Credit: ESO/L.Calcada

A DISINTEGRATING PLANET WITH A COMETARY HEAD AND TAIL

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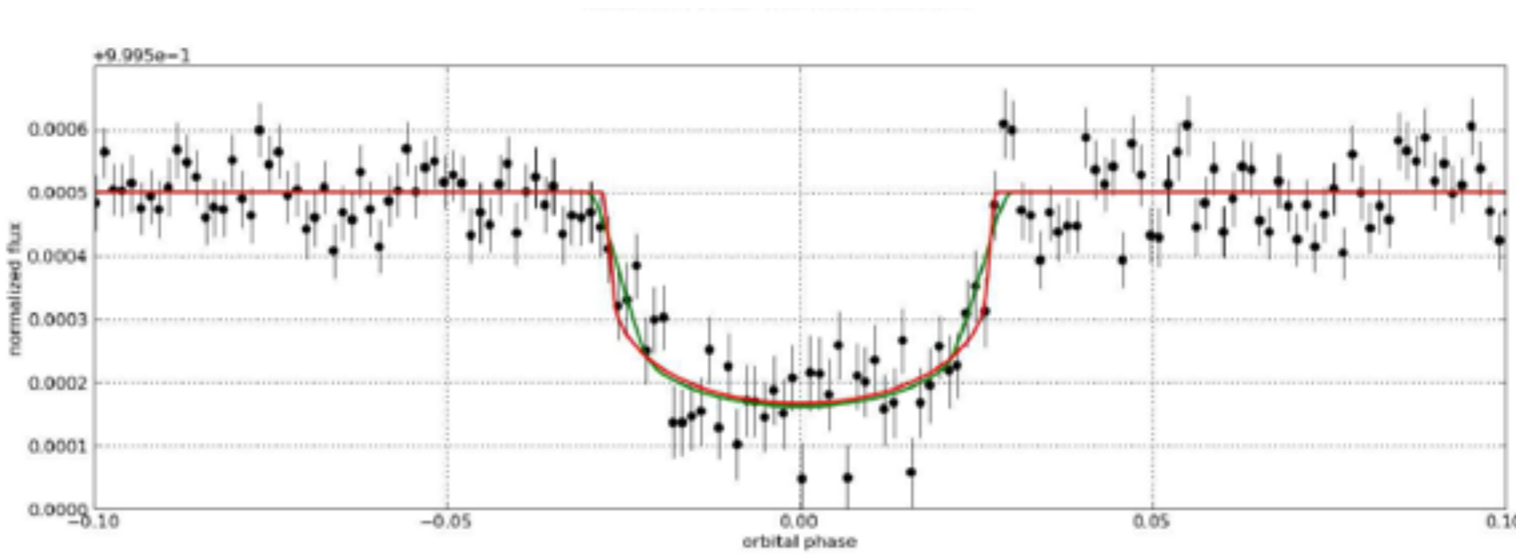
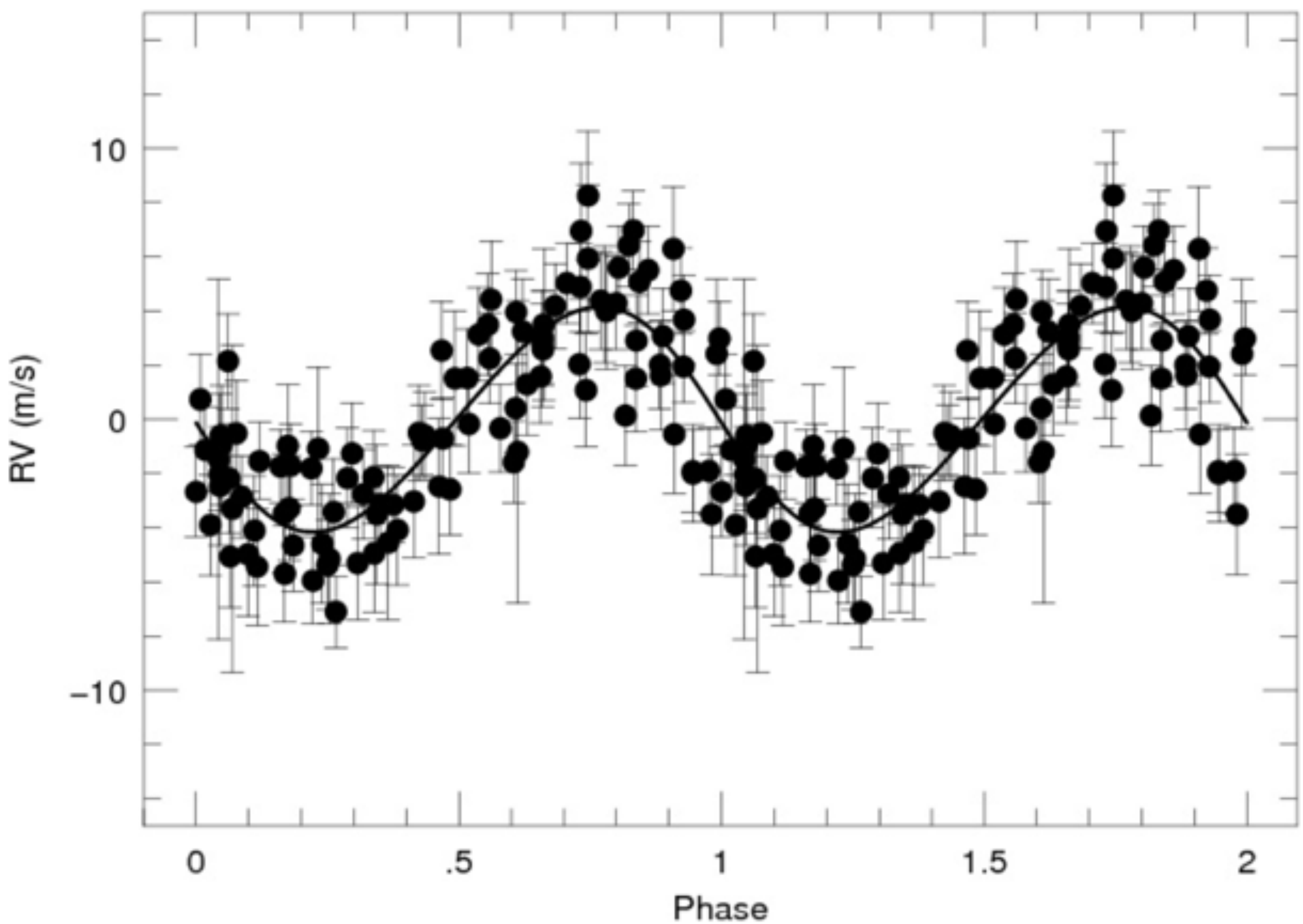
The first rocky planet: The USP CoRot-7b





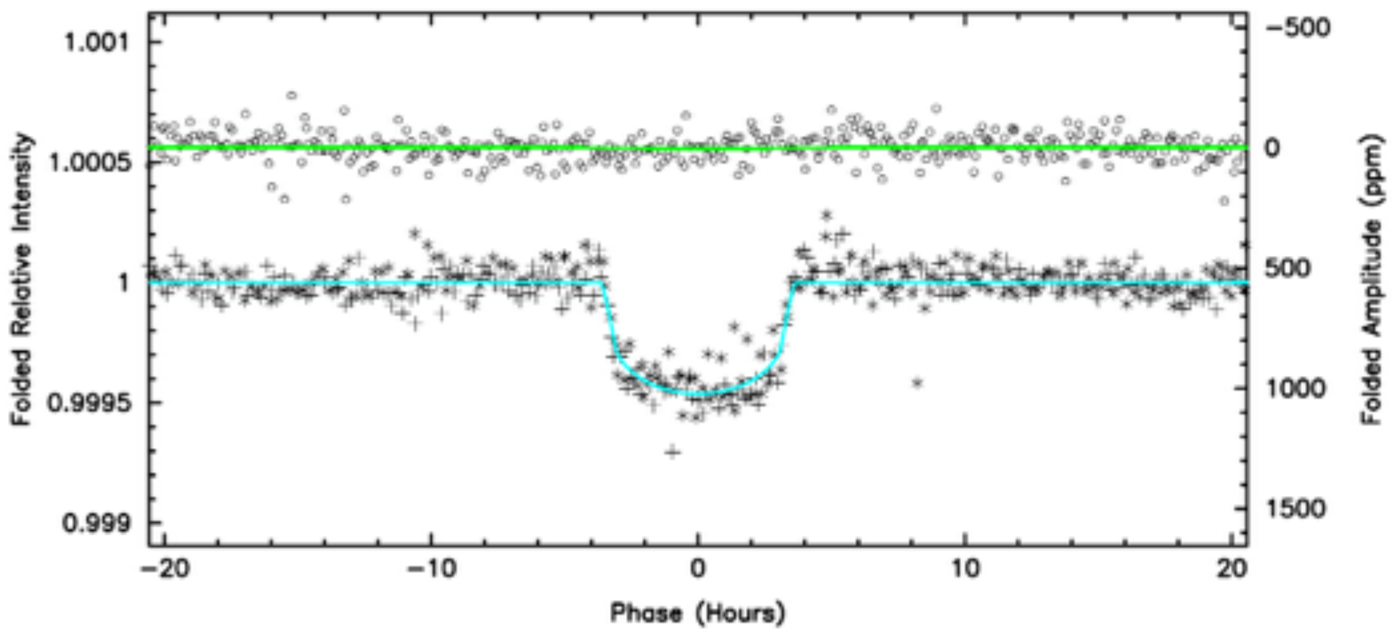
P_{orb} = 20.5 hr

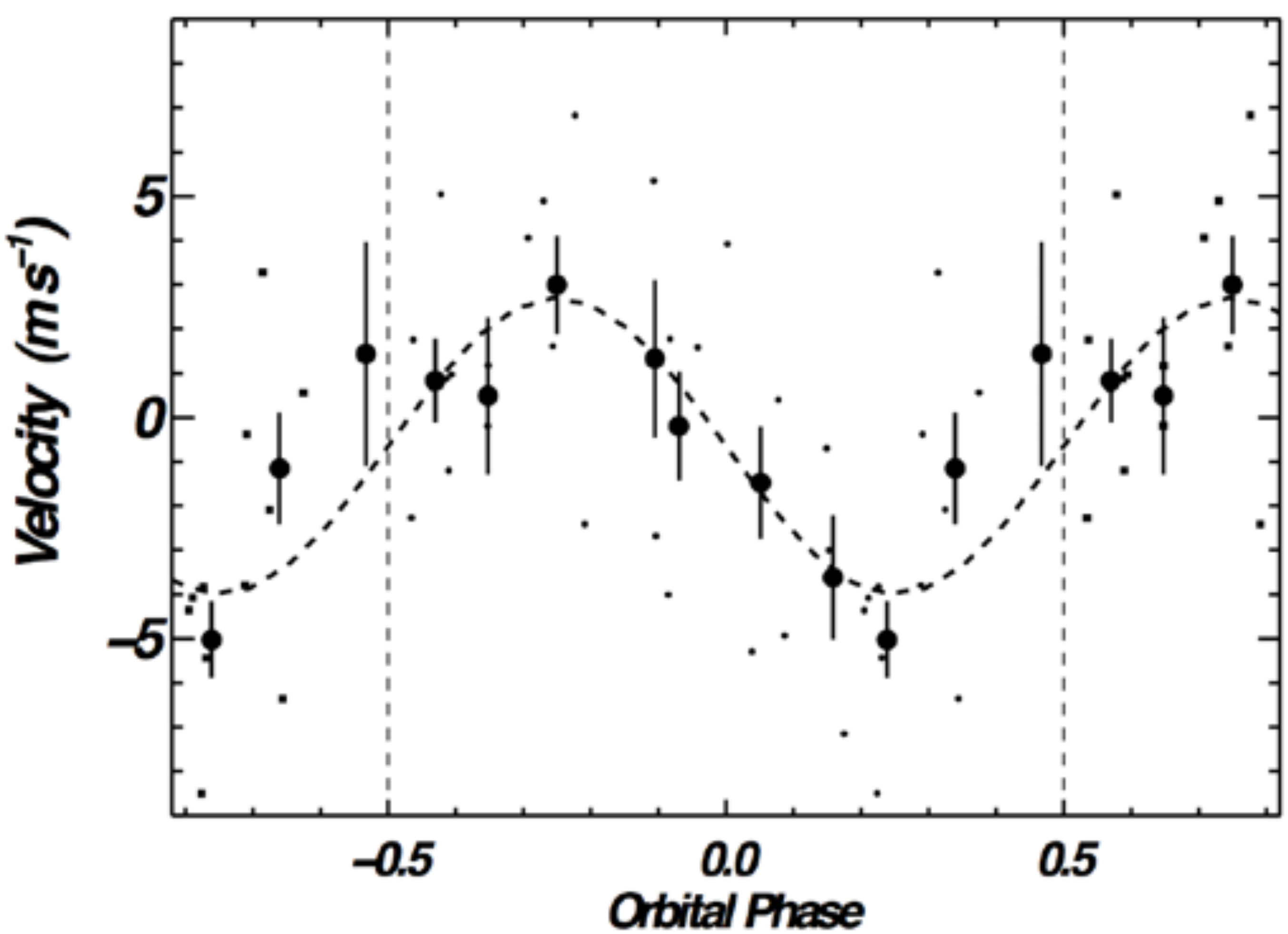
M = 5 M_{Earth}

R = 1.6 R_{Earth}

Léger+ 2009,
Queloz+ 2009

Kepler's 1st rocky planet: Kepler-10b



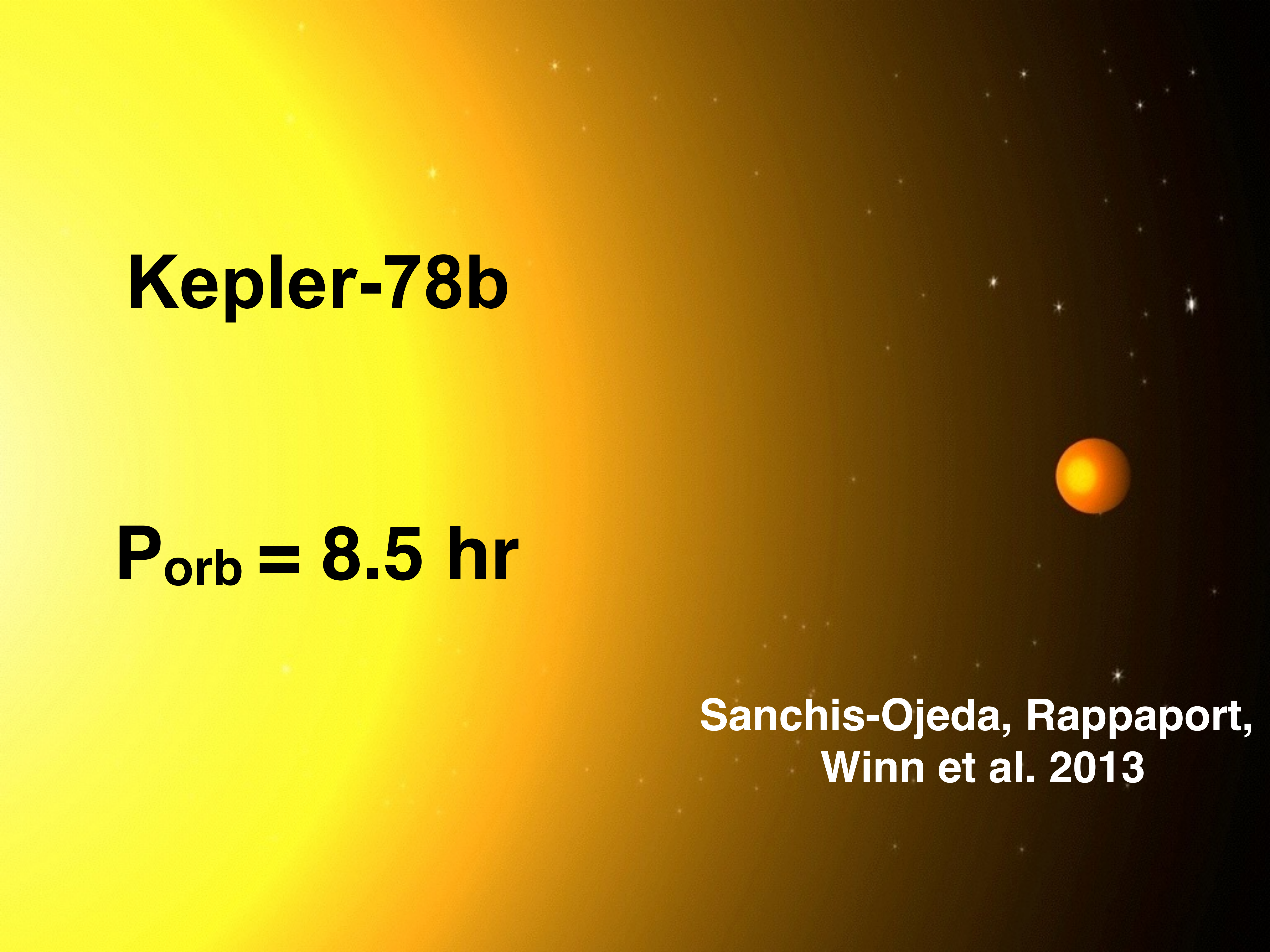


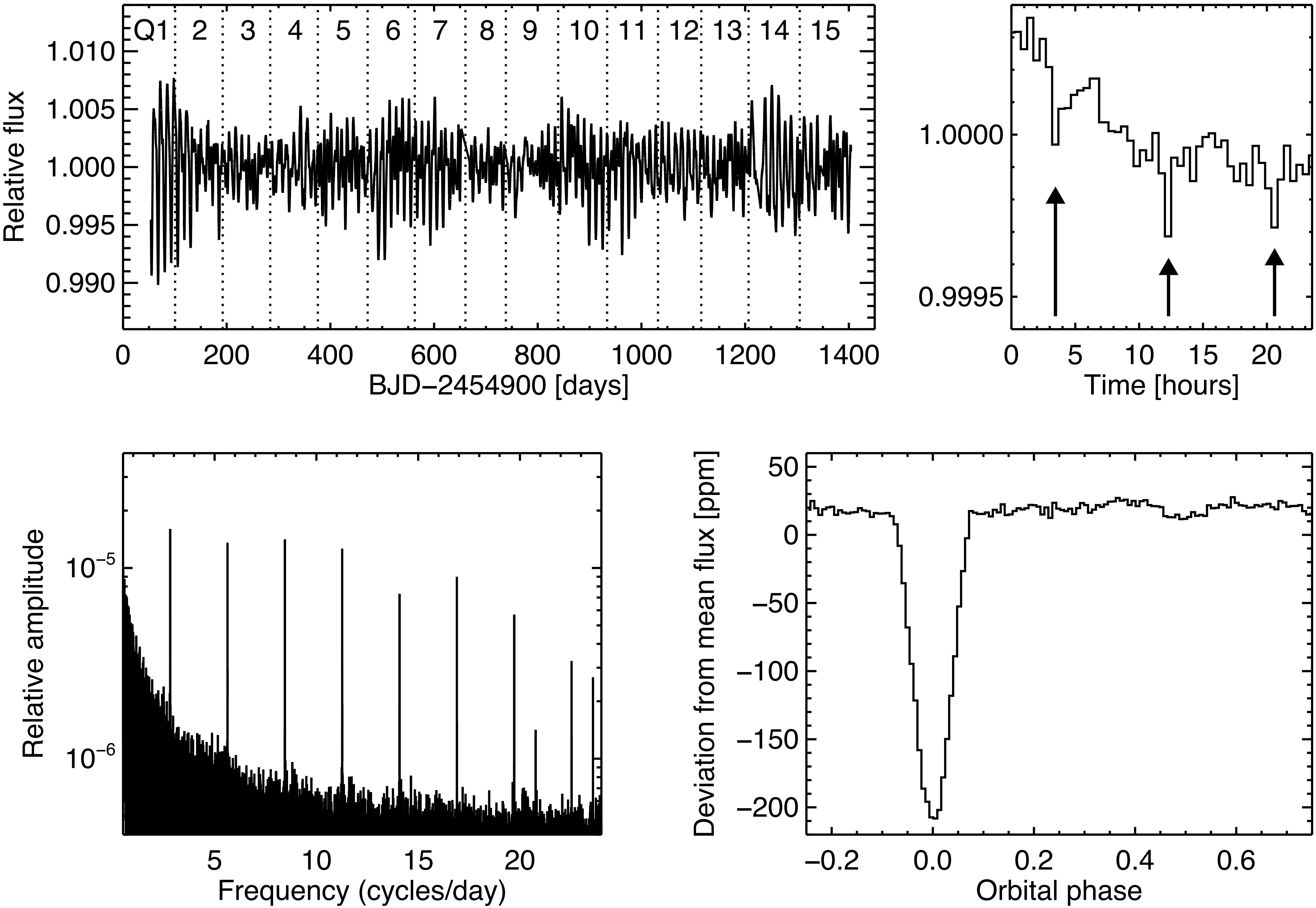
P_{orb} = 20 hr

M = 4.5 M_{Earth}

R = 1.4 R_{Earth}

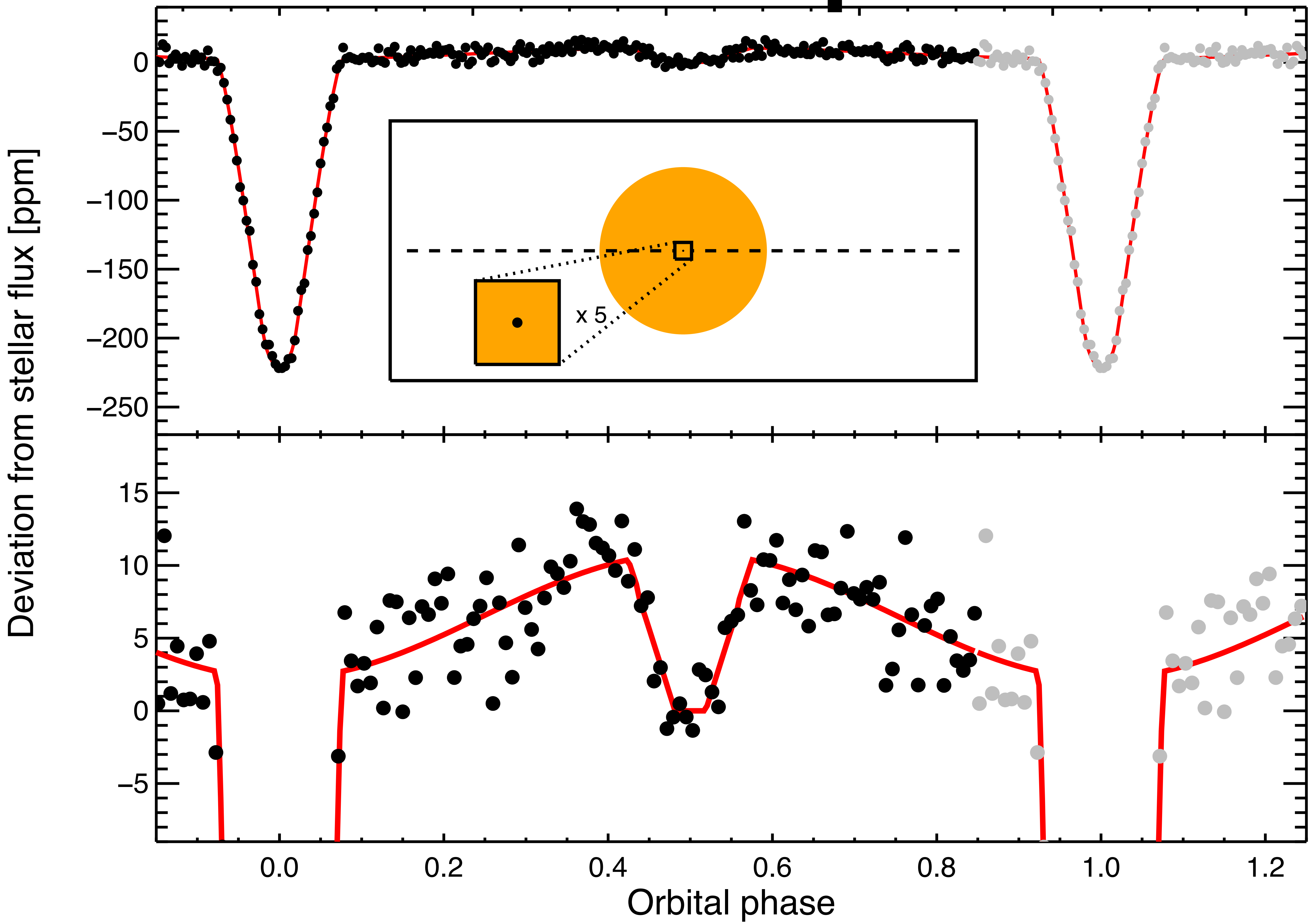
Batalha+ 2011


Kepler-78b
P_{orb} = 8.5 hr
Sanchis-Ojeda, Rappaport,
Winn et al. 2013

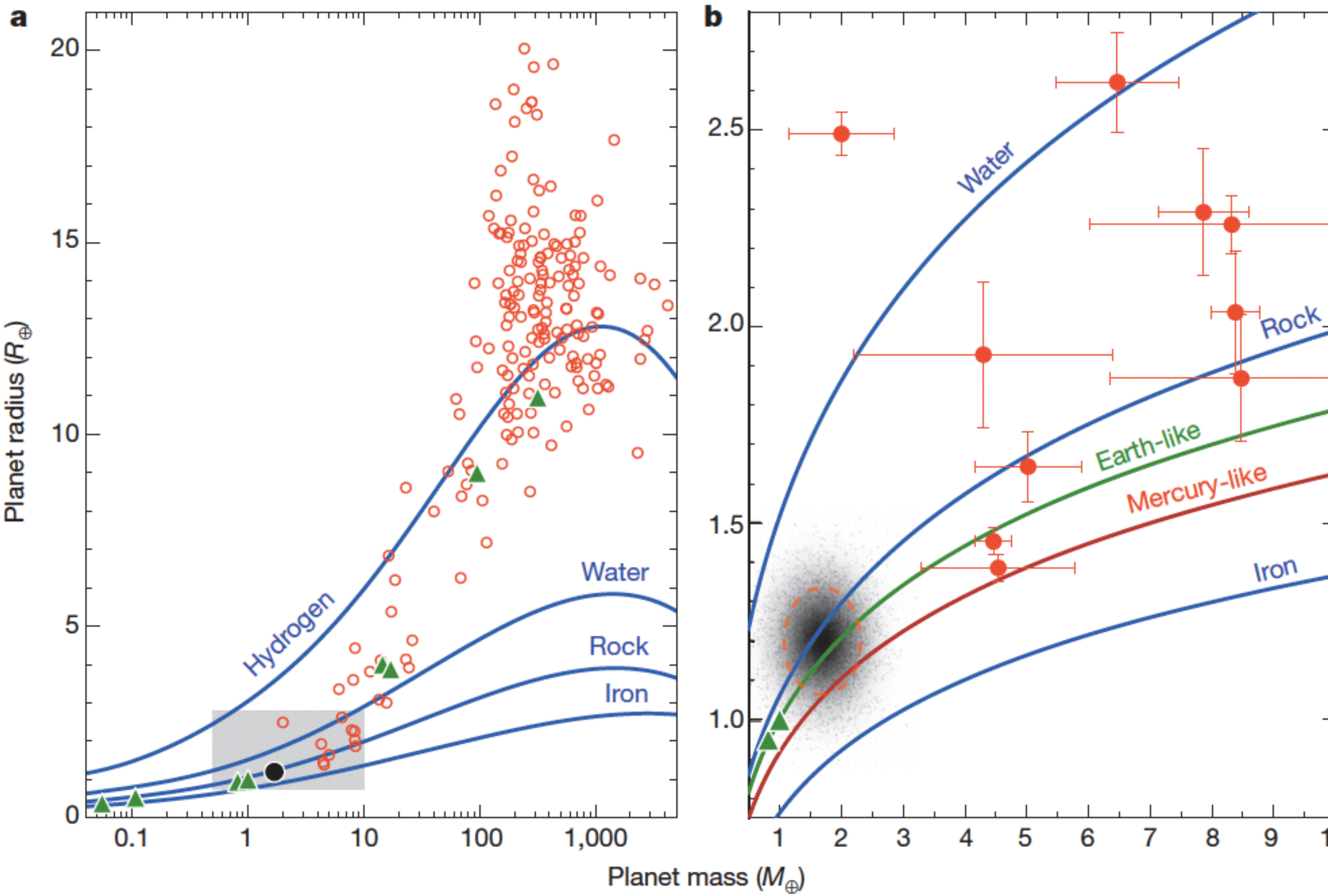


Q1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Relative flux
1.010
1.005
1.000
0.995
0.990
0
200
400
600
800
1000
1200
1400
BJD−2454900 [days]
1.0000
0.9995
0
5
10
15
20
Time [hours]
Relative amplitude
10^{-5}
10^{-6}
5
10
15
20
Frequency (cycles/day)
Deviation from mean flux [ppm]
50
0
−50
−100
−150
−200
−0.2
0.0
0.2
0.4
0.6
Orbital phase

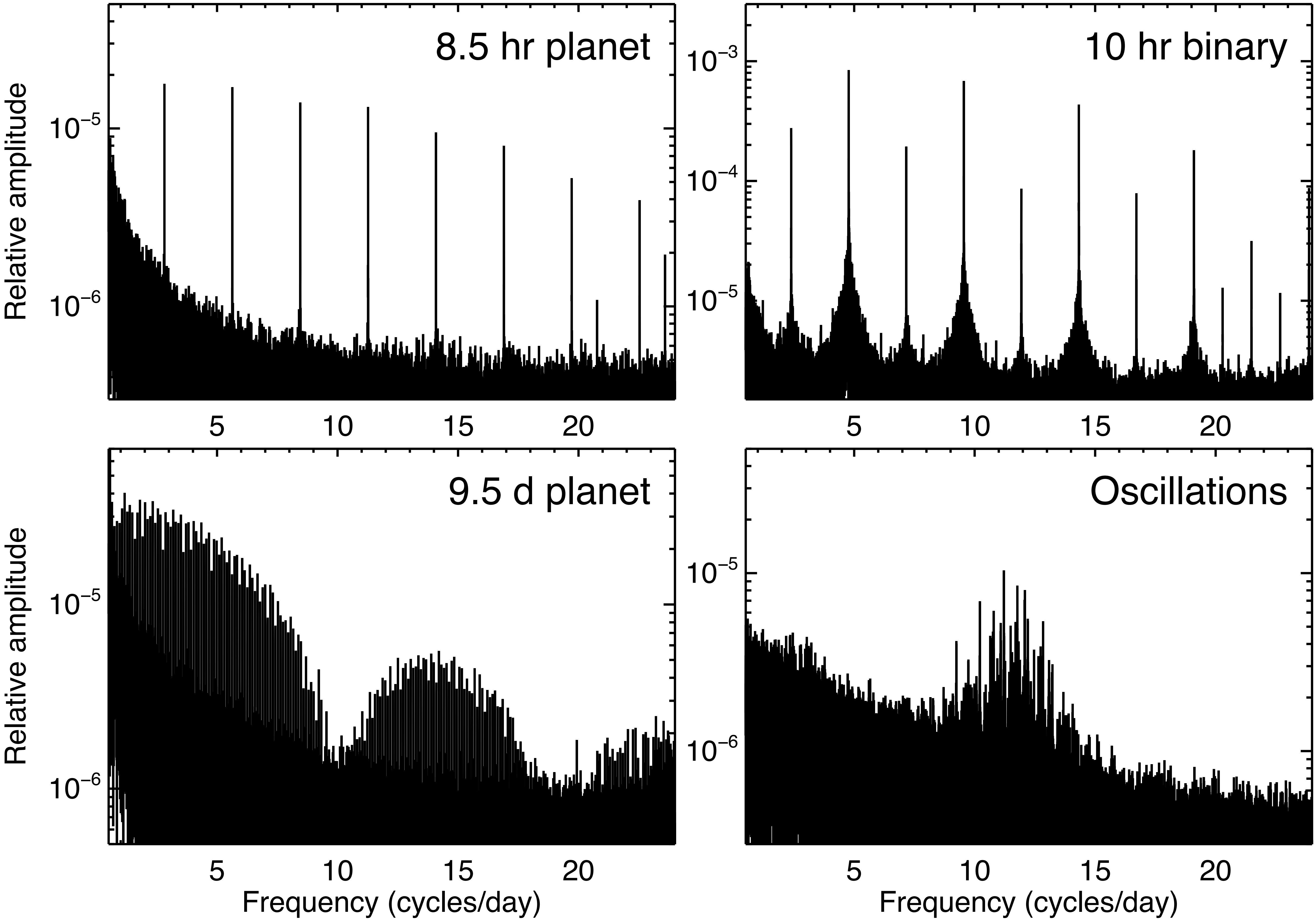
Secondary eclipse detection for an Earth-Sized planet



Sanchis-Ojeda, Rappaport, Winn et al. 2013

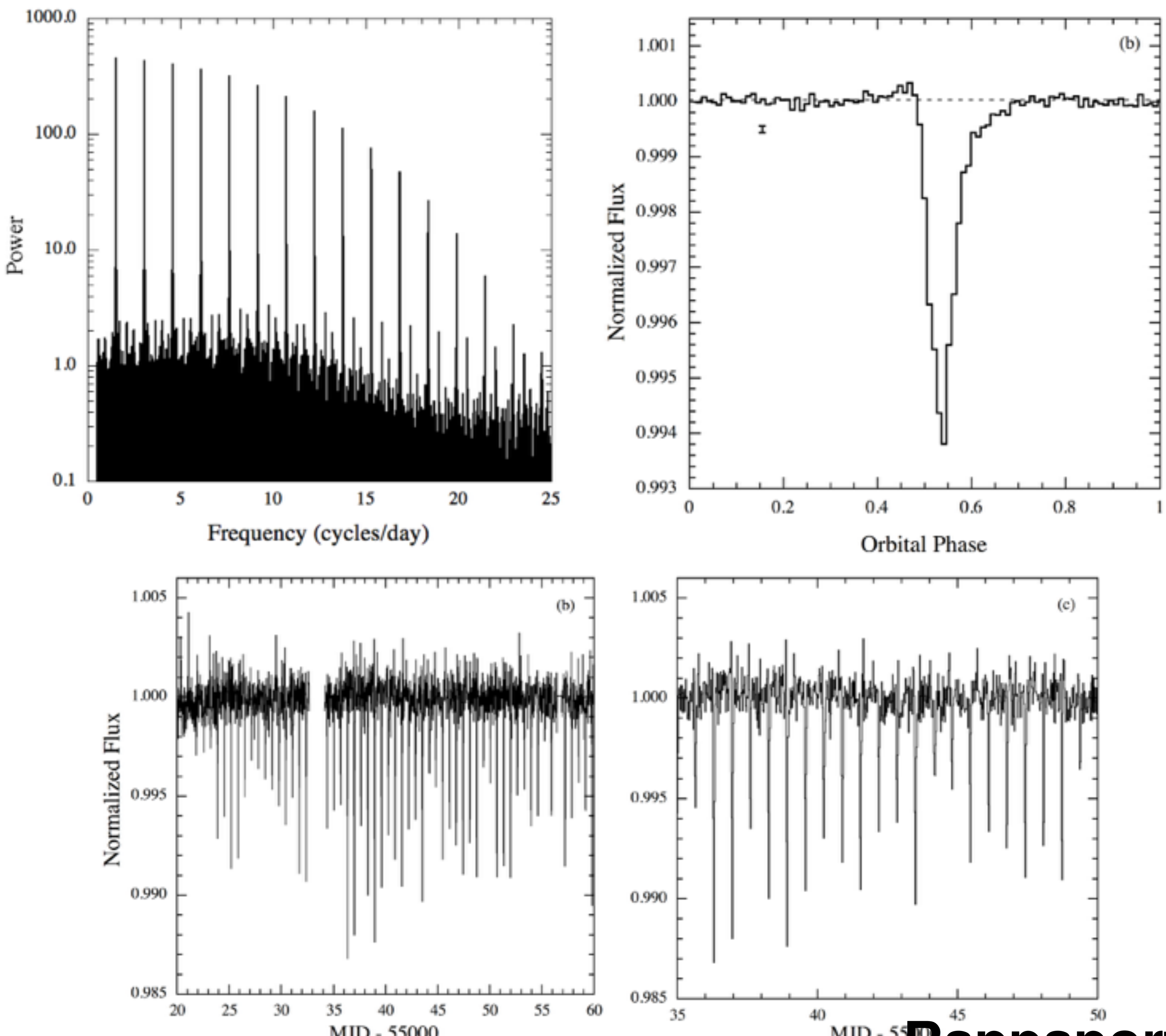


Howard et al. 2013, Pepe et al. 2013



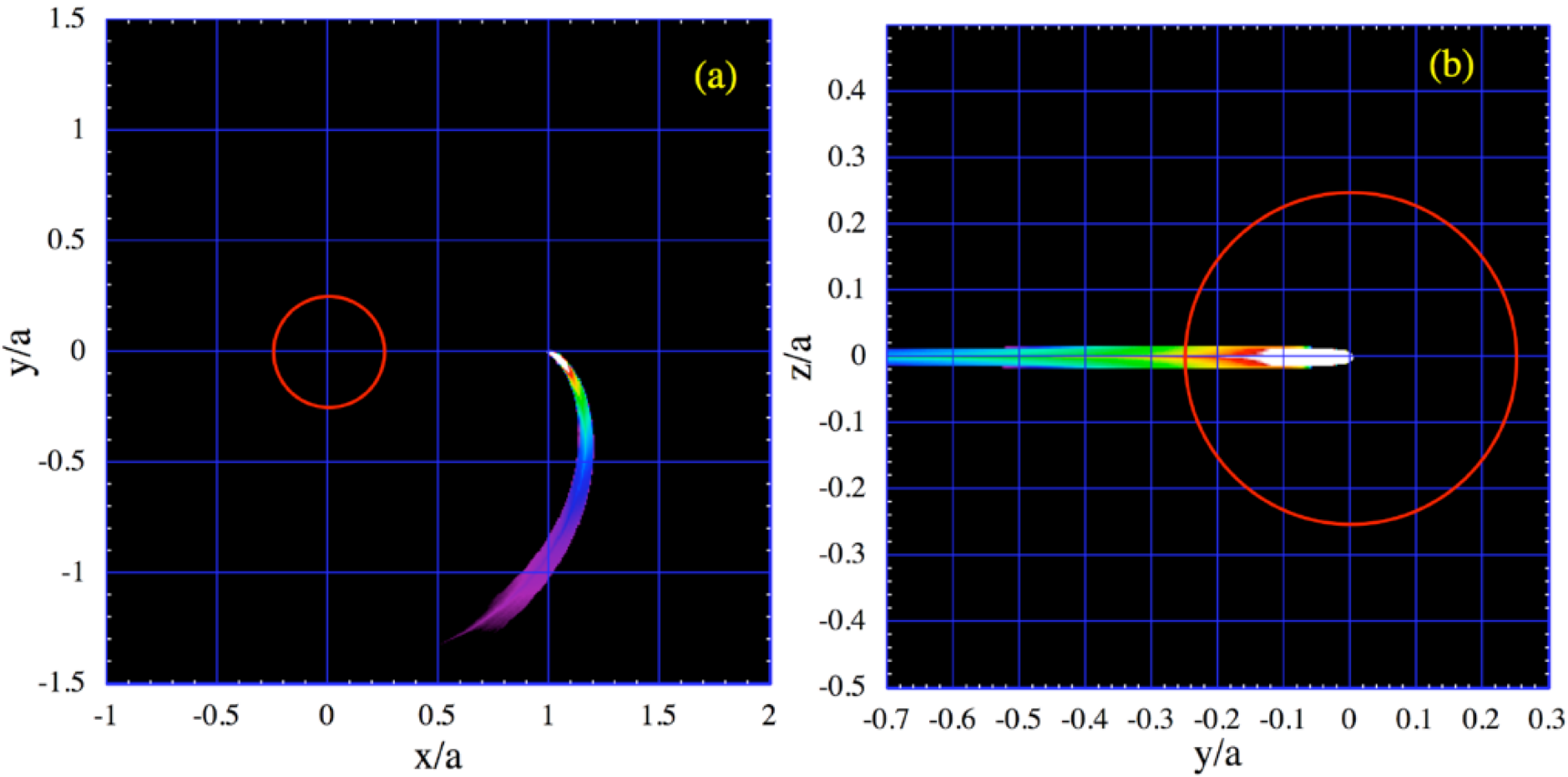
Sanchis-Ojeda et al, 2014

Another type of USP planet



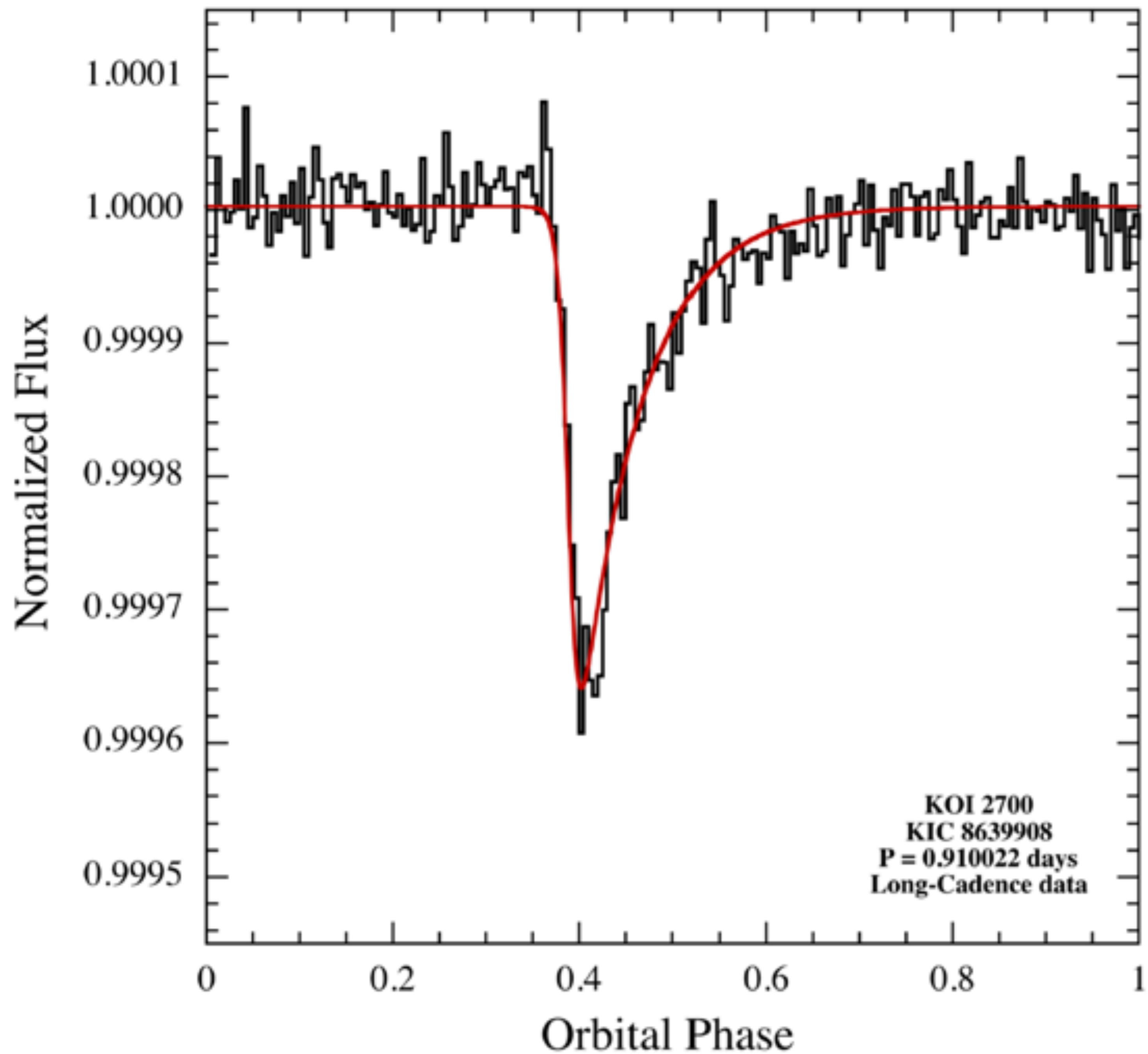
Rappaport+ 2012

Hypothesis: A dust tail from the disintegration of the planet's surface



Rappaport+ 2012

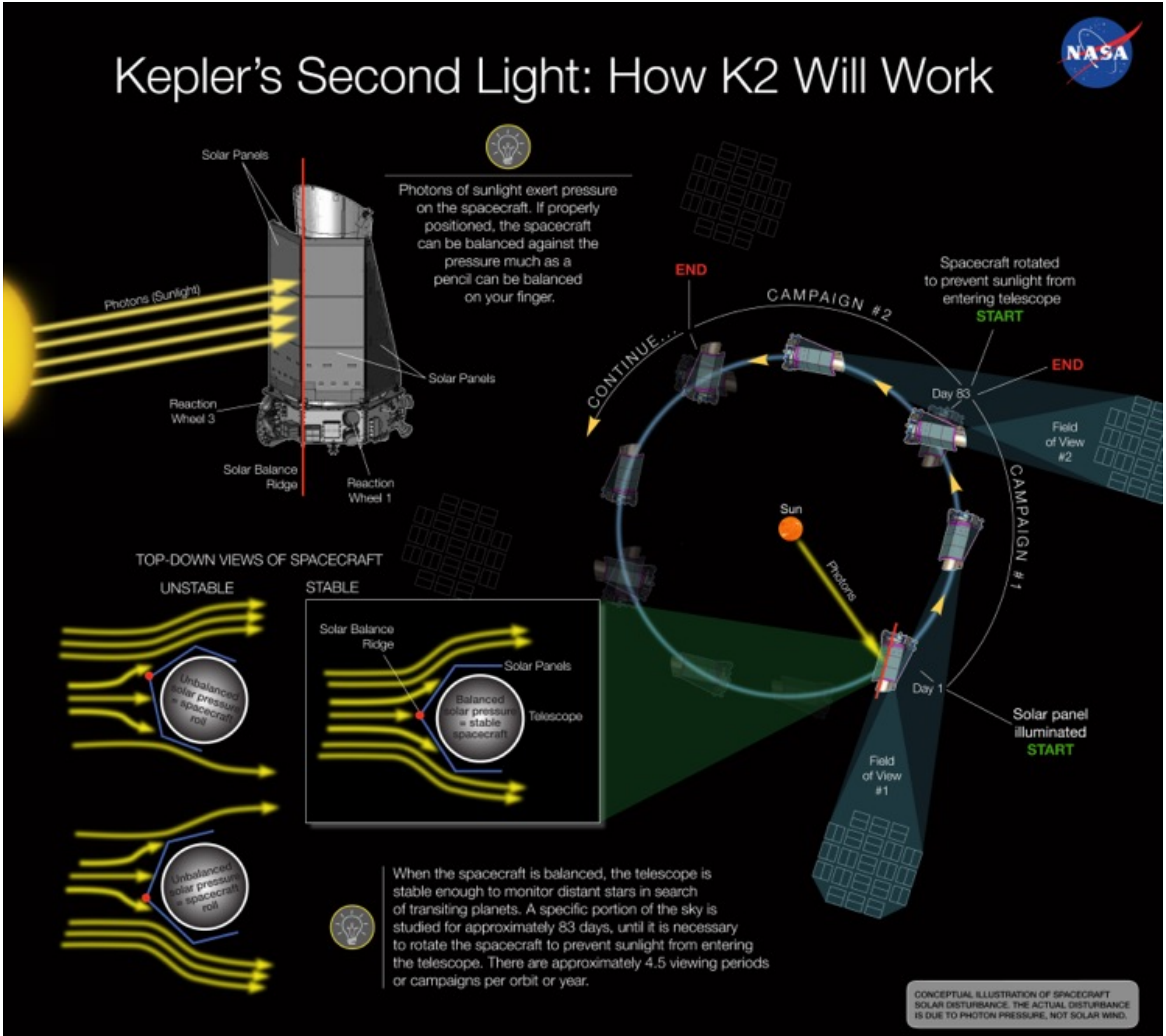
Another candidate: KOI 2700b



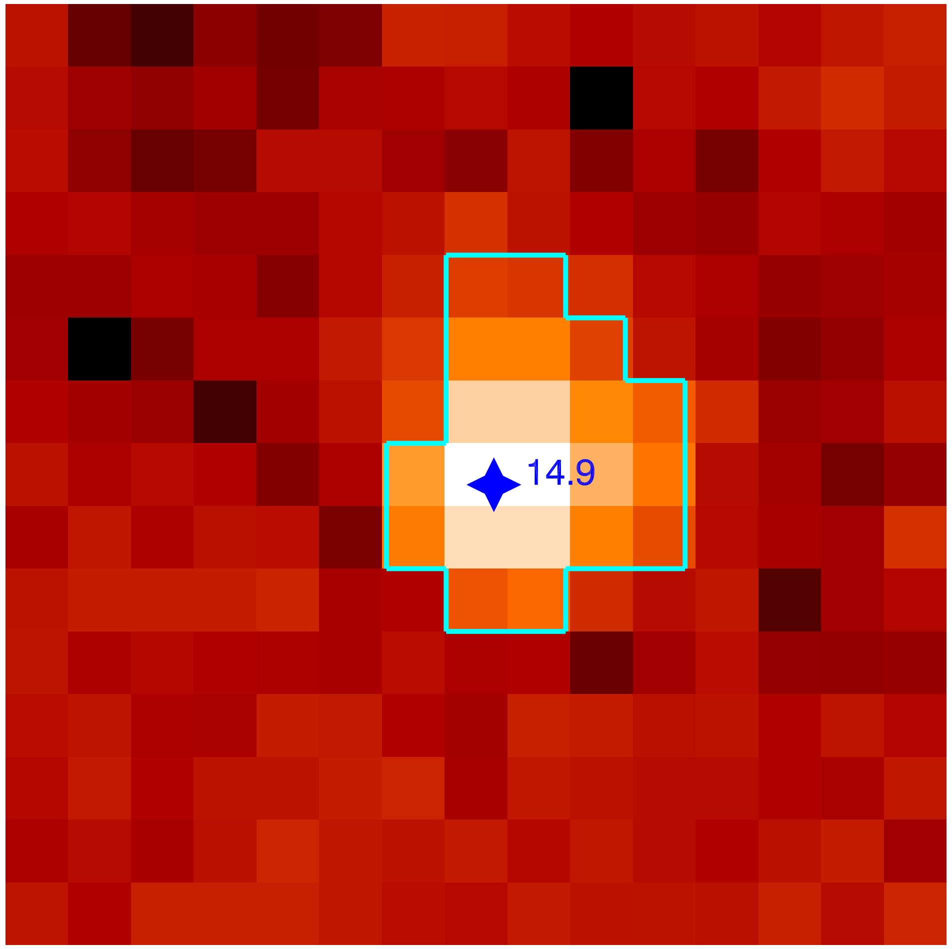
P_{orb} = 21.8 hr (15.7 hr) T_{eff} = 4400 K (4400 K)

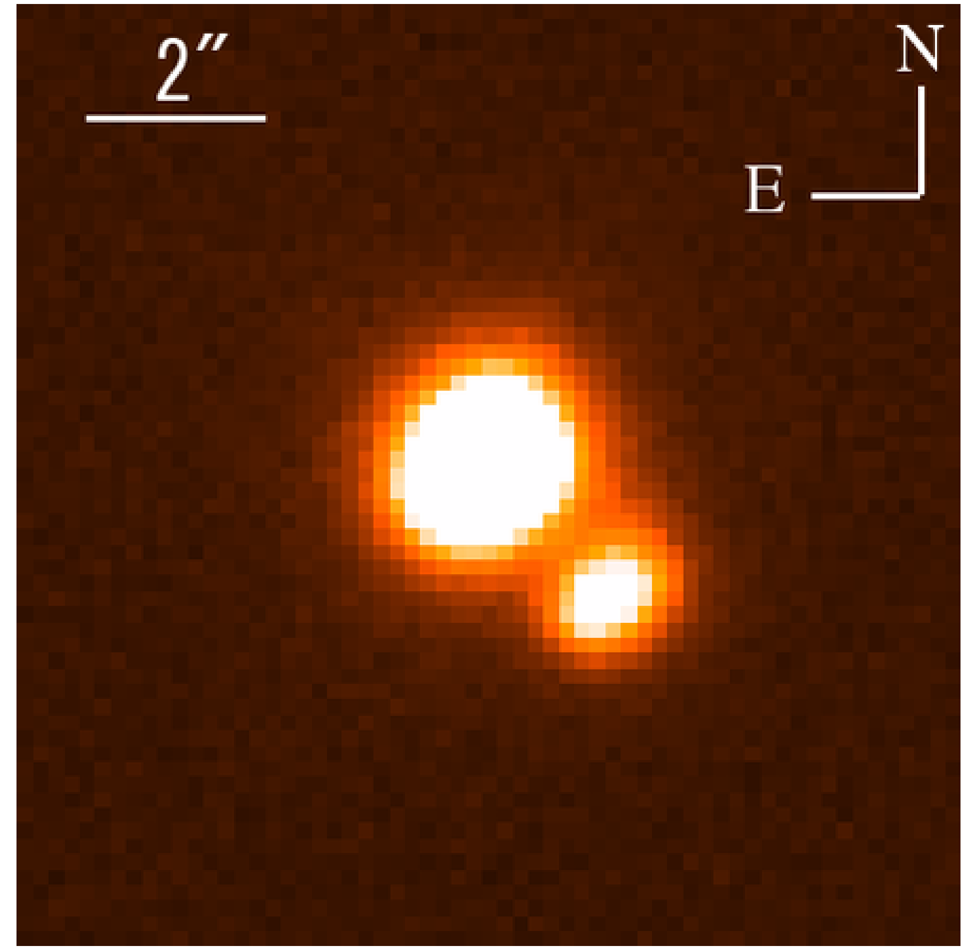
Rappaport+ 2014

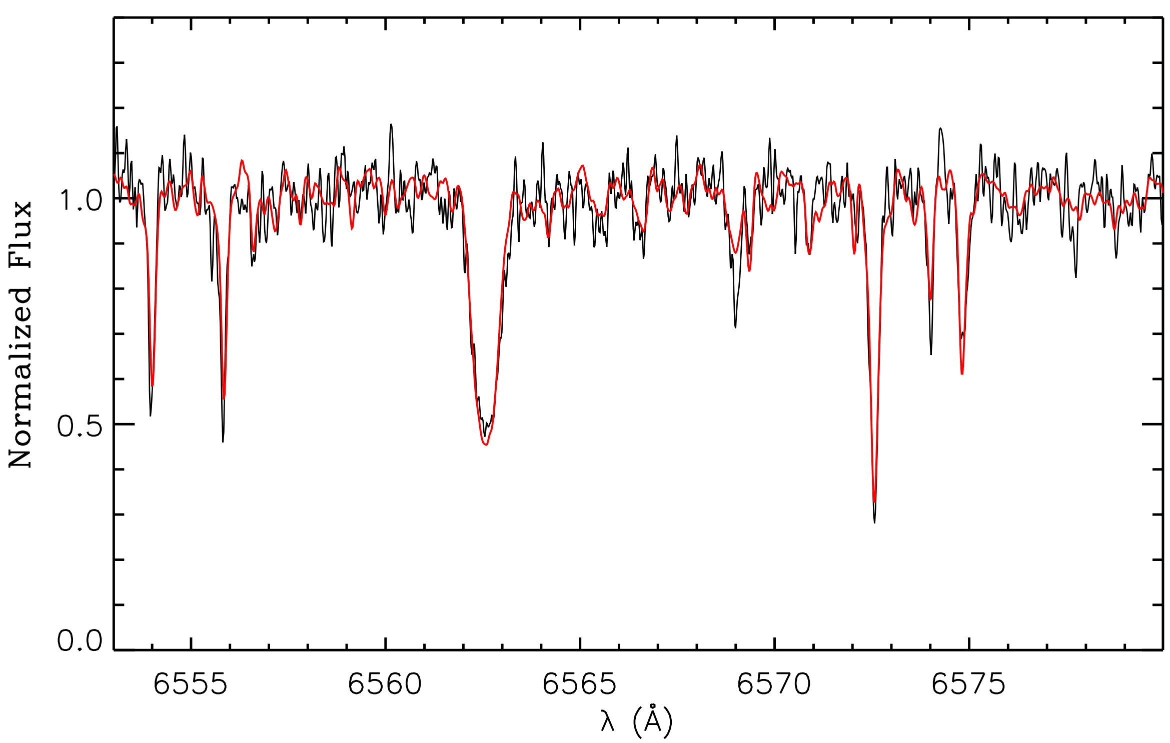
What about K2?



A disintegrating planet orbiting an M-Dwarf

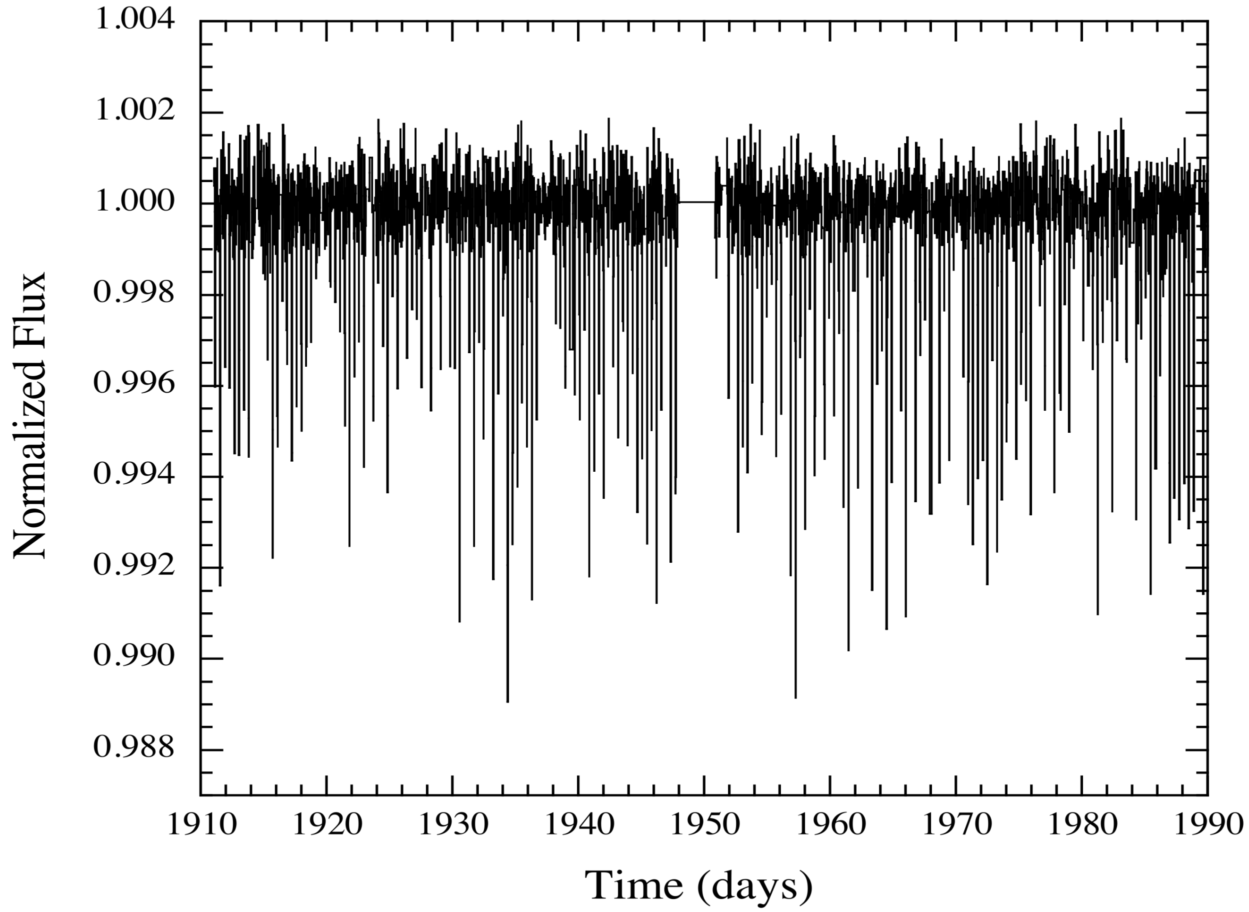


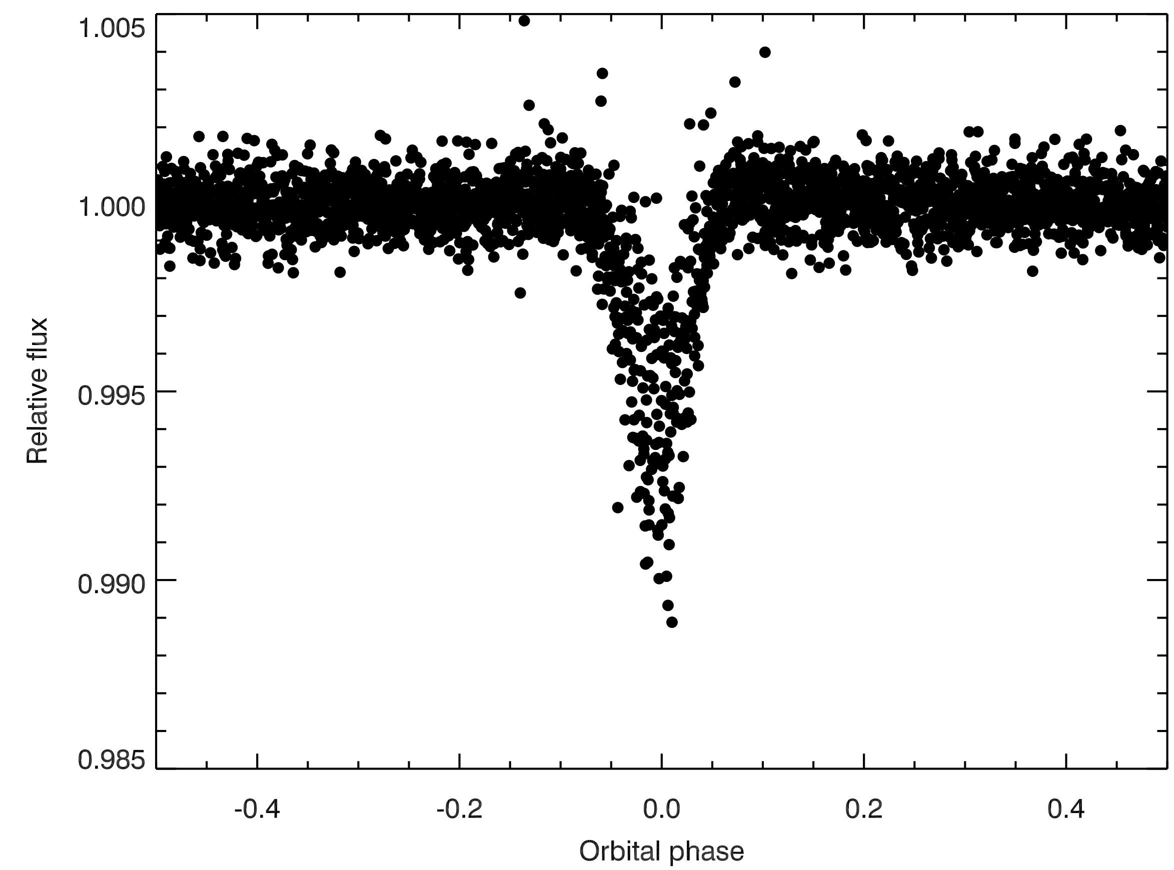


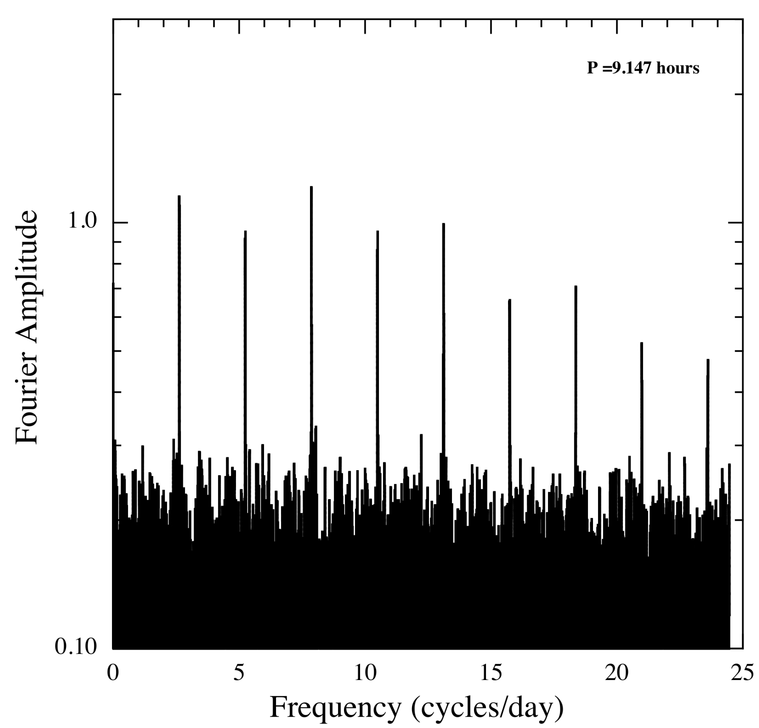


$T_{\rm eff}$ (K)	3830 ± 100
$\log g$	4.65 ± 0.12
$[Fe/H]$	0.03 ± 0.08
M_* $(R_\odot)$	0.60 ± 0.07
R_* $(M_\odot)$	0.57 ± 0.06

A disintegrating planet orbiting an M-Dwarf







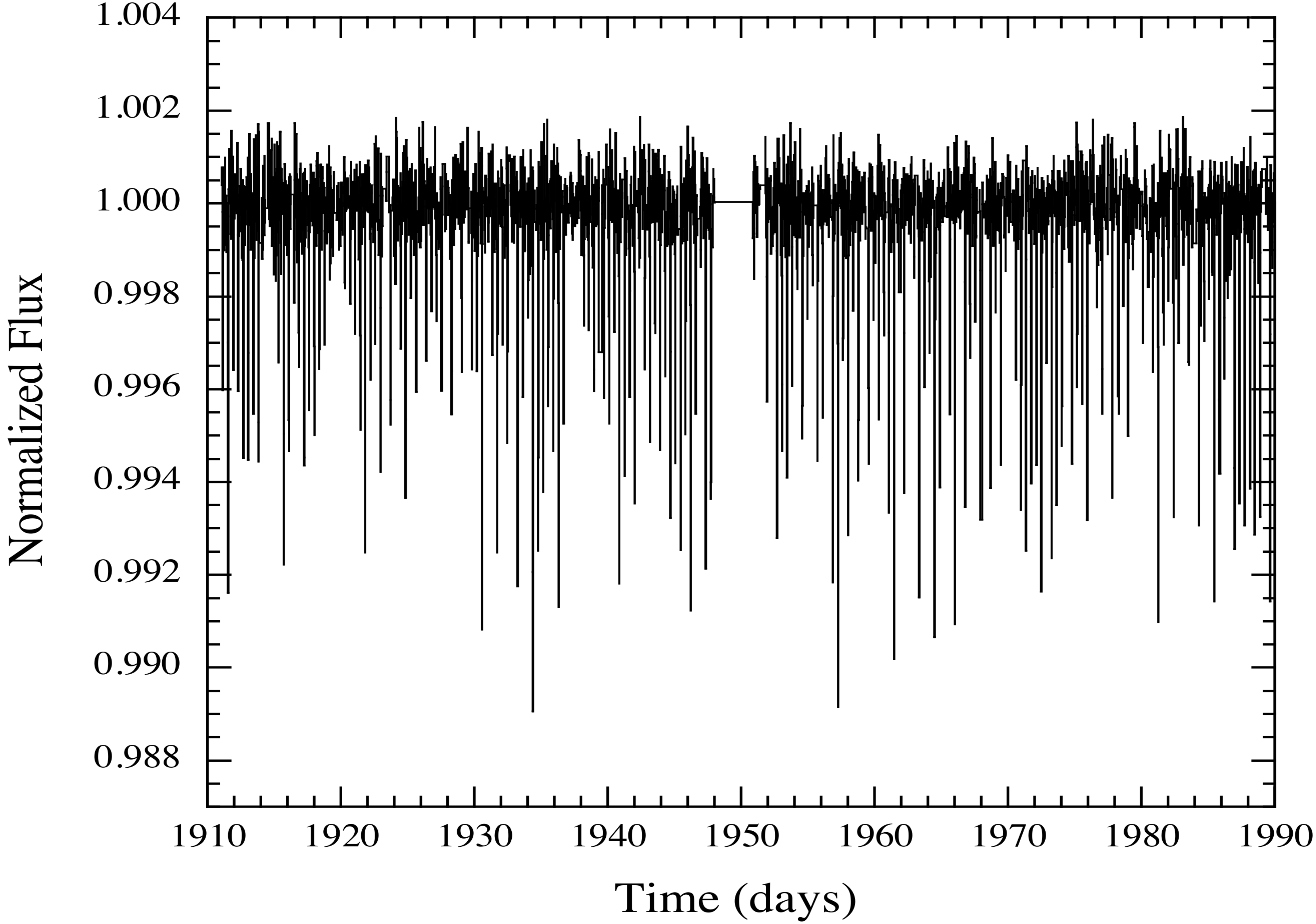
$P_{orb} = 9.15$ h

Depth = 0.5 %

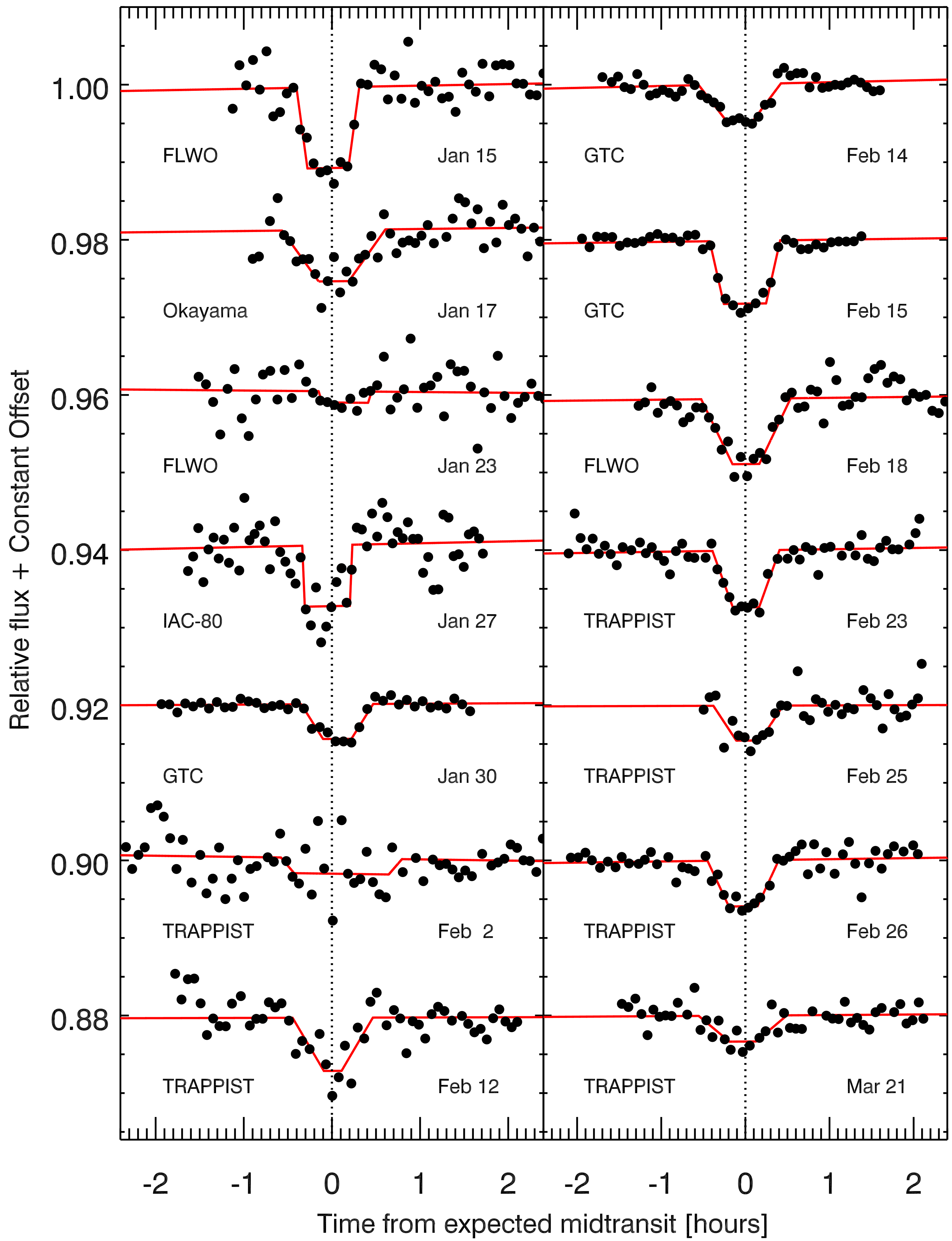
Dur. ≈ 1 hour

Sanchis-Ojeda+, 2015

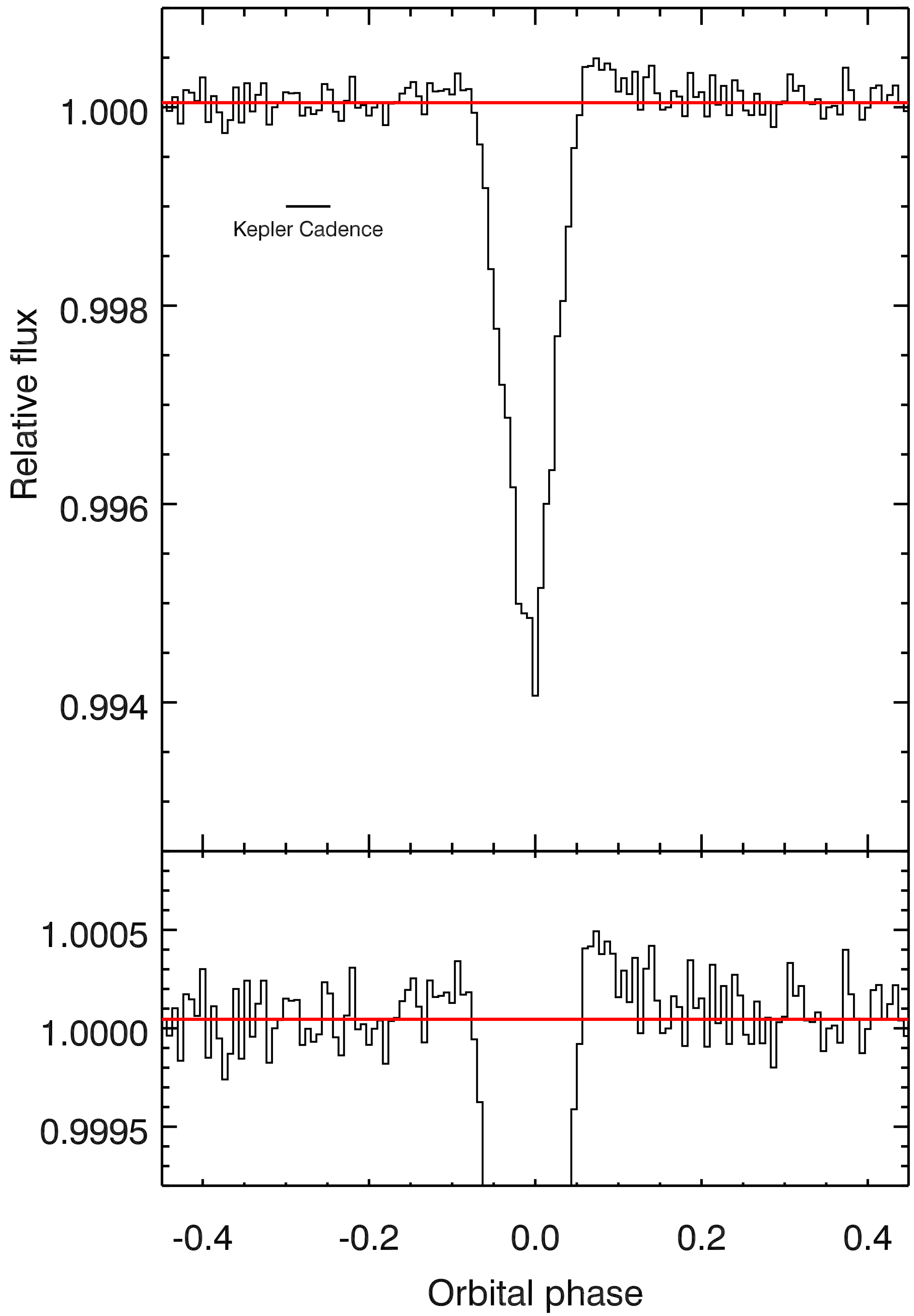
A disintegrating planet orbiting an M-Dwarf



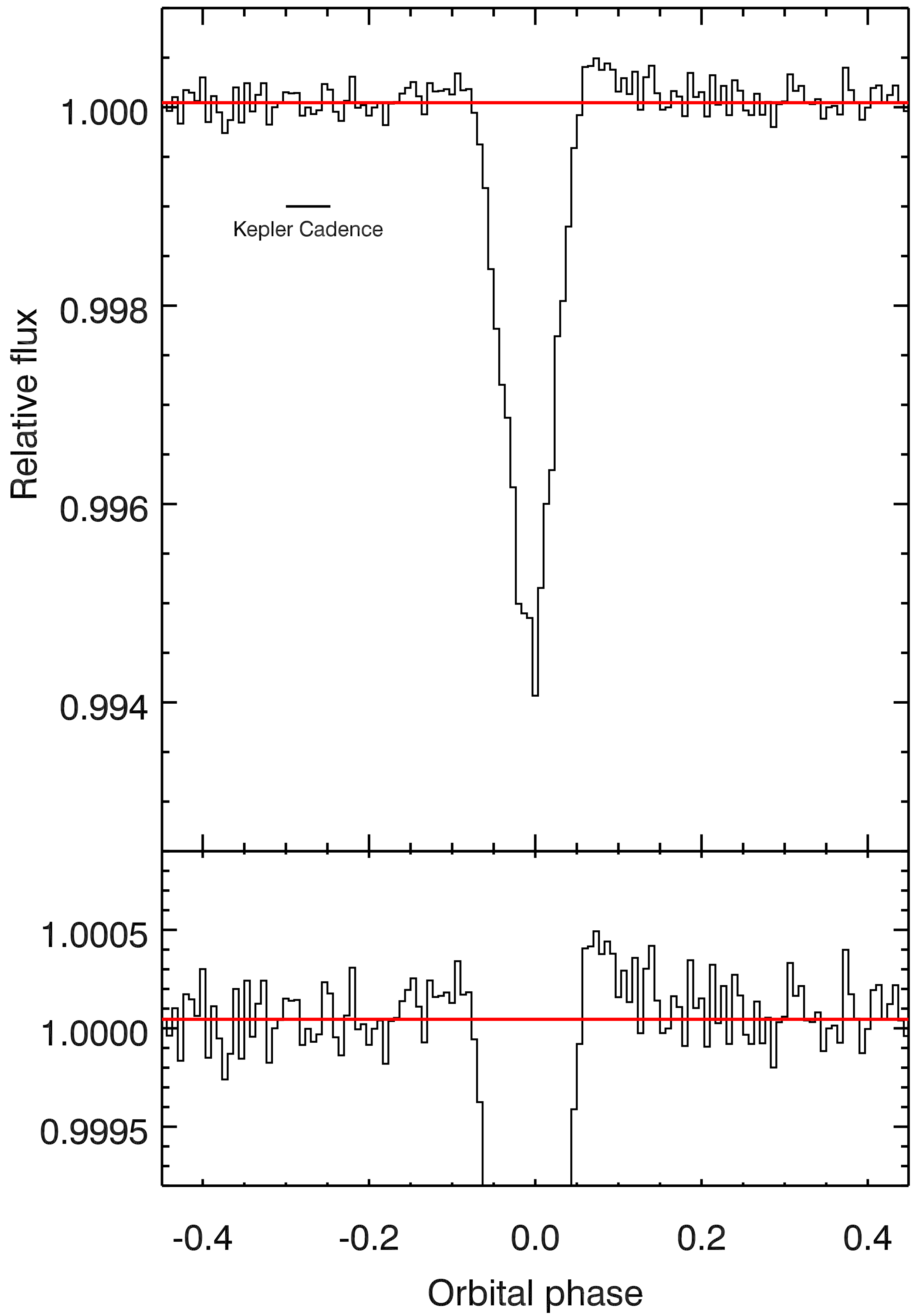
Ground based confirmation

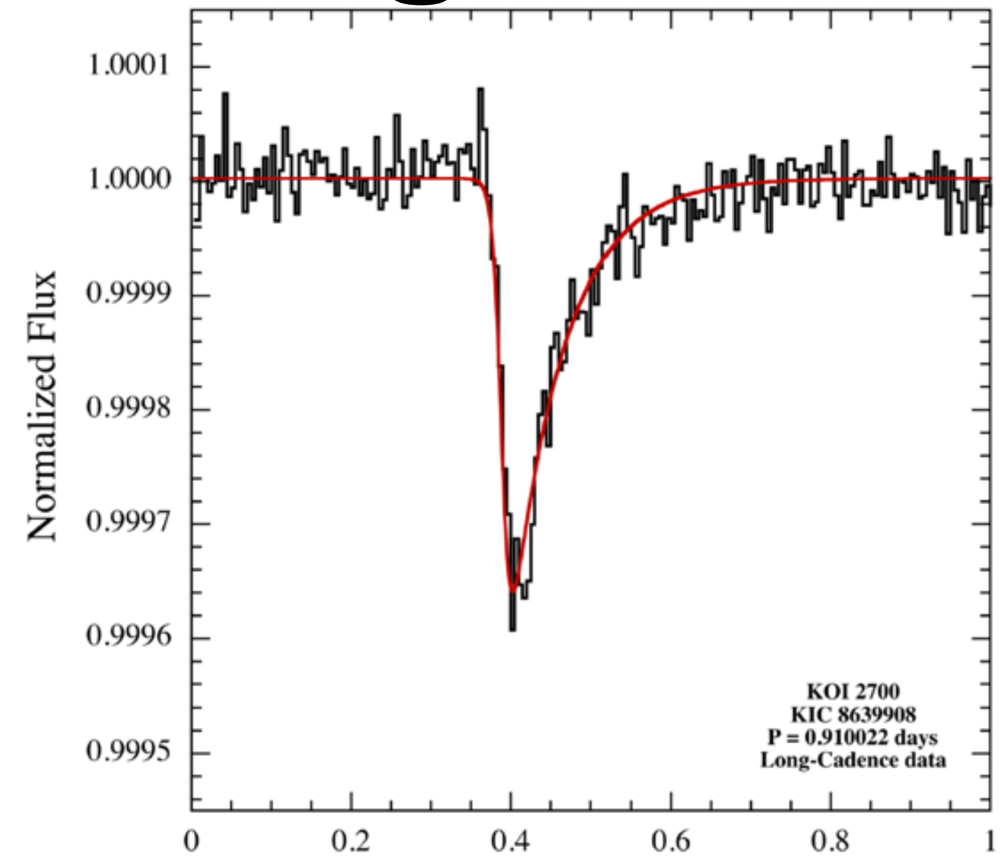


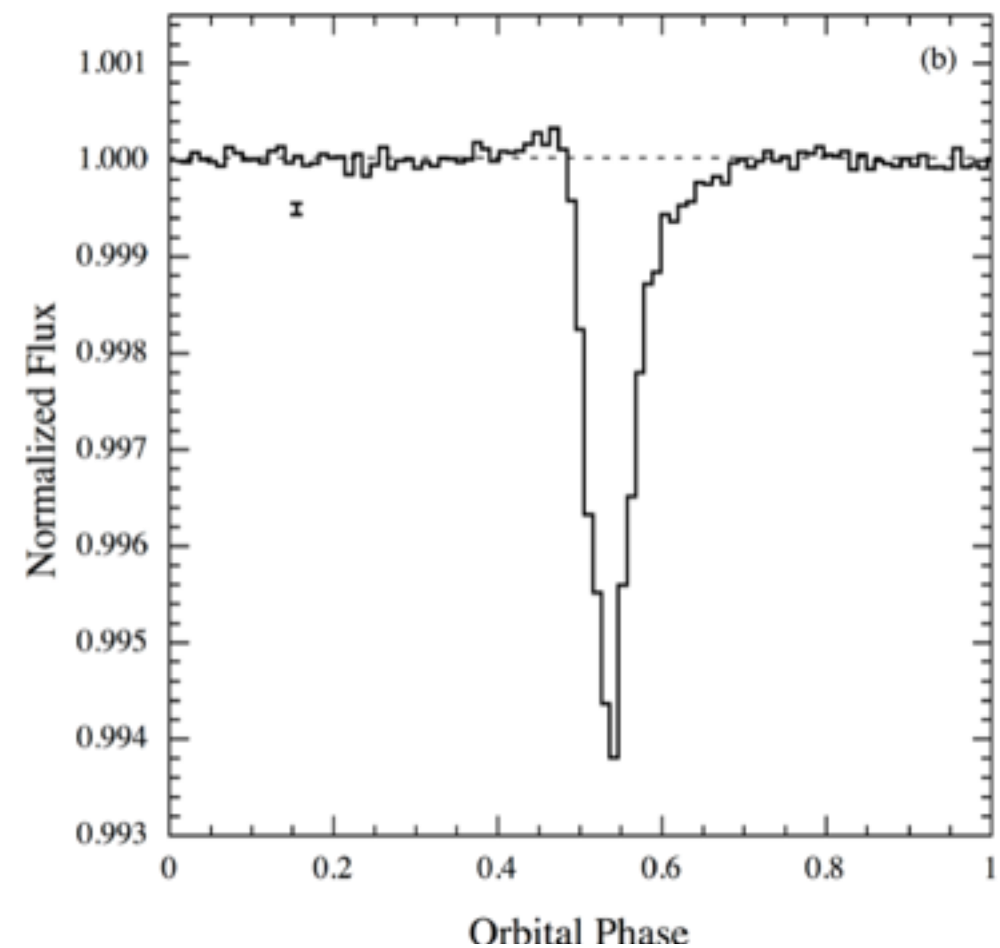
Where is the slow egress?



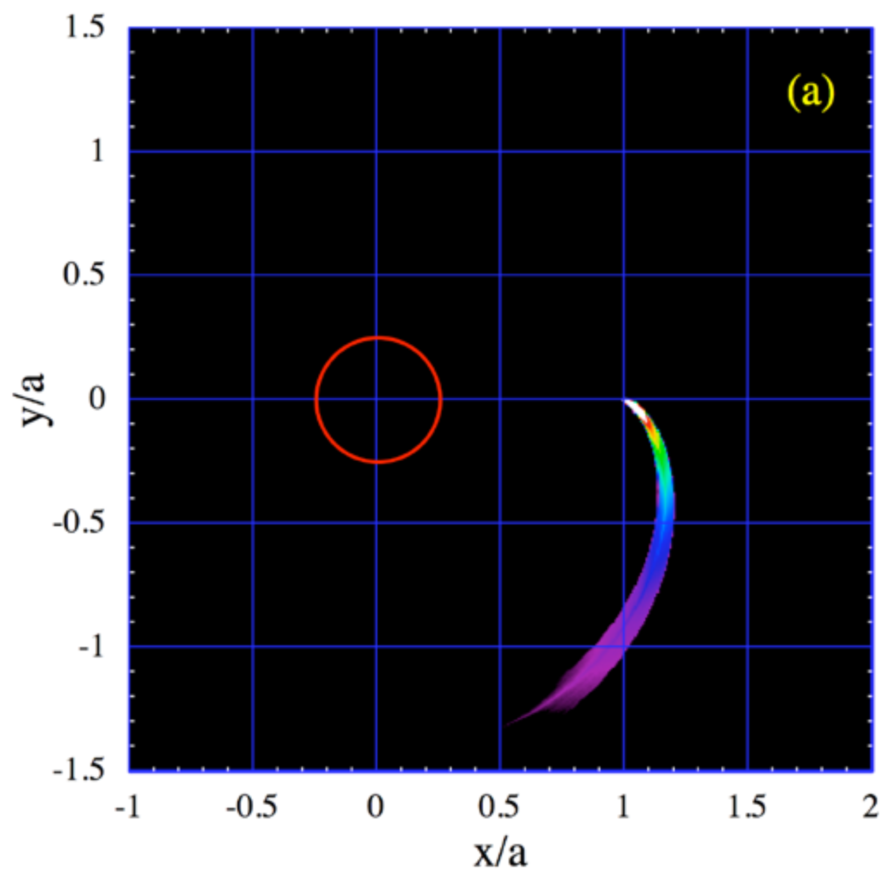
Where is the slow egress?

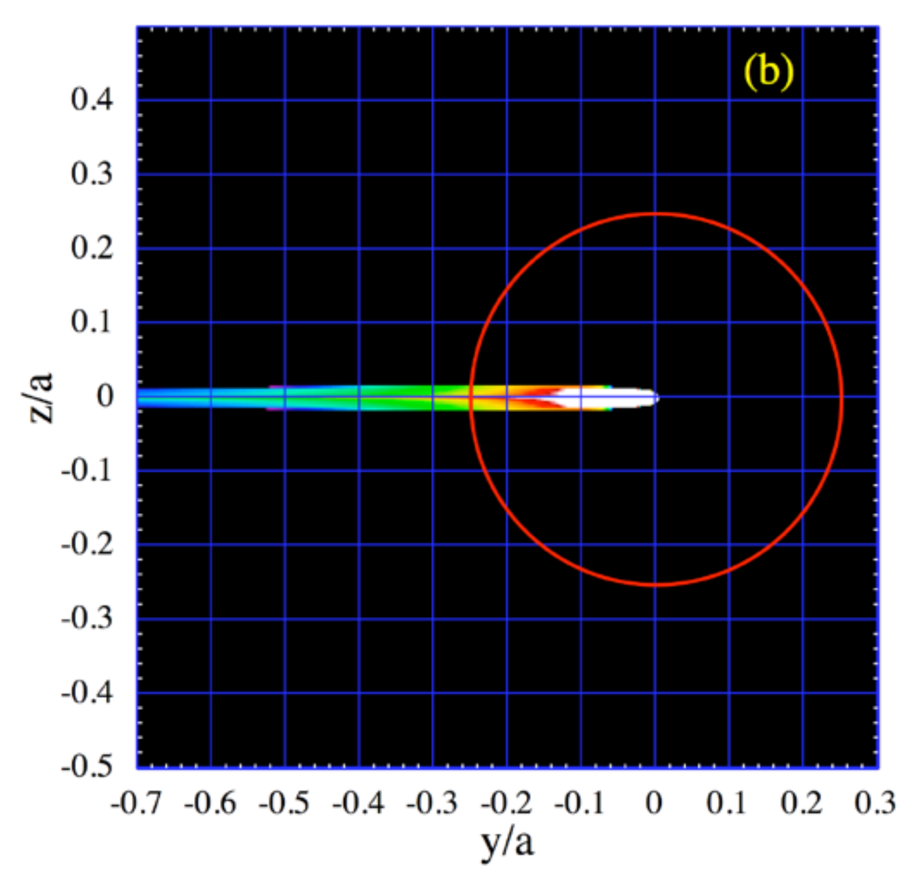


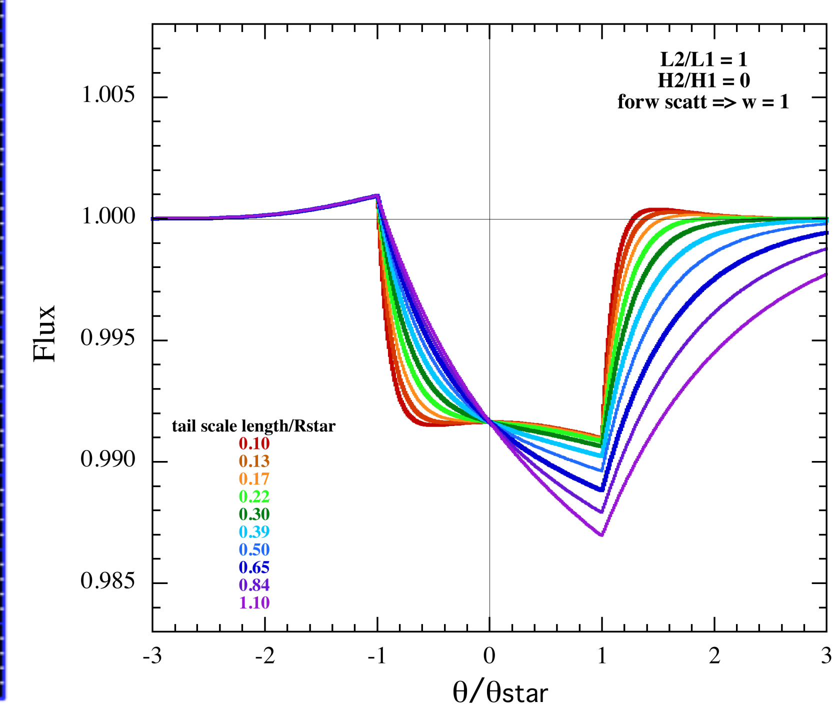


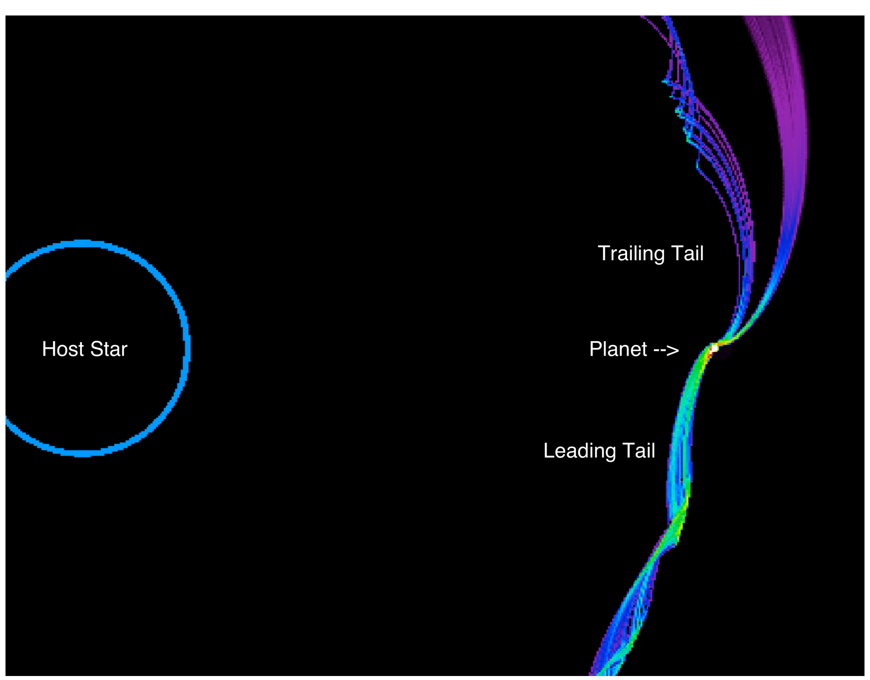


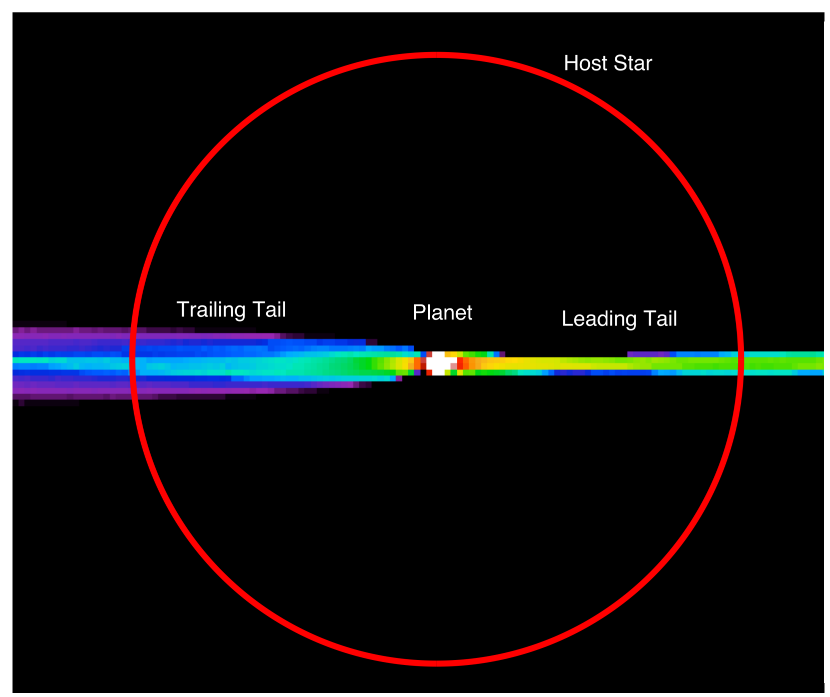
Hypothesis: Forward scattering by a leading dust tail

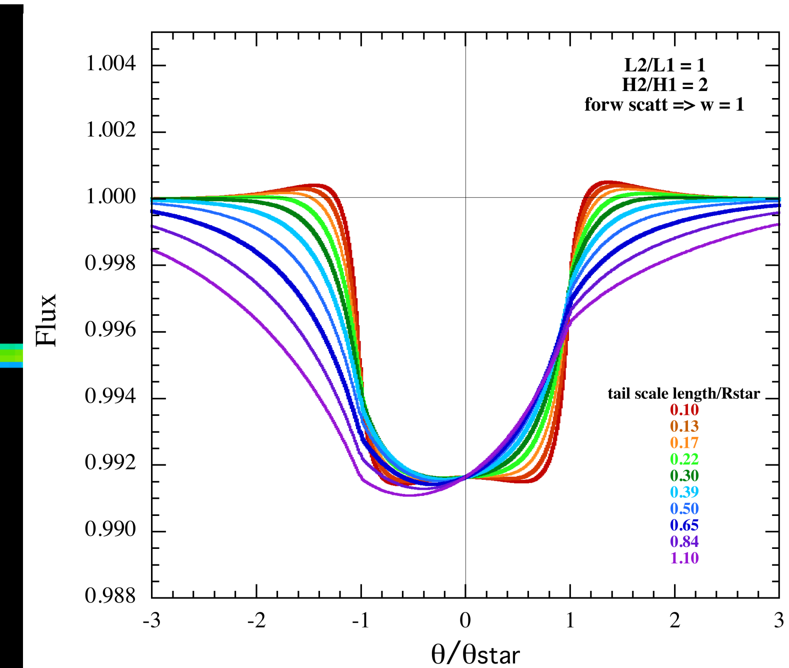




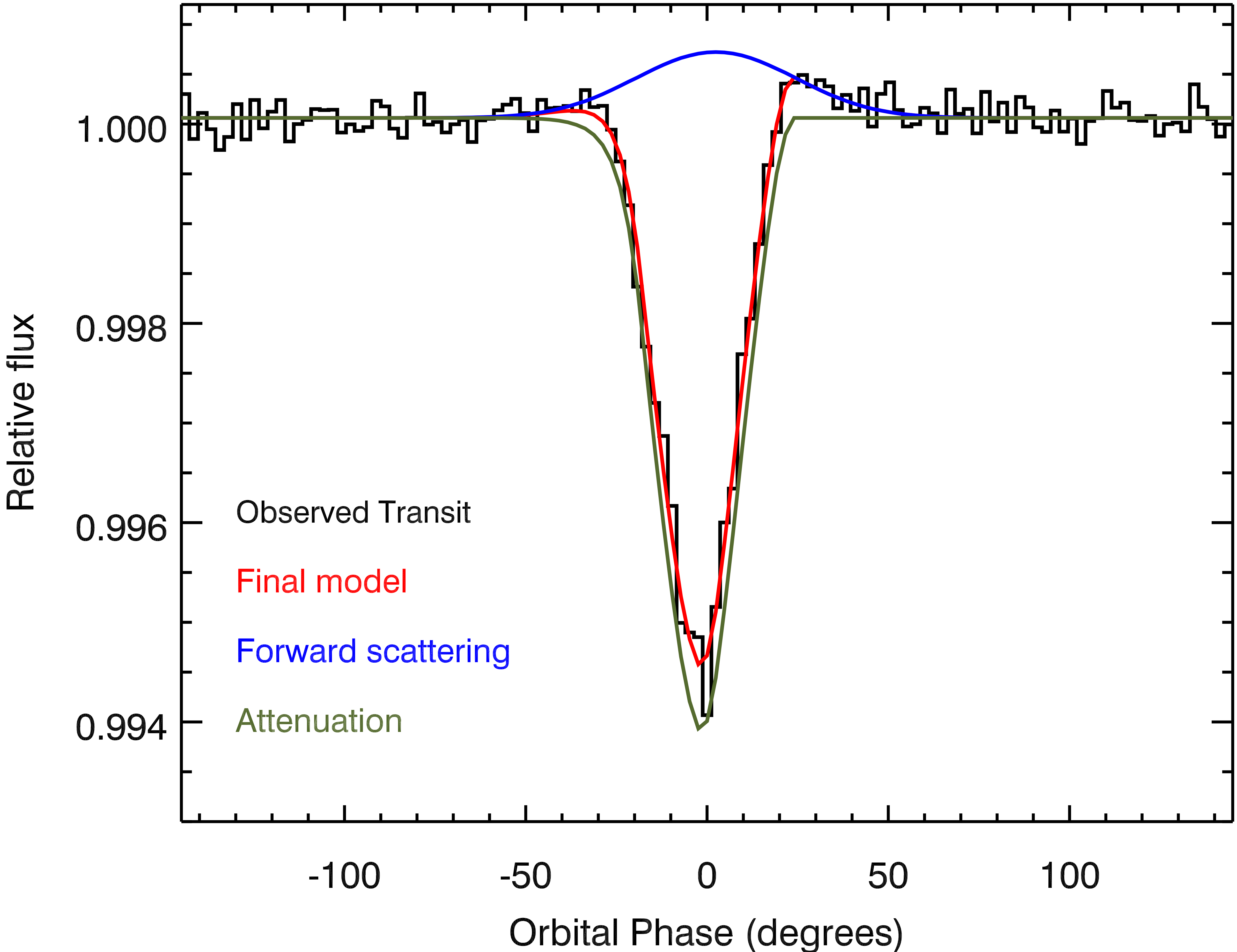




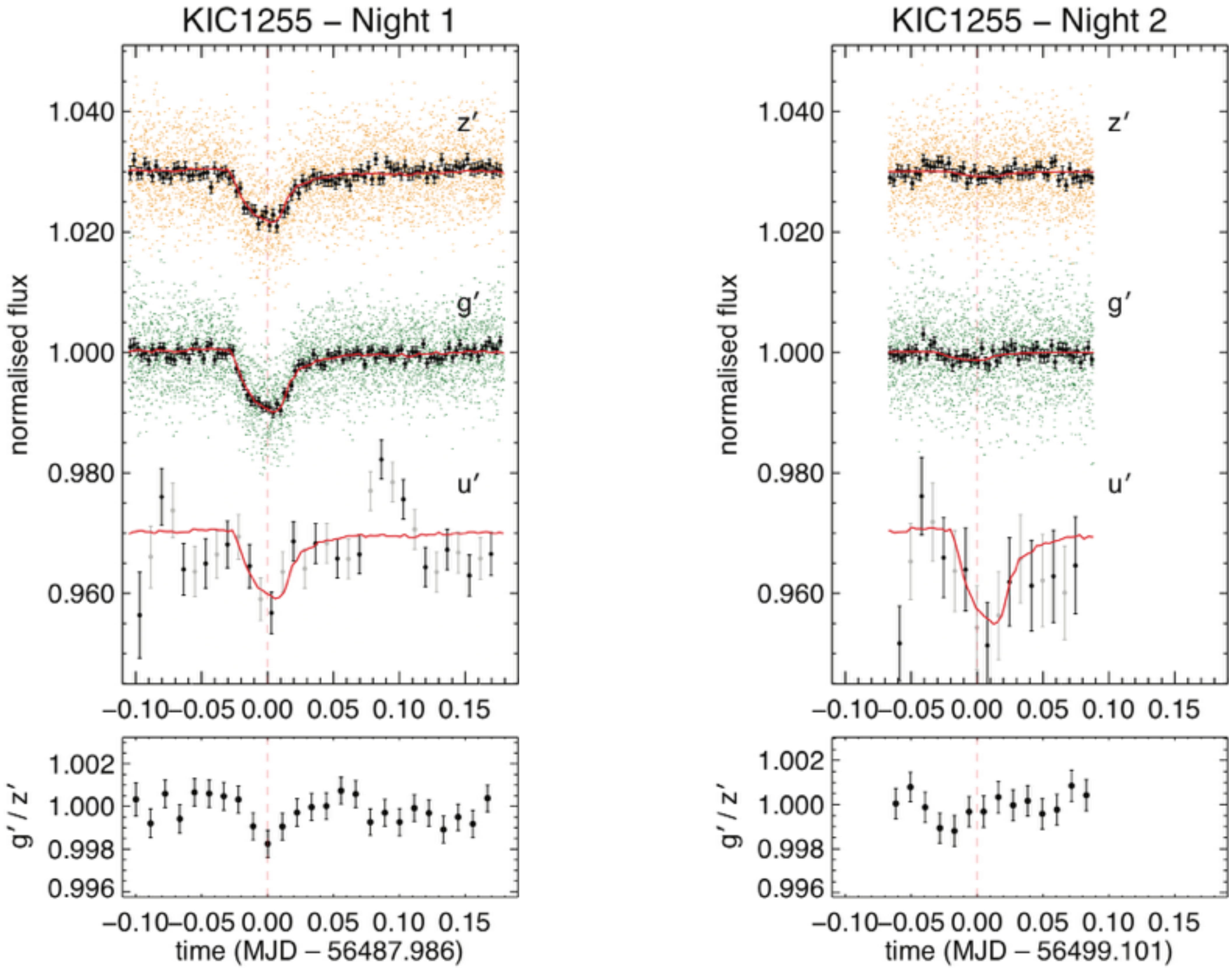




The different contributions

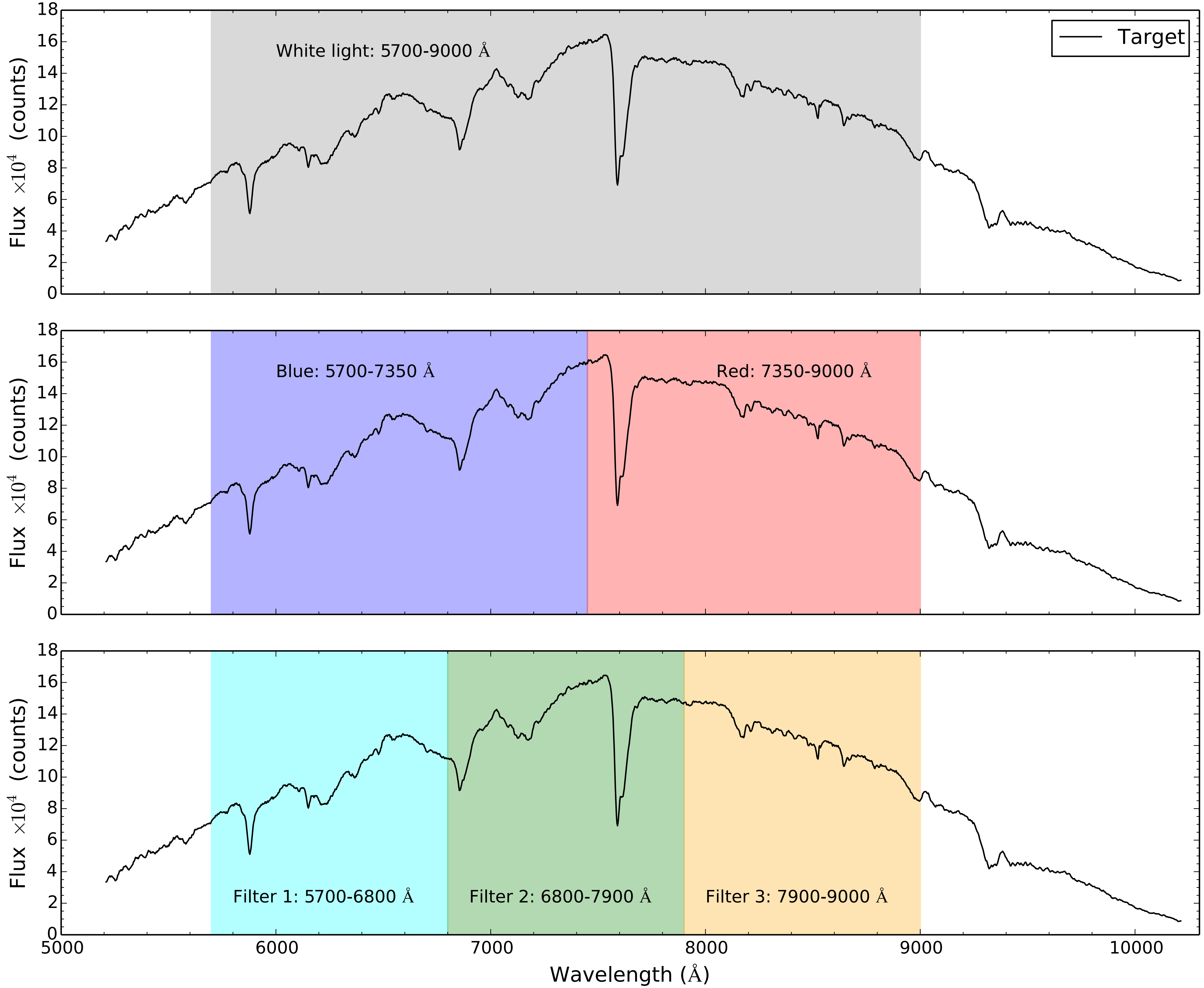


Is it really dust?

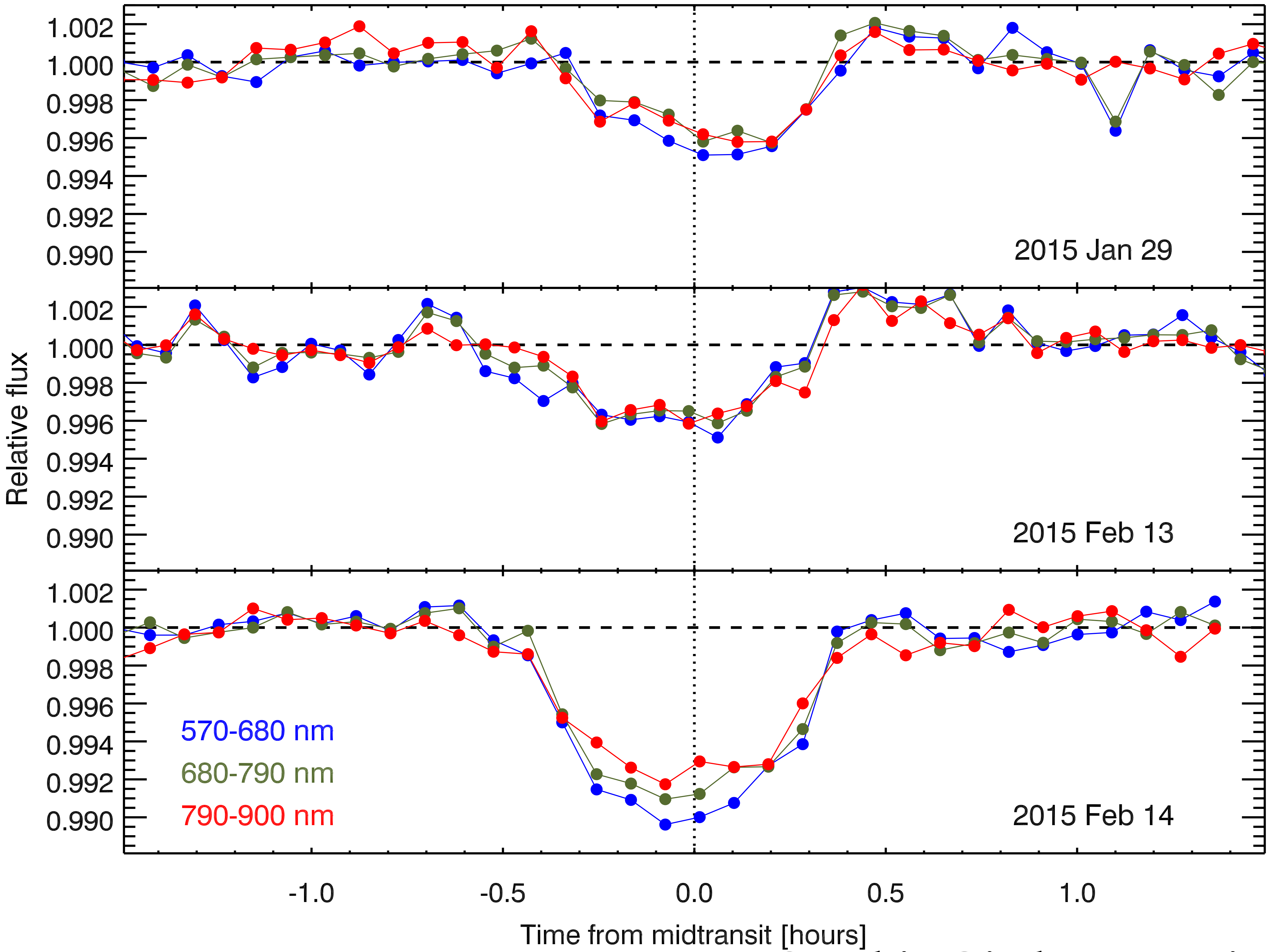


Bochinski+ 2015

We can split the GTC observations

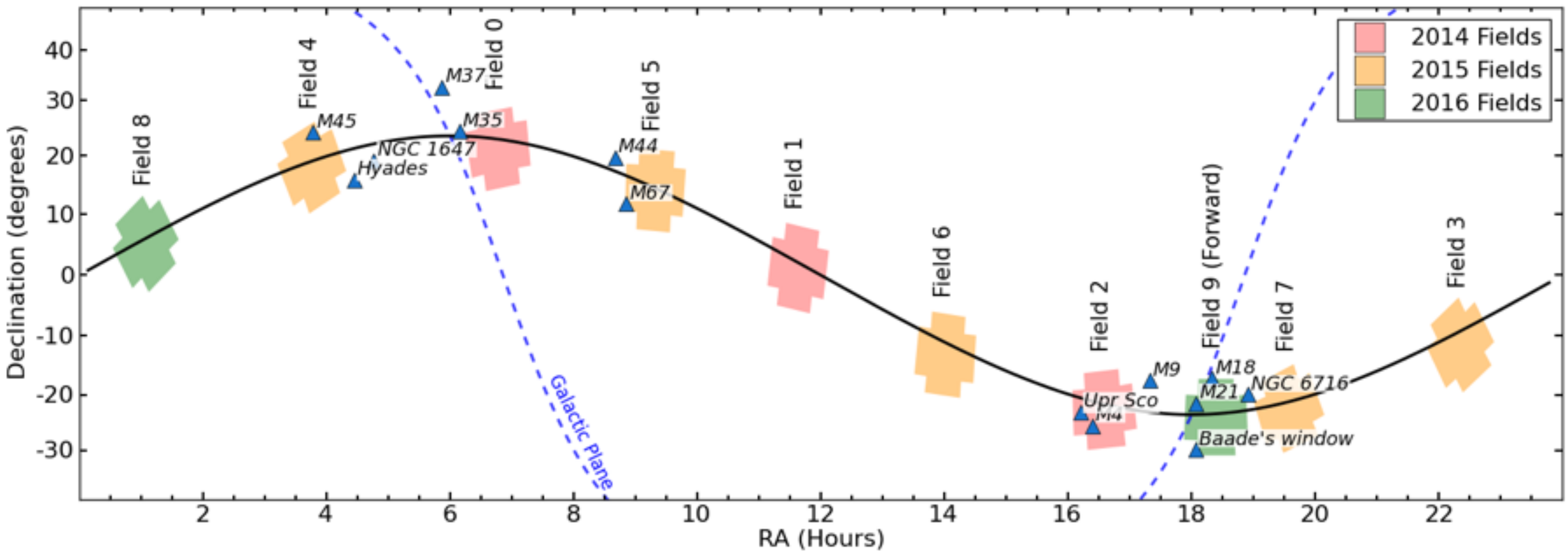


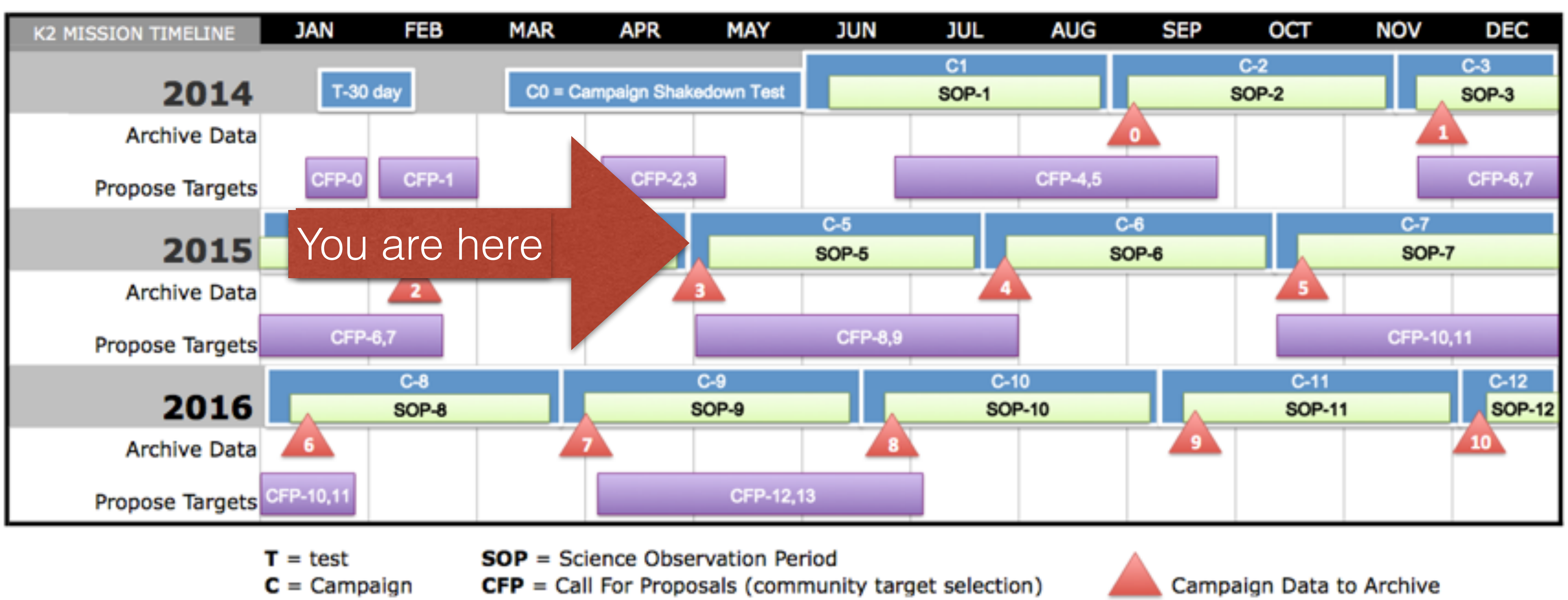
Color variations are also confirmed



Sanchis-Ojeda+, 2015, in prep

It's only the beginning





Conclusions

- Ultra-short period planets represent a great opportunity in terms of access to smaller planets and easier follow-up observations.
- Kepler gave us more than a 100 planet candidates with orbital periods shorter than 1 day, with Kepler-10b and Kepler-78b as illustrious examples. It also discovered the first disintegrating planets.
- K2 is particularly capable to help us understand close-in planets, because they are orbiting brighter stars.
- I have presented the first K2 disintegrating planet. Because it orbits and M-dwarf, the level of radiation is lower, allowing the generation of a cometary head. Follow-up observations seem to confirm the dust nature of the transit variability.