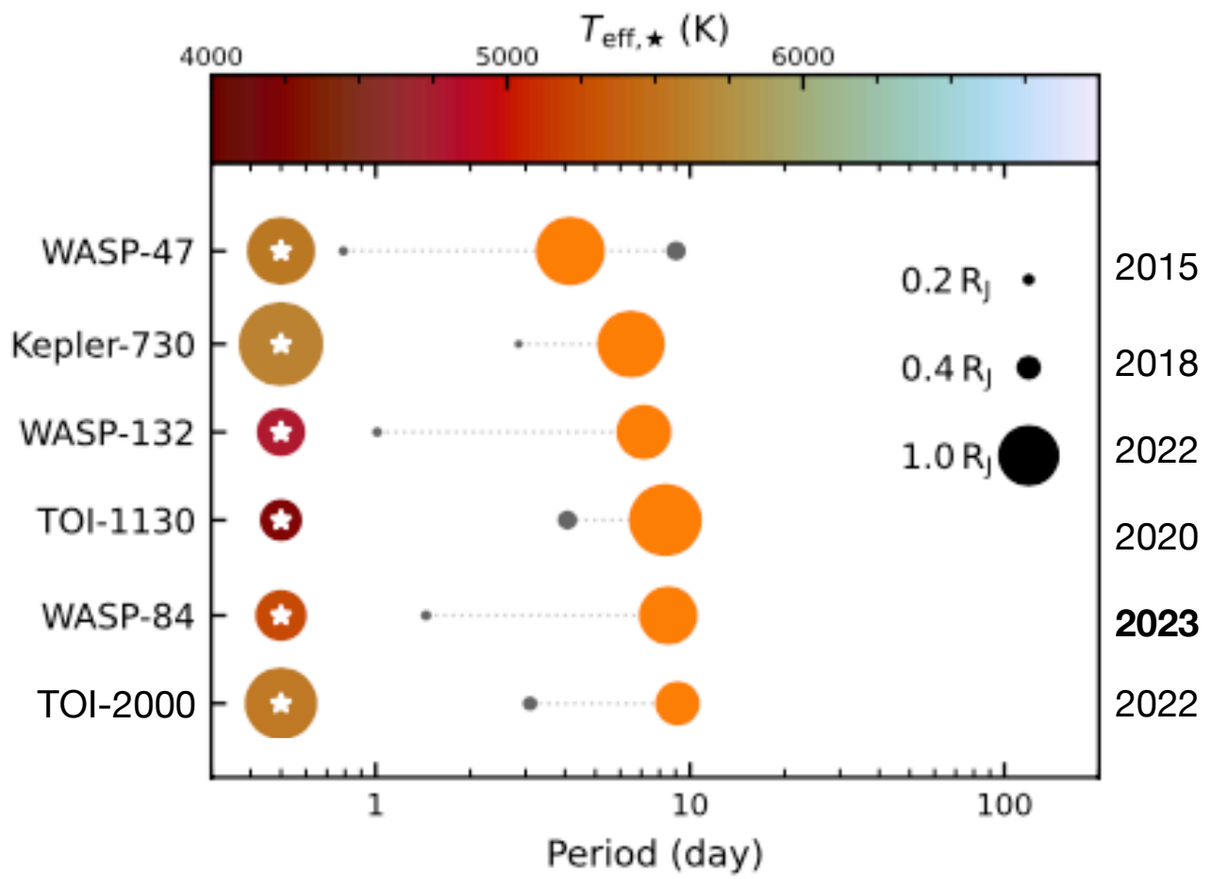
Loneliness of hot Jupiters

Warm Jupiters



Hot Jupiters



Sha *et al*. 2023, 2023, MNRAS, 524, 1113

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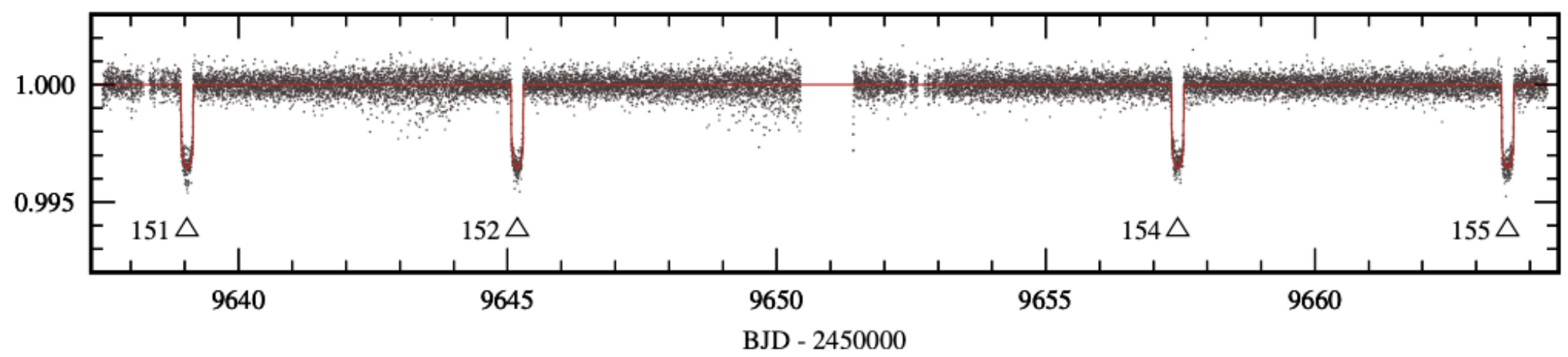
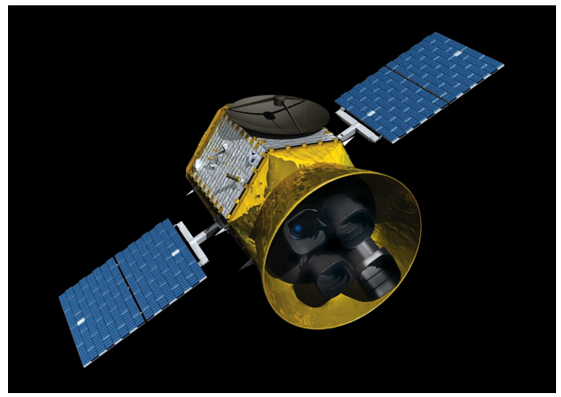
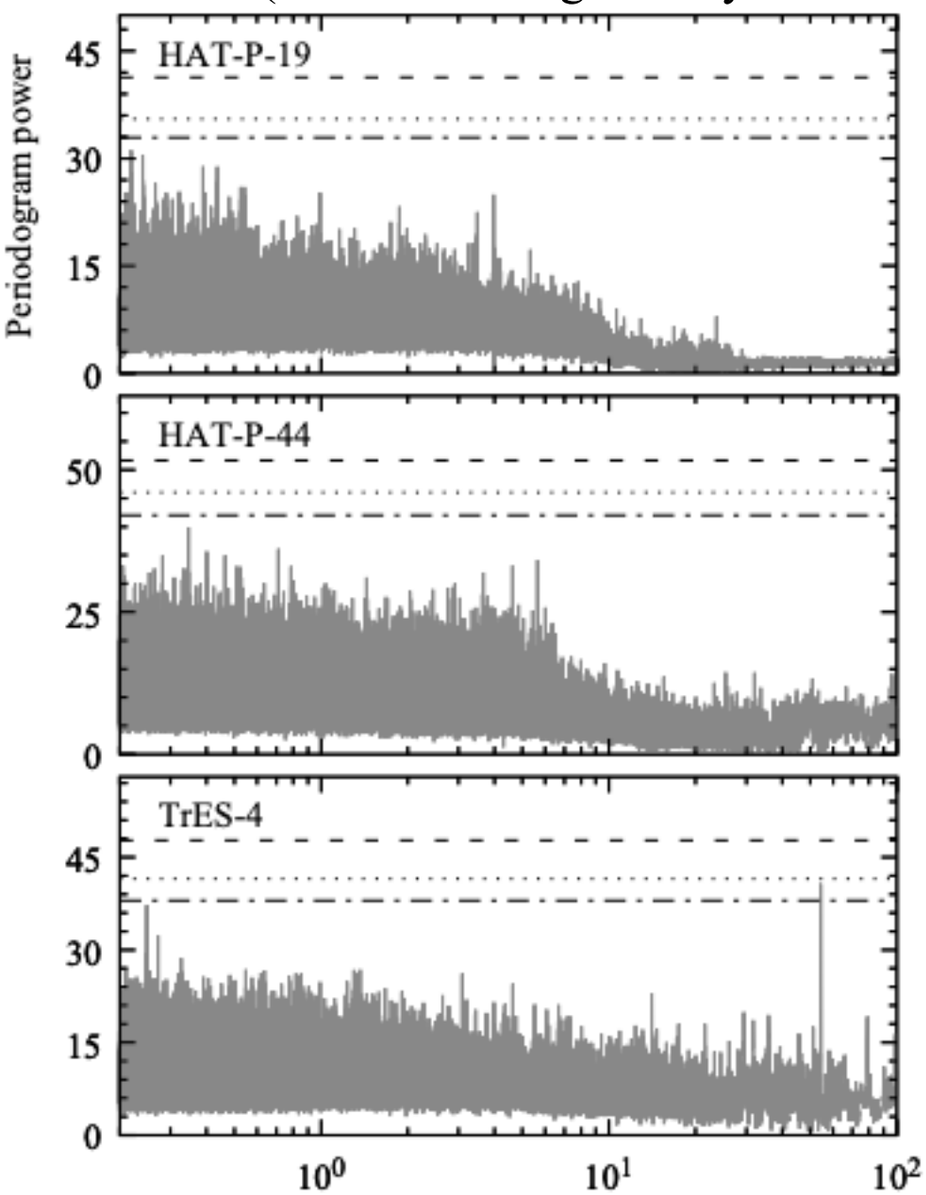
Search for planets in hot Jupiter systems with multi-sector TESS photometry

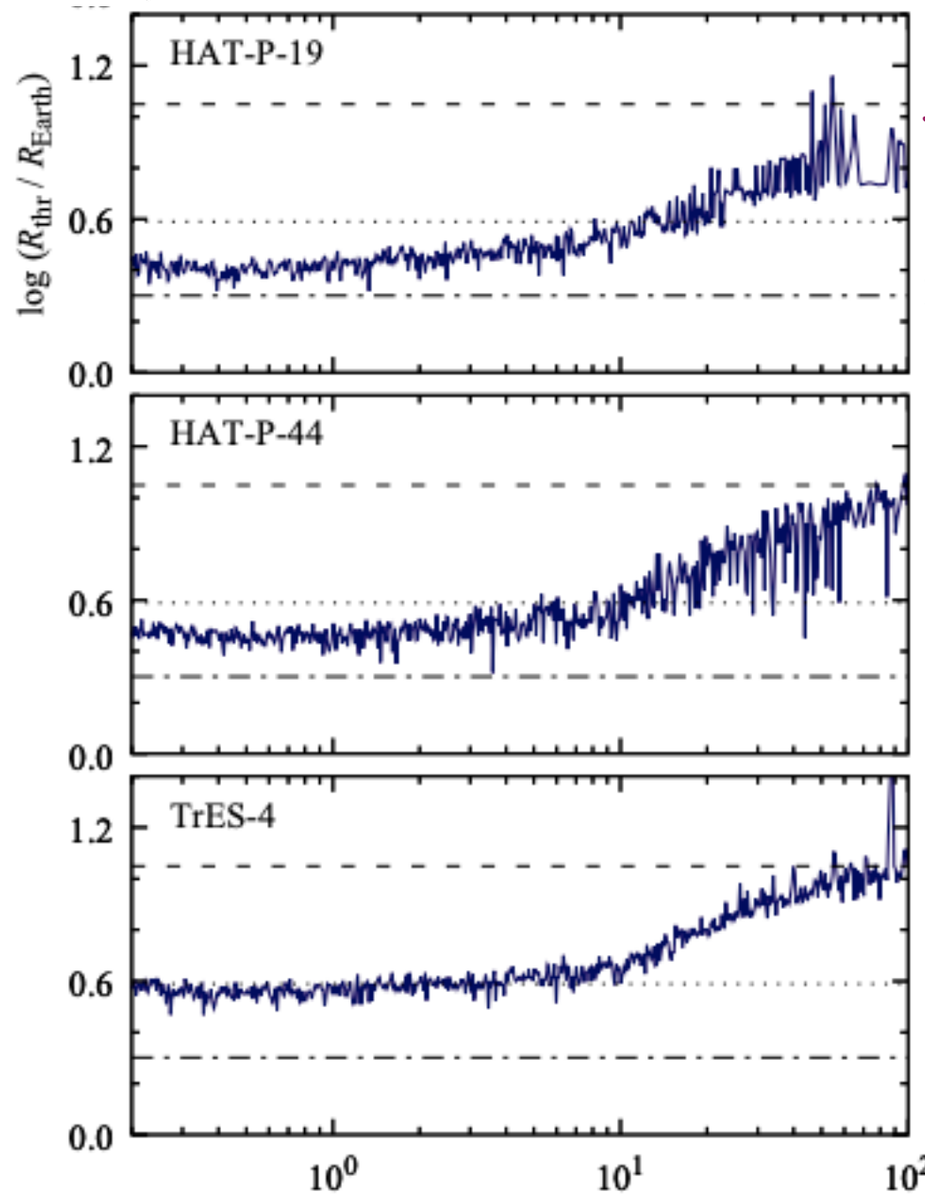




Transiting Exoplanet Survey Satellite

AoVtr (Schwarzenberg-Czerny & Beaulieu 2006)





trial period [d]

Jupiter-sized

Neptune-sized

2 $R_\oplus$ (super-Earth)

1 $R_\oplus$ (Earth-like)

Maciejewski 2020, Acta Astron., 70, 181
Maciejewski 2022, Acta Astron., 72, 1
Maciejewski et al. 2023, Acta Astron., 73, 57
Maciejewski, Sierzputowska, Golonka 2023, Acta Astron., submitted

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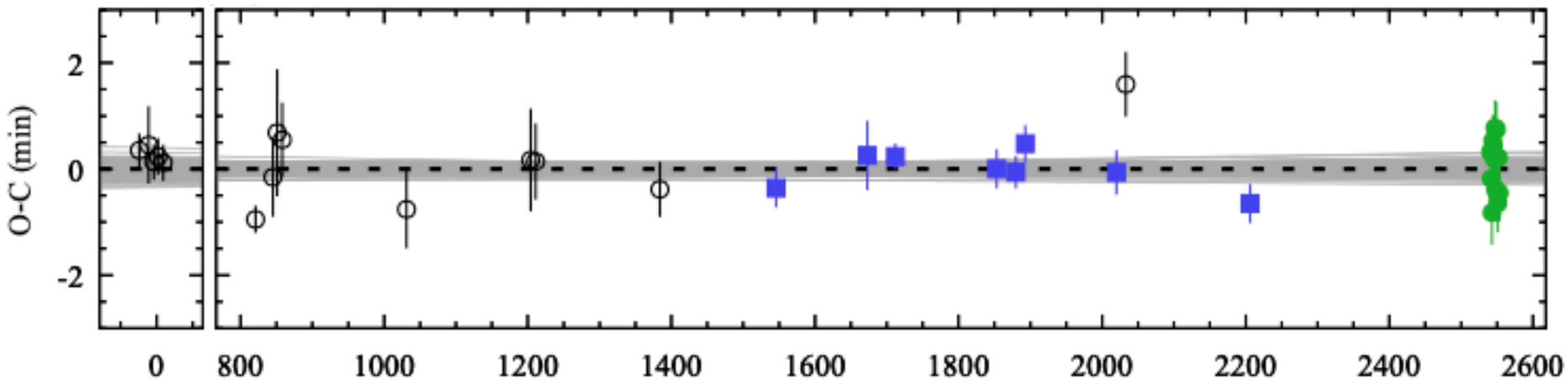
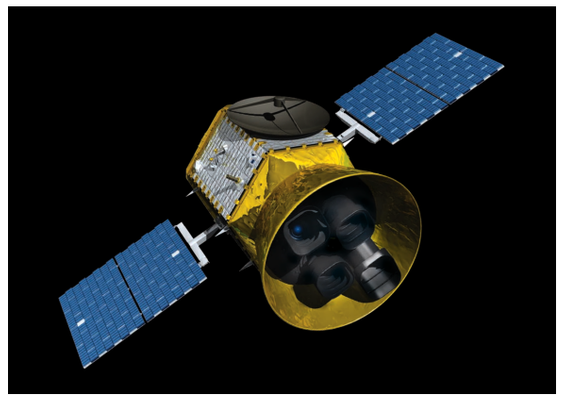
Search for planets in hot Jupiter systems with multi-sector TESS photometry

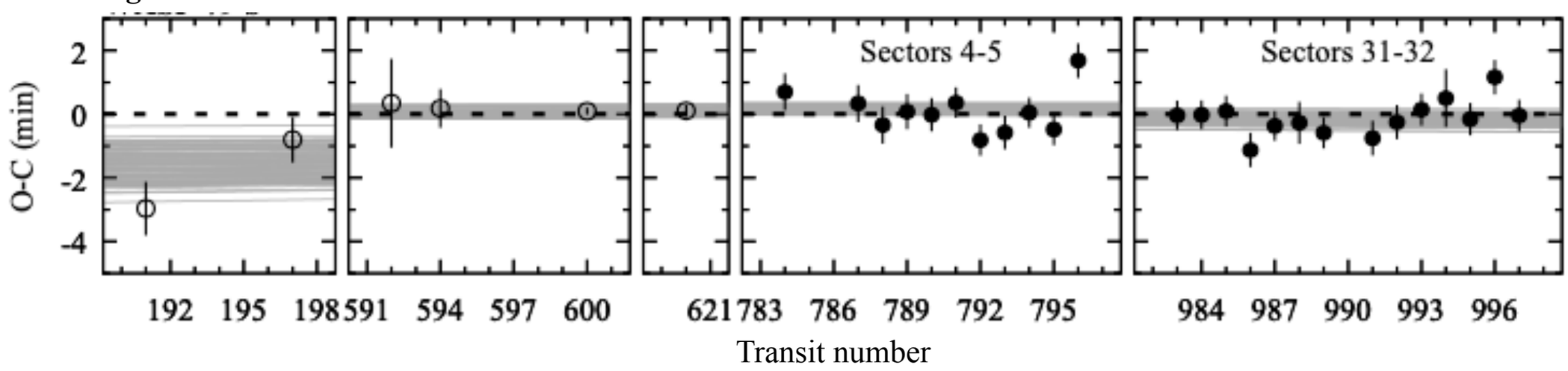
Precise transit timing



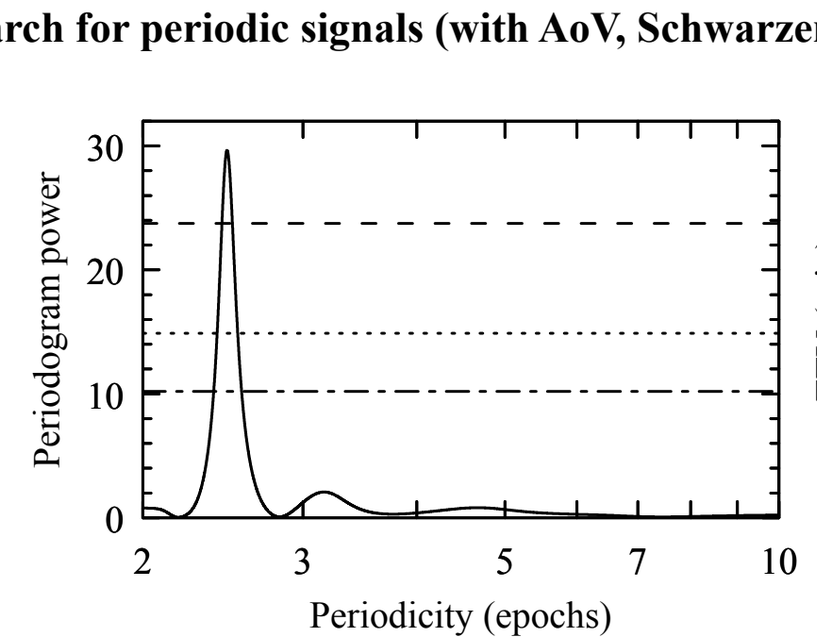


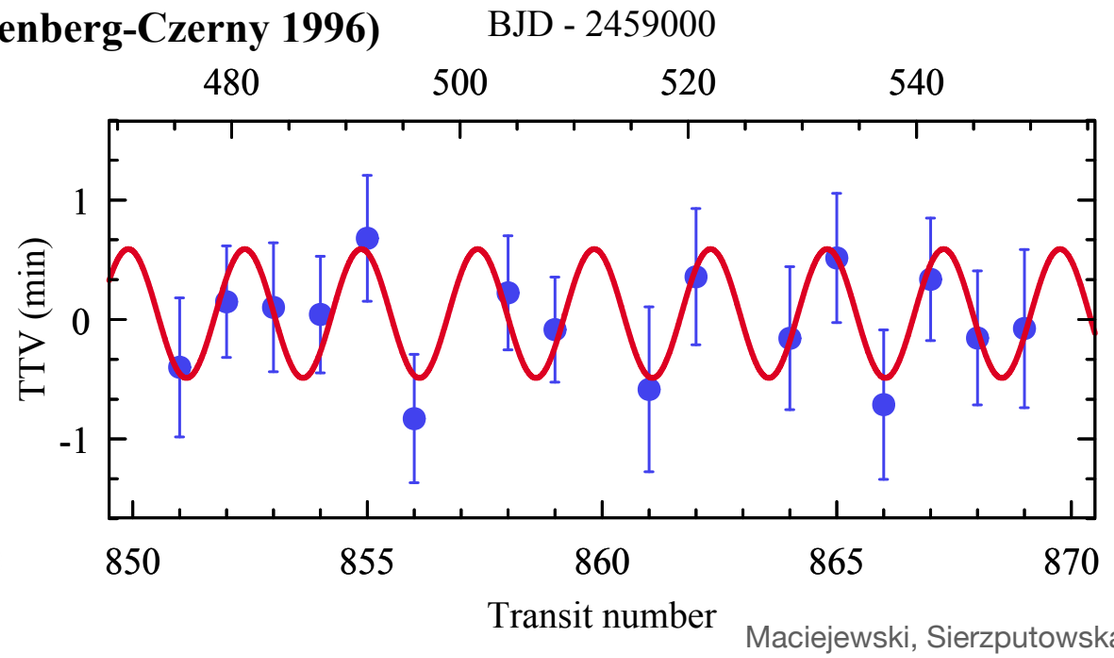
Transiting Exoplanet Survey Satellite

Search for long-term trends



Search for periodic signals (with AoV, Schwarzenberg-Czerny 1996)





Maciejewski, Sierzputowska, Golonka 2023, Acta Astron., submitted

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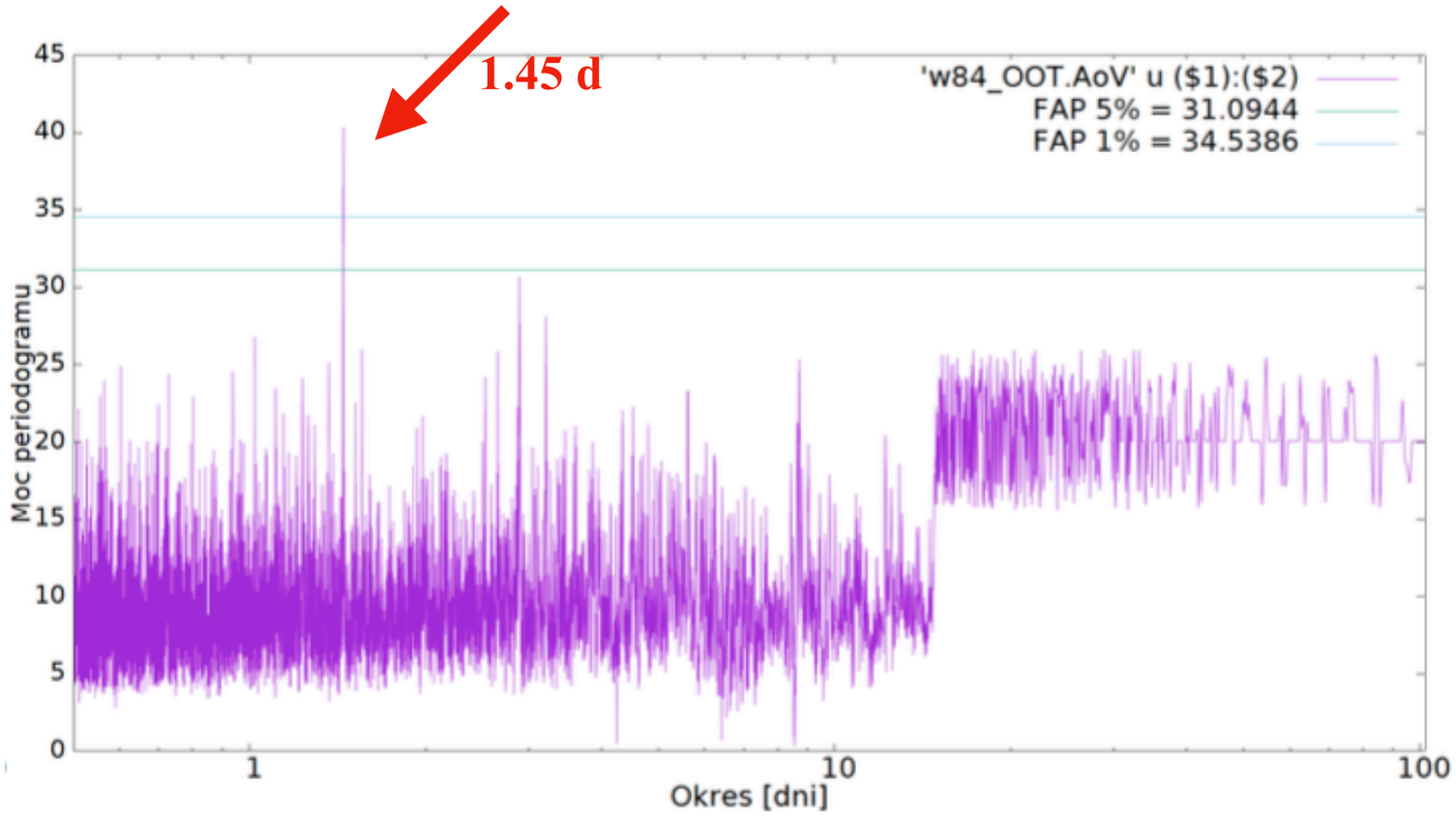
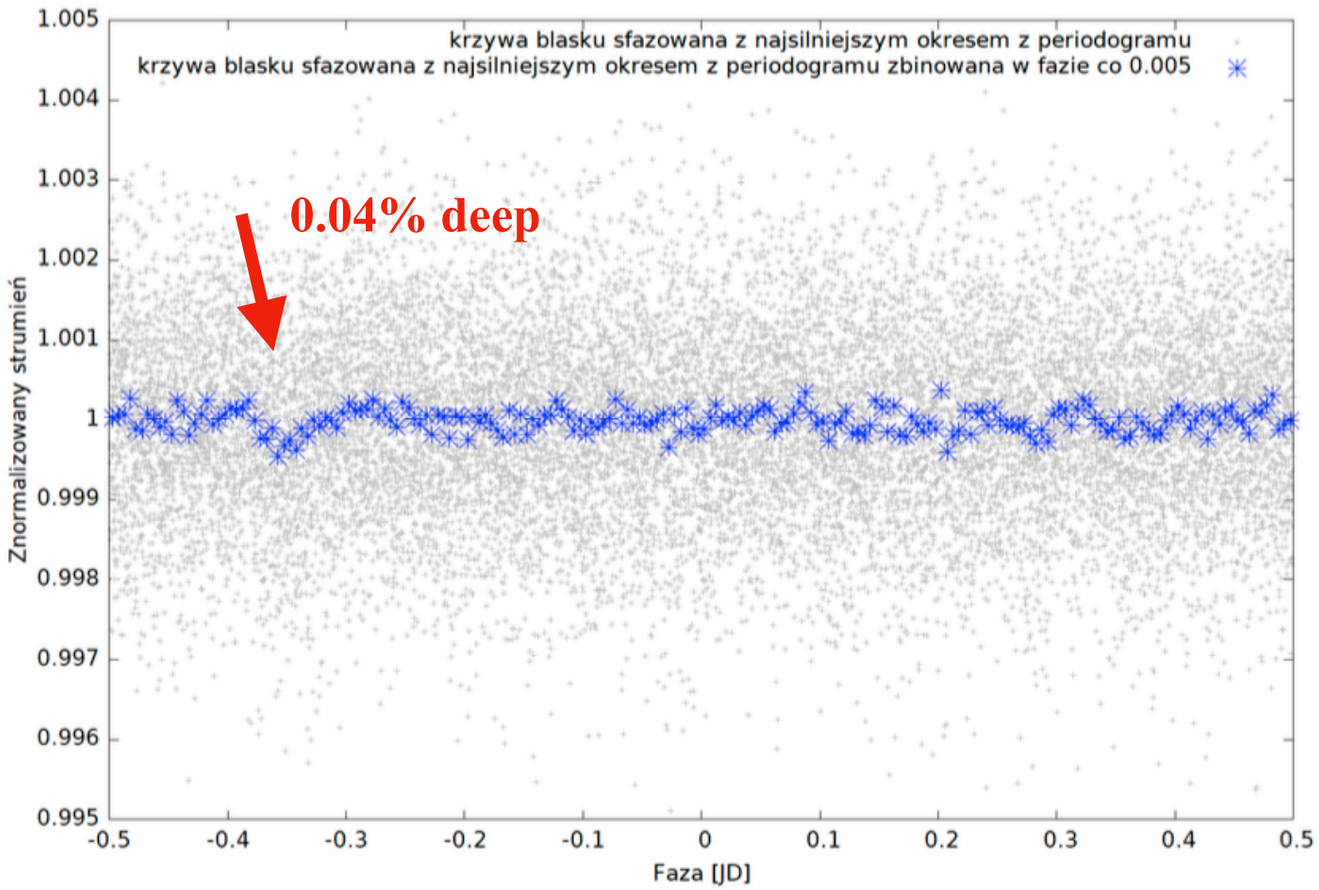
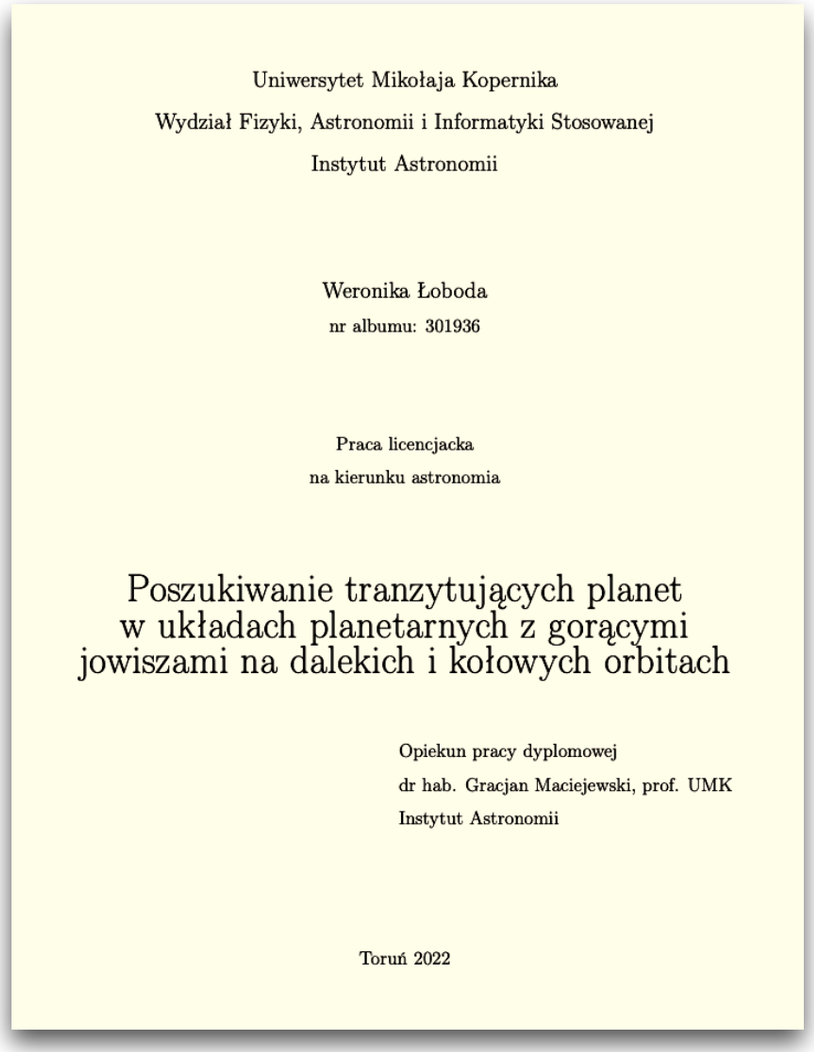
Flux drops for WASP-84







Uniwersytet Mikołaja Kopernika

Wydział Fizyki, Astronomii i Informatyki Stosowanej

Instytut Astronomii

Weronika Łoboda

nr albumu: 301936

Praca licencjacka

na kierunku astronomia

Poszukiwanie tranzytujących planet w układach planetarnych z gorącymi jowiszami na dalekich i kołowych orbitach

Opiekun pracy dyplomowej

dr hab. Gracjan Maciejewski, prof. UMK

Instytut Astronomii

Toruń 2022

Łoboda 2022, Bachelor's thesis, Nicolaus Copernicus University

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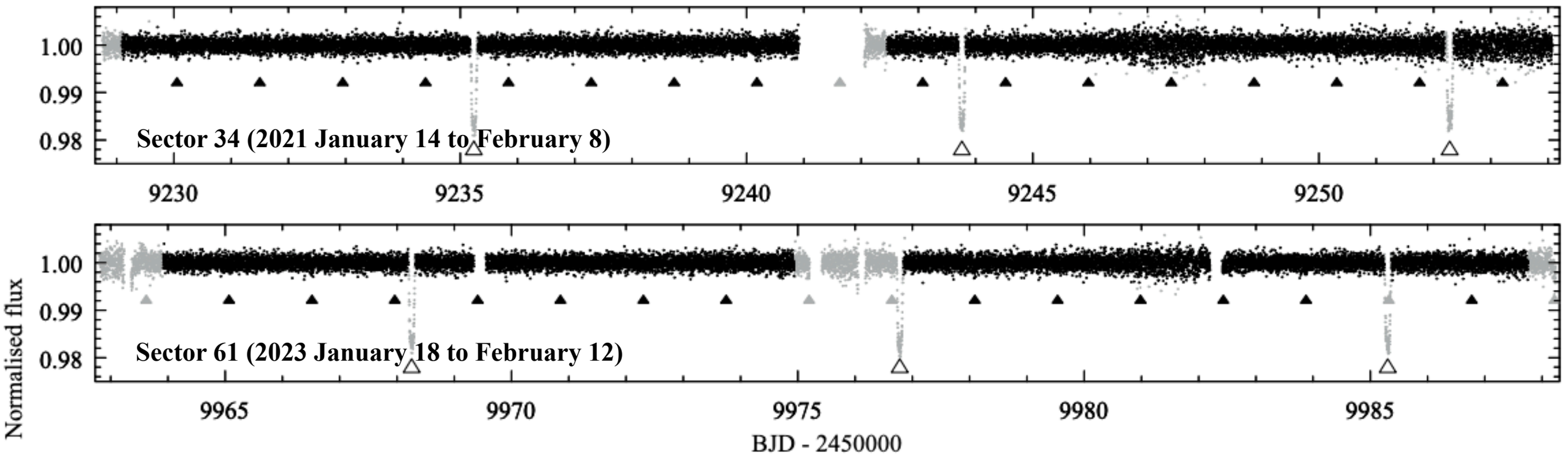

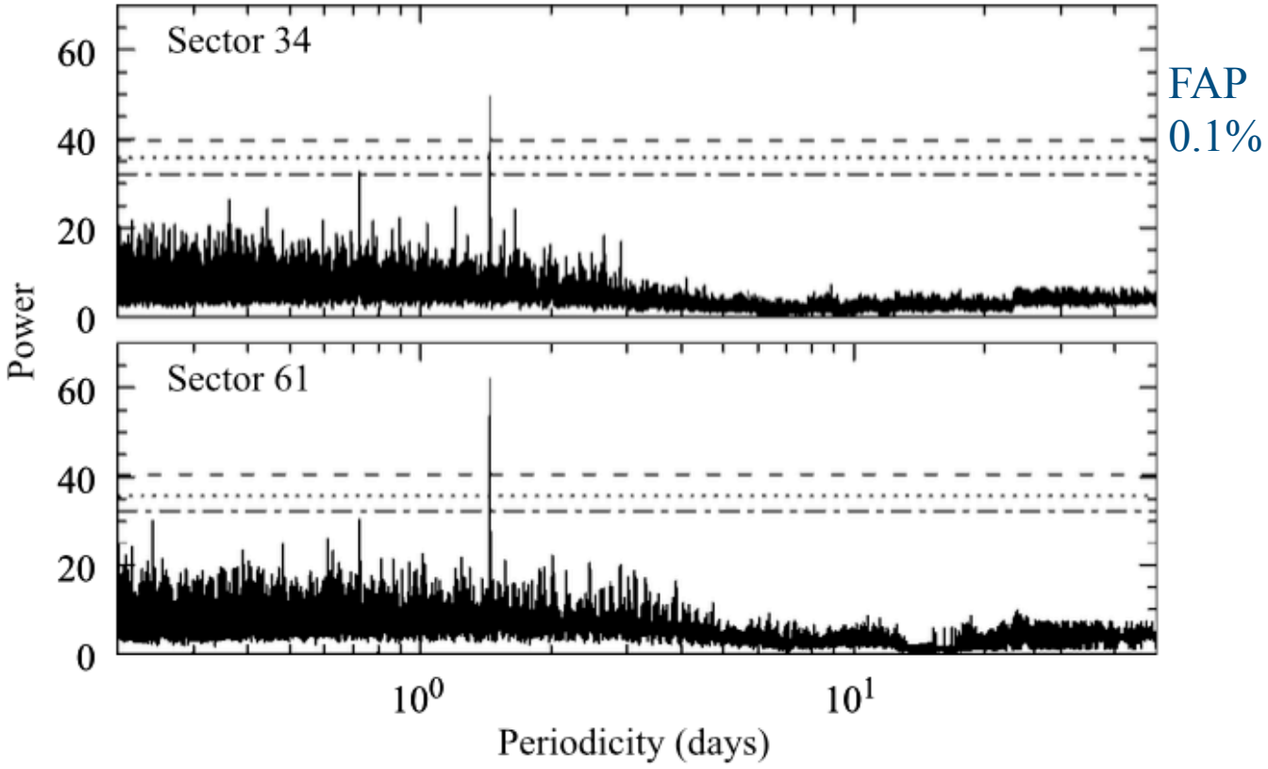

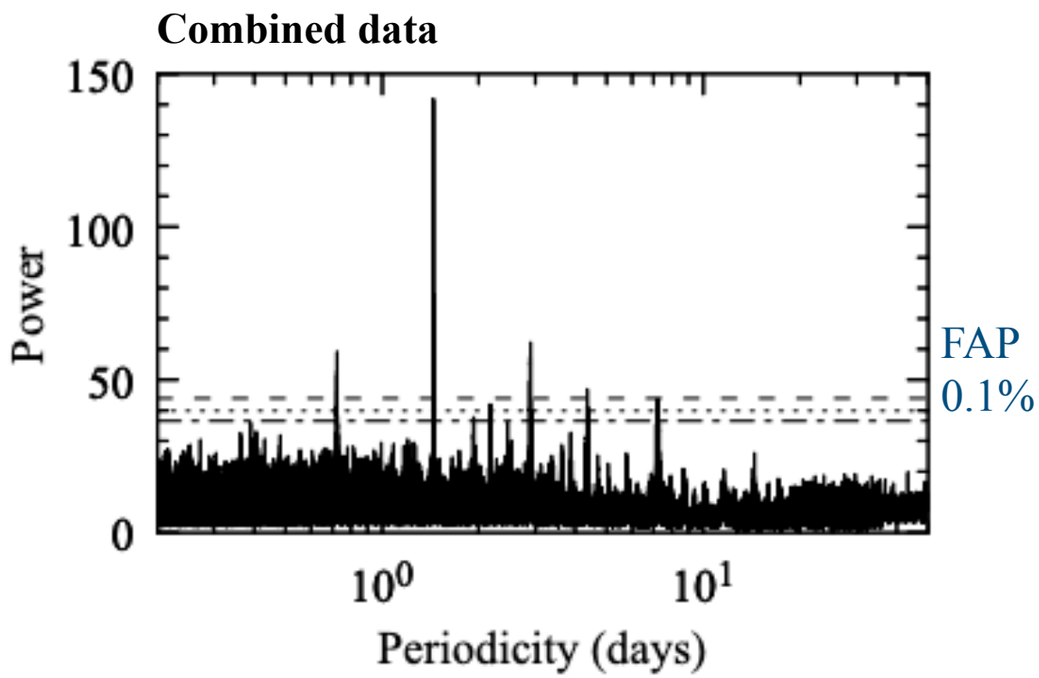

Maciejewski, Golonka, Łoboda, et al. 2023, MNRAS 525, L43 (Letters)

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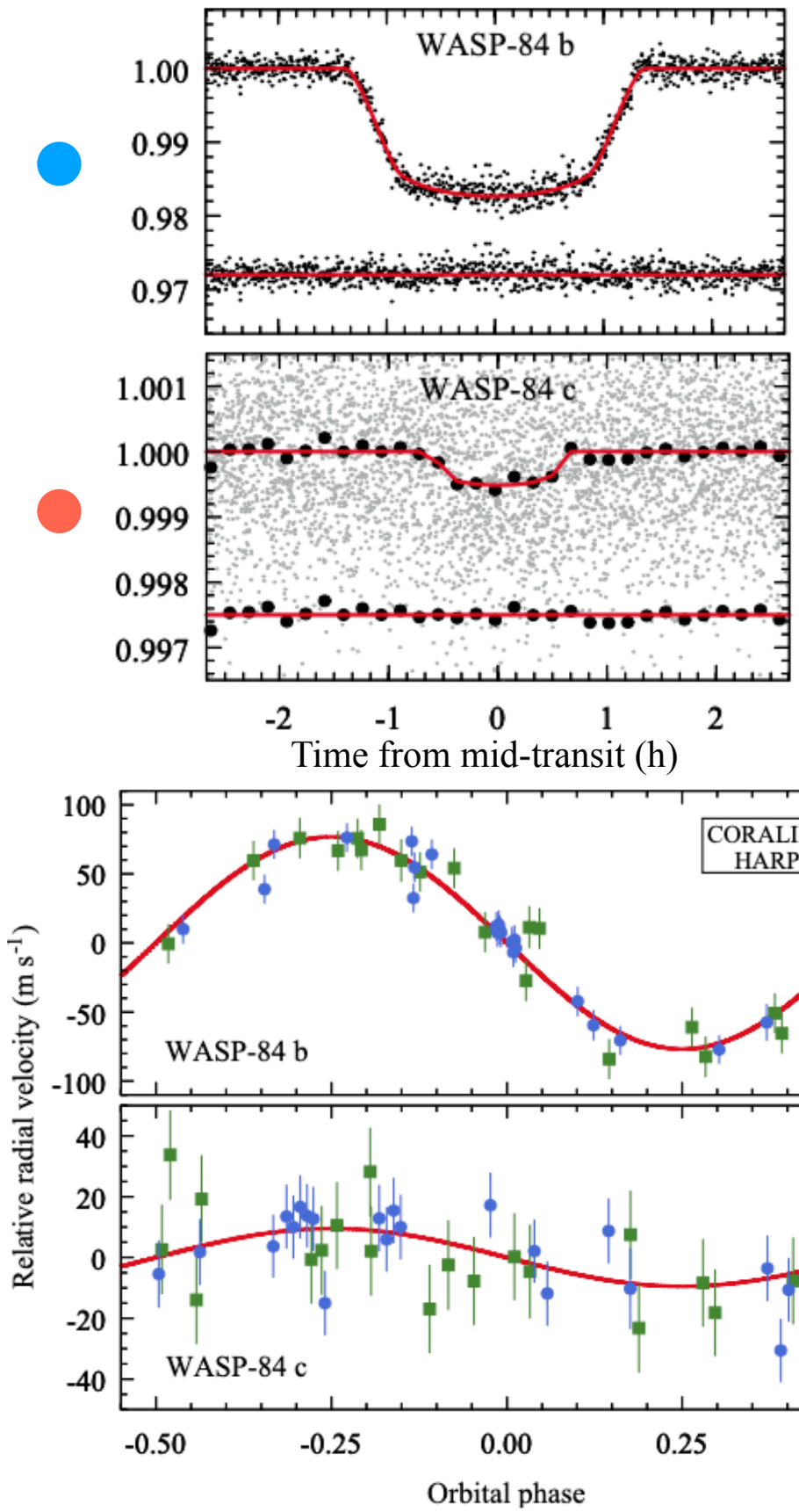
WASP-84 system



Maciejewski, Golonka, Łoboda, et al. 2023, MNRAS 525, L43 (Letters)

Parameter (unit)	Value
$R_b/R_\star$	0.12793 ± 0.00058
$a_b/R_\star$	$21.78^{+0.21}_{-0.20}$
i_b (deg)	$88.292^{+0.045}_{-0.042}$
$T_{0,b}$ (BJD$_{TDB}$)	$2457956.71194 \pm 0.00011$
P_b (d)	$8.52349648 \pm 0.00000060$
K_b (km s^{-1})	0.0768 ± 0.0027
$R_c/R_\star$	0.0233 ± 0.0014
$a_c/R_\star$	$6.61^{+0.22}_{-0.23}$
i_c (deg)	$83.20^{+0.51}_{-0.49}$
$T_{0,c}$ (BJD$_{TDB}$)	$2457952.4543^{+0.0018}_{-0.0031}$
P_c (d)	$1.4468849^{+0.0000022}_{-0.0000016}$
K_c (km s^{-1})	0.0095 ± 0.0026
Companion radius b, R_b ($R_\oplus$)	10.72 ± 0.27
Companion radius b, R_b (R_{Jup})	0.956 ± 0.024
Semi-major axis b, a_b (au)	0.0778 ± 0.0021
Companion mass b, M_b ($M_\oplus$)	220 ± 18
Companion mass b, M_b (M_{Jup})	0.692 ± 0.058
Impact parameter b, b_b	$0.649^{+0.010}_{-0.011}$
Transit depth b, $\delta_{tr,b}$ (ppth)	$17.23^{+0.10}_{-0.12}$
Total transit duration b, $T_{tot,b}$ (h)	2.760 ± 0.010
Companion density b, ρ_b (cgs)	$0.98^{+0.13}_{-0.12}$
Companion surface gravity b, g_b (cgs)	1901 ± 87
Equilibrium temperature b, $T_{eq,b}$ (K)	732 ± 12
Companion radius c, R_c ($R_\oplus$)	1.95 ± 0.12
Companion radius c, R_c (R_{jup})	0.174 ± 0.011
Semi-major axis c, a_c (au)	0.02359 ± 0.00100
Companion mass c, M_c ($M_\oplus$)	$15.2^{+4.5}_{-4.2}$
Companion mass c, M_c (M_{jup})	$0.048^{+0.014}_{-0.013}$
Impact parameter c, b_c	$0.785^{+0.034}_{-0.047}$
Transit depth c, $\delta_{tr,c}$ (ppth)	0.532 ± 0.057
Total transit duration c, $T_{tot,c}$ (h)	$1.111^{+0.075}_{-0.064}$
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Companion surface gravity c, g_c (cgs)	3800^{+1300}_{-1100}
Equilibrium temperature c, $T_{eq,c}$ (K)	1329^{+31}_{-30}

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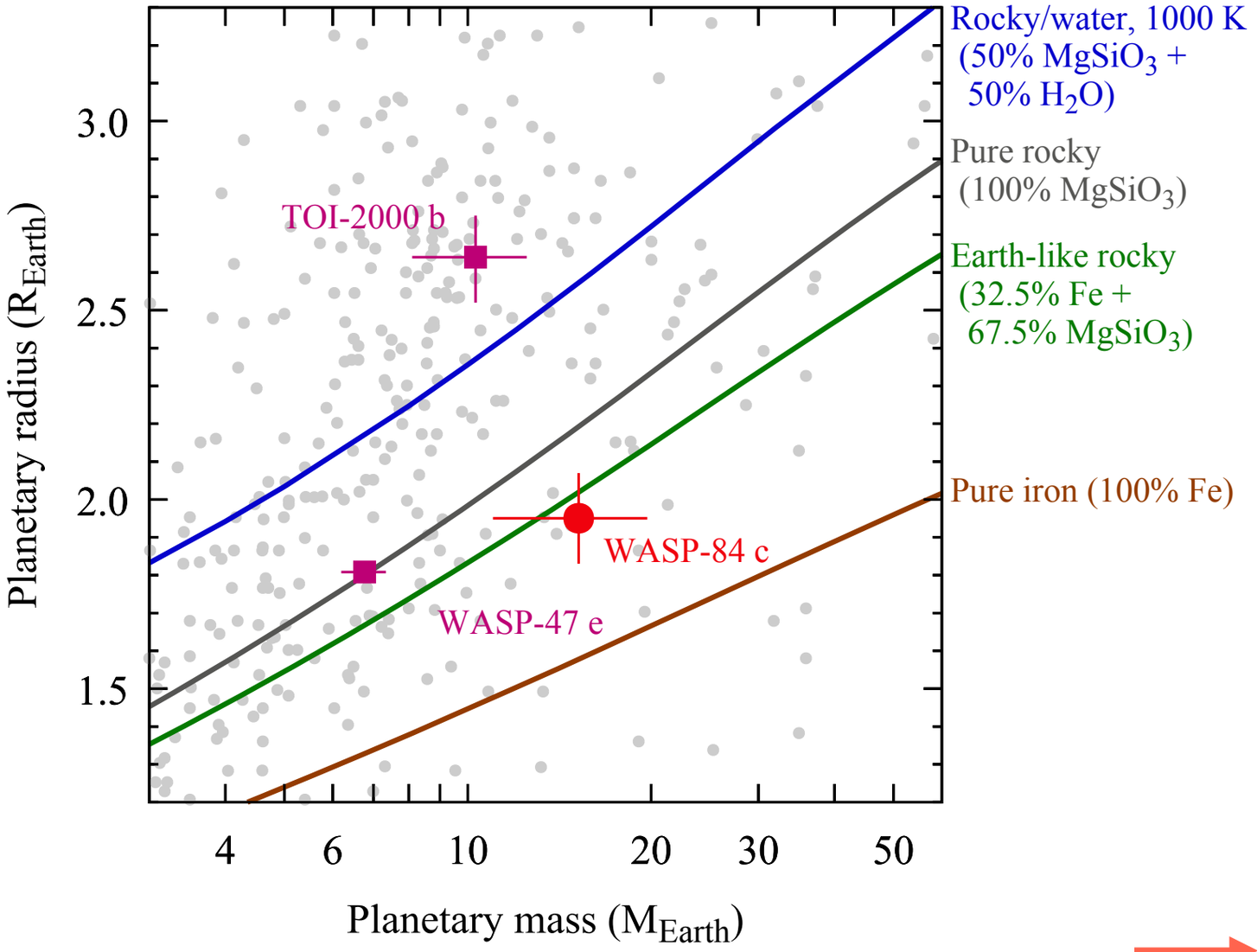

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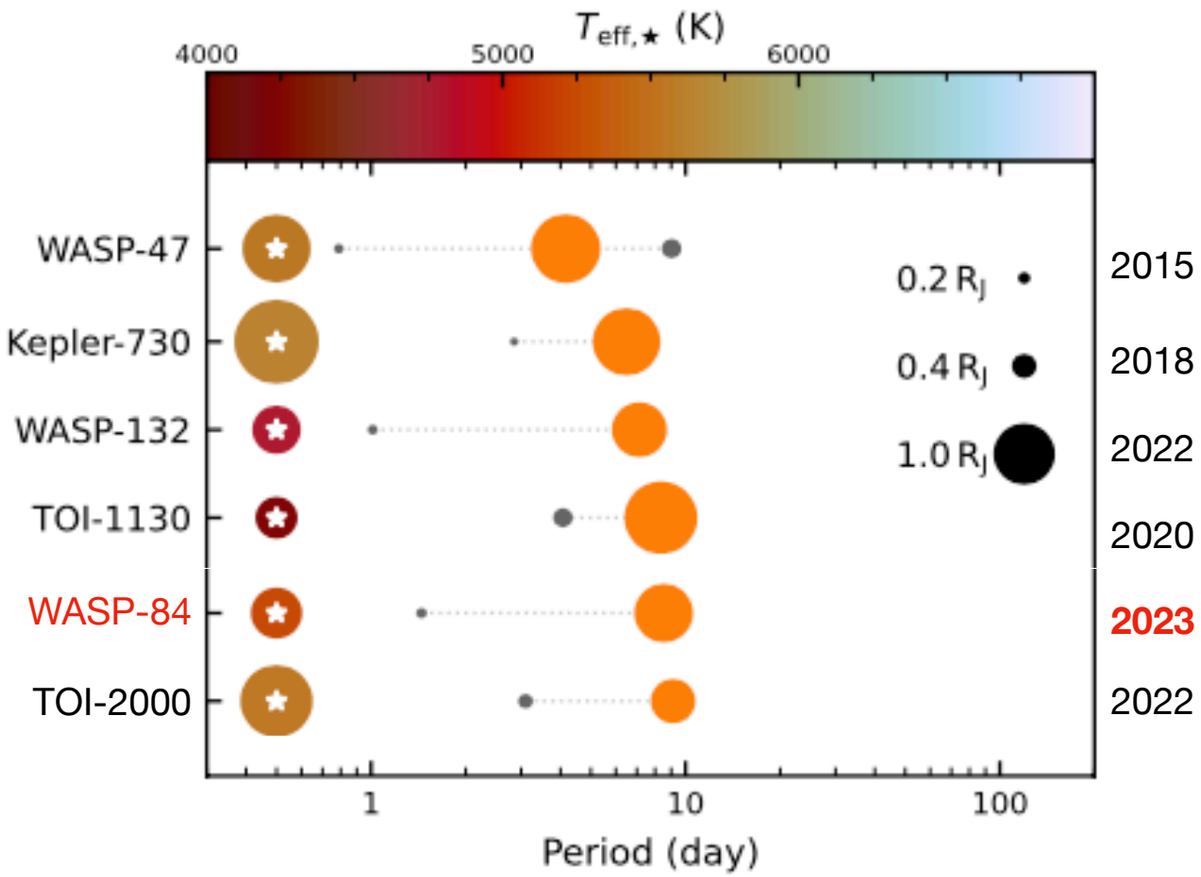

Sha *et al*. 2023, 2023, MNRAS, 524, 1113

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