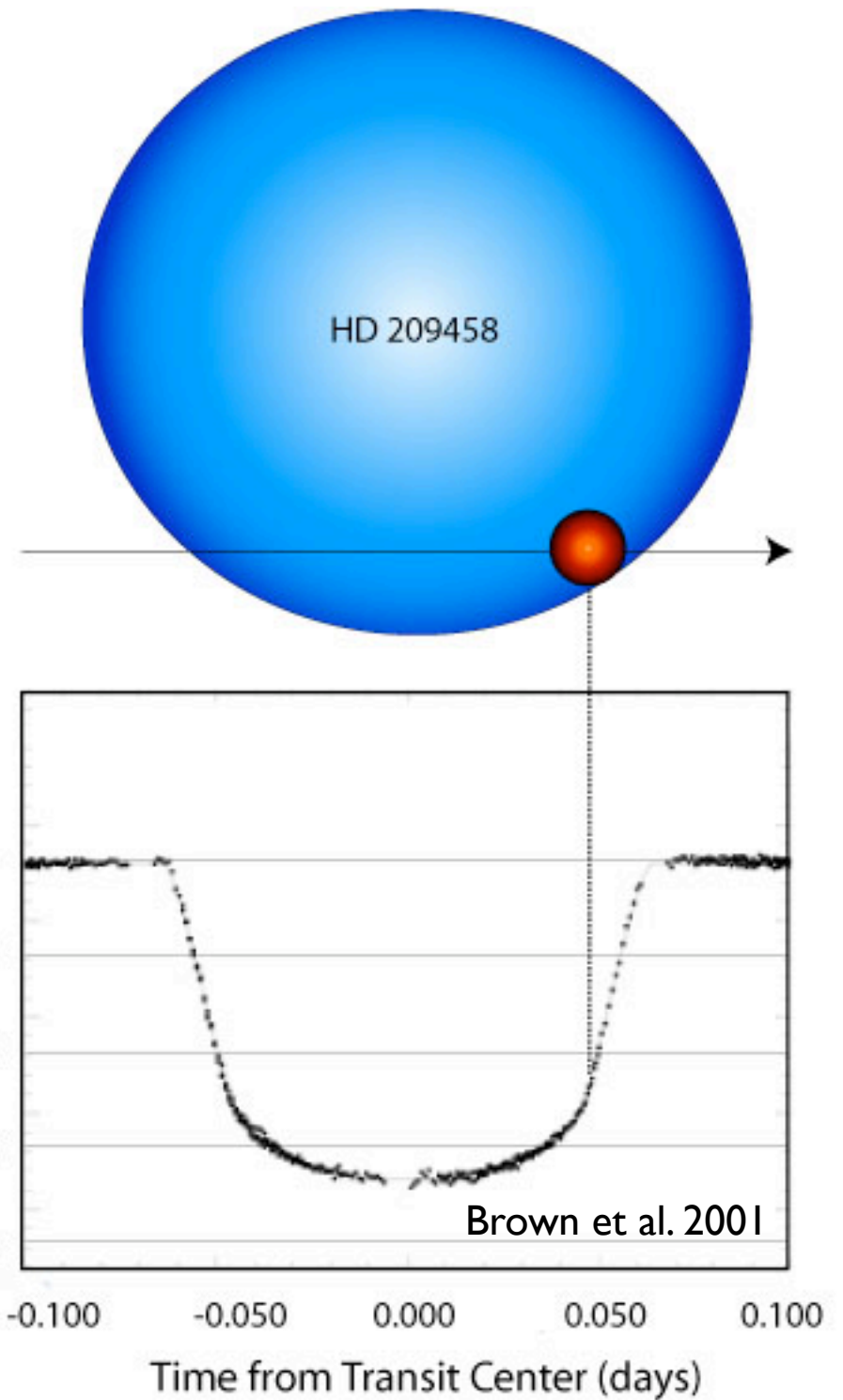


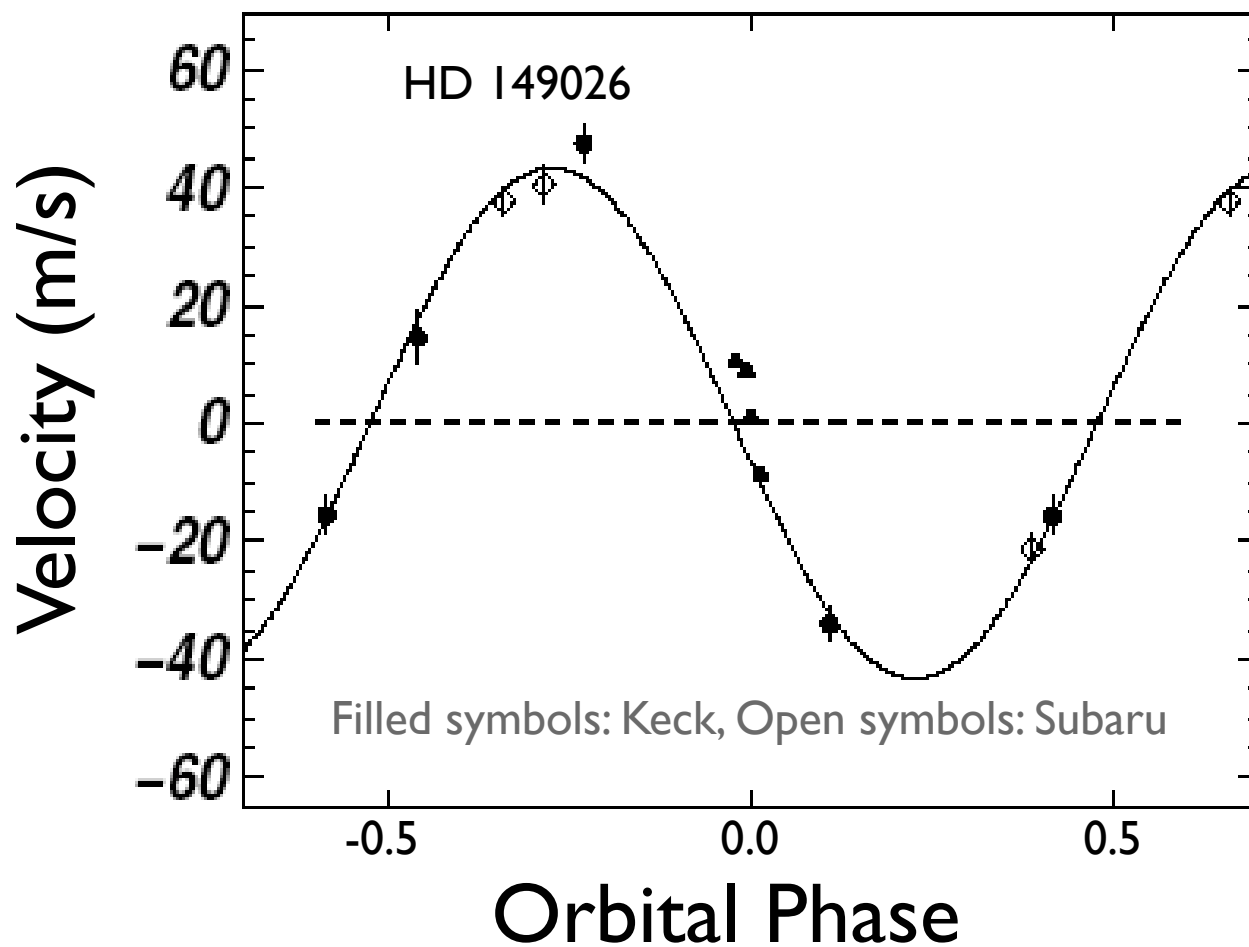
Detection and Characterization of Transiting Planets

Gregory Laughlin - UCO/Lick observatory



Transit of Venus
June 2004



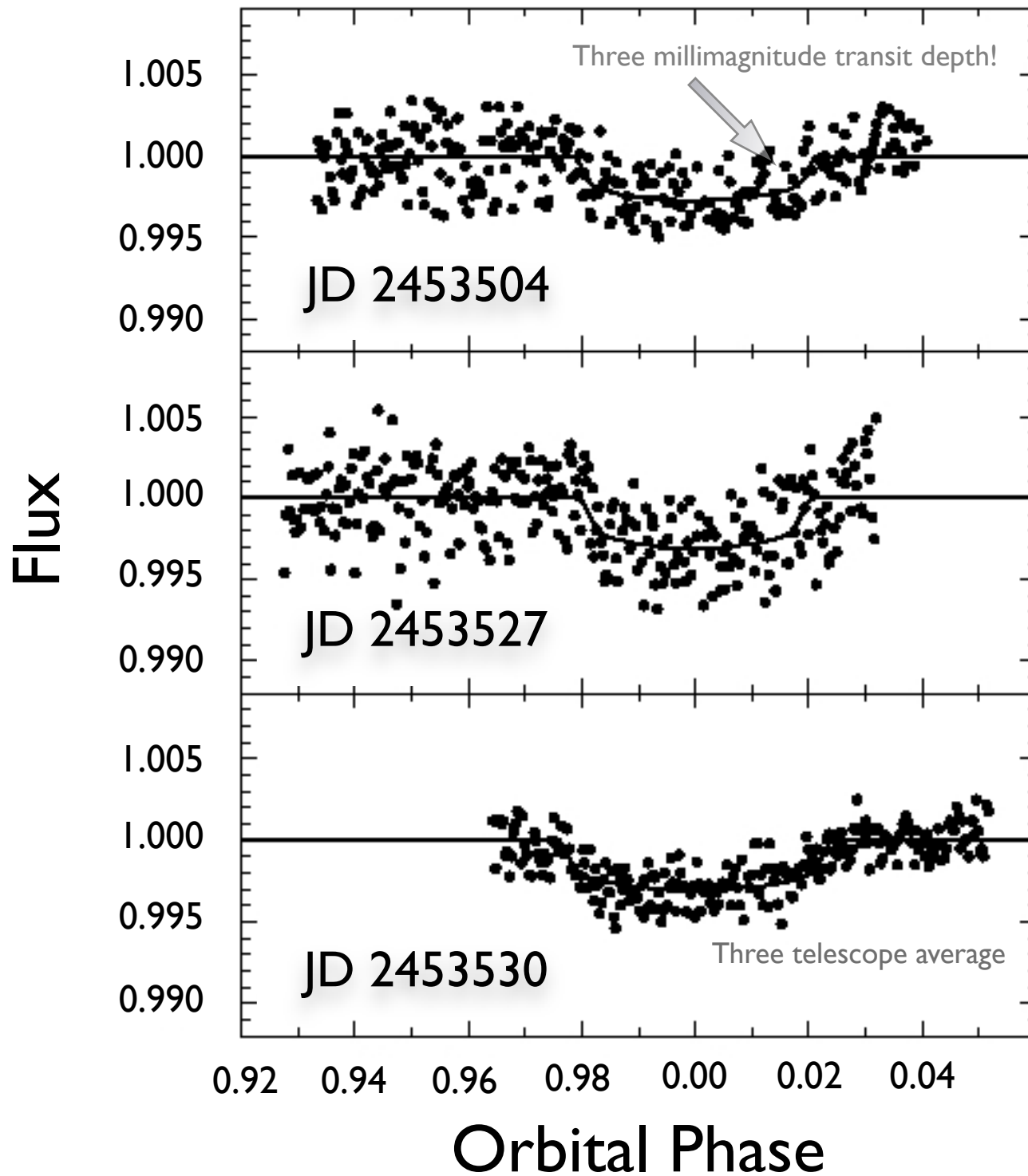


HD 149026

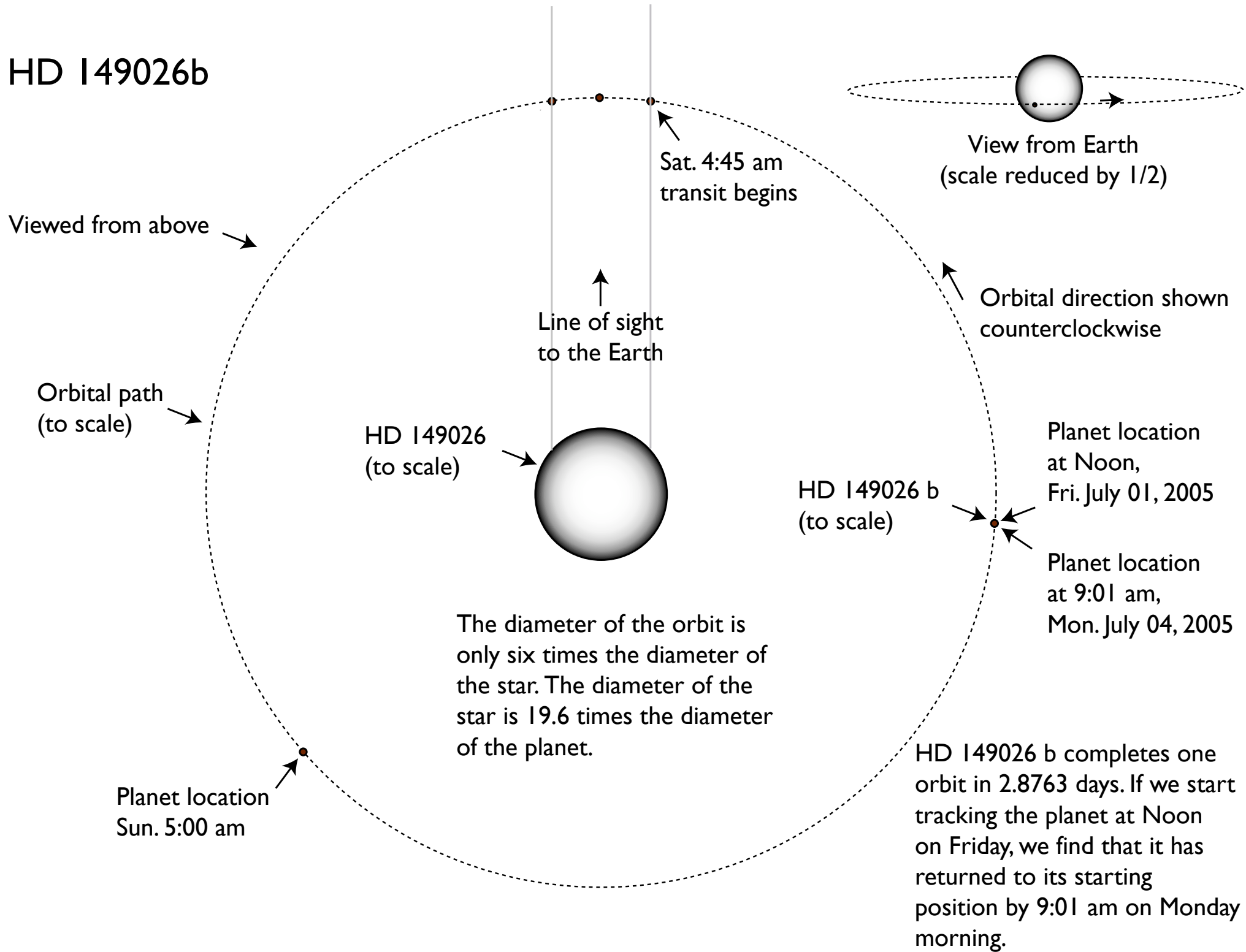
R 1.45 (0.1) R_{sun}
M 1.3 (0.1) M_{sun}
L 2.7 (0.5) L_{sun}
d 79 (7) pc
T_{eff} 6147 (50) K
Age 2.0 (0.8) Gyr
Type G0 IV
V 8.15
v_{sin i} 6.0 (0.5) km/s
[Fe/H] 0.36 (0.05) dex
dec +30

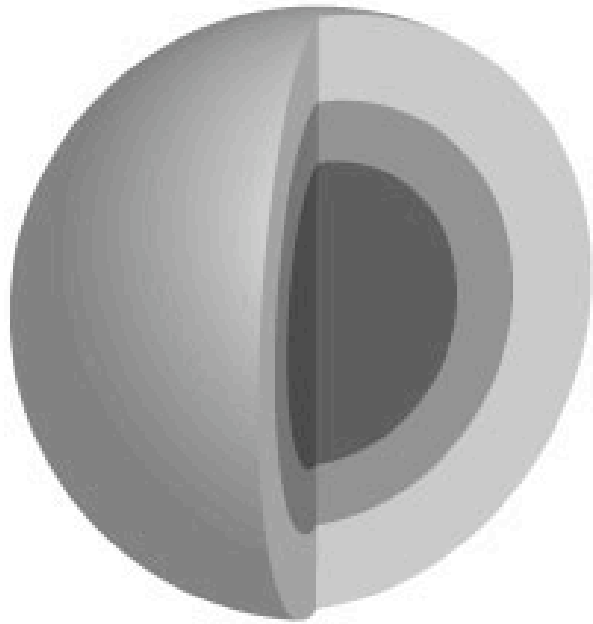
HD 149026 b

P 2.8766 (0.001) d
e 0.00 (fixed)
K 43.3 (1.2) m/s
M_{sin i} 0.36 (0.03) M_{jup}

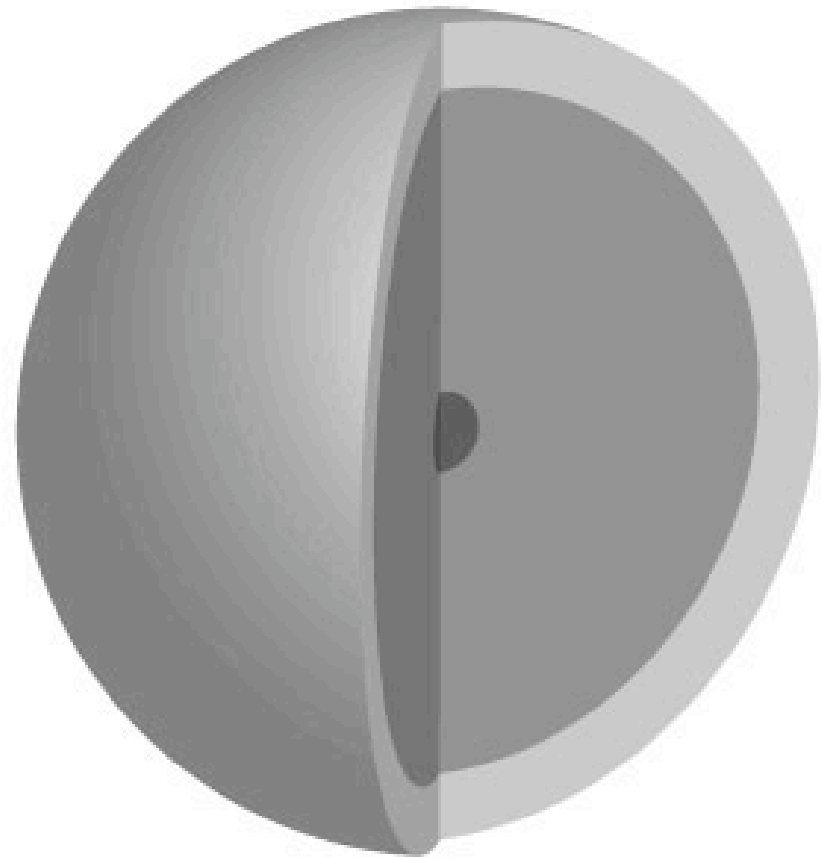


HD 149026b



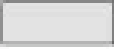




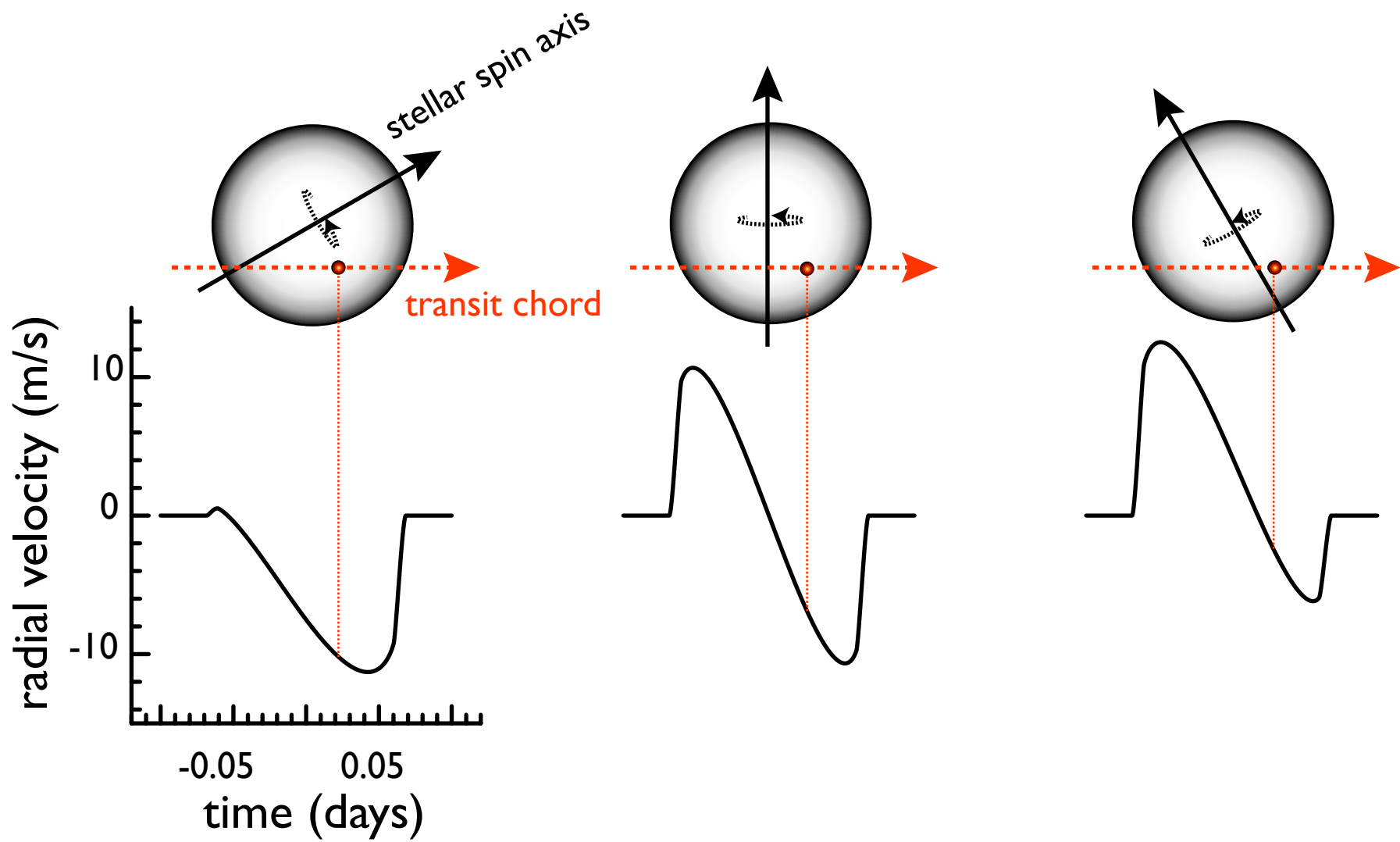
HD 149026 b

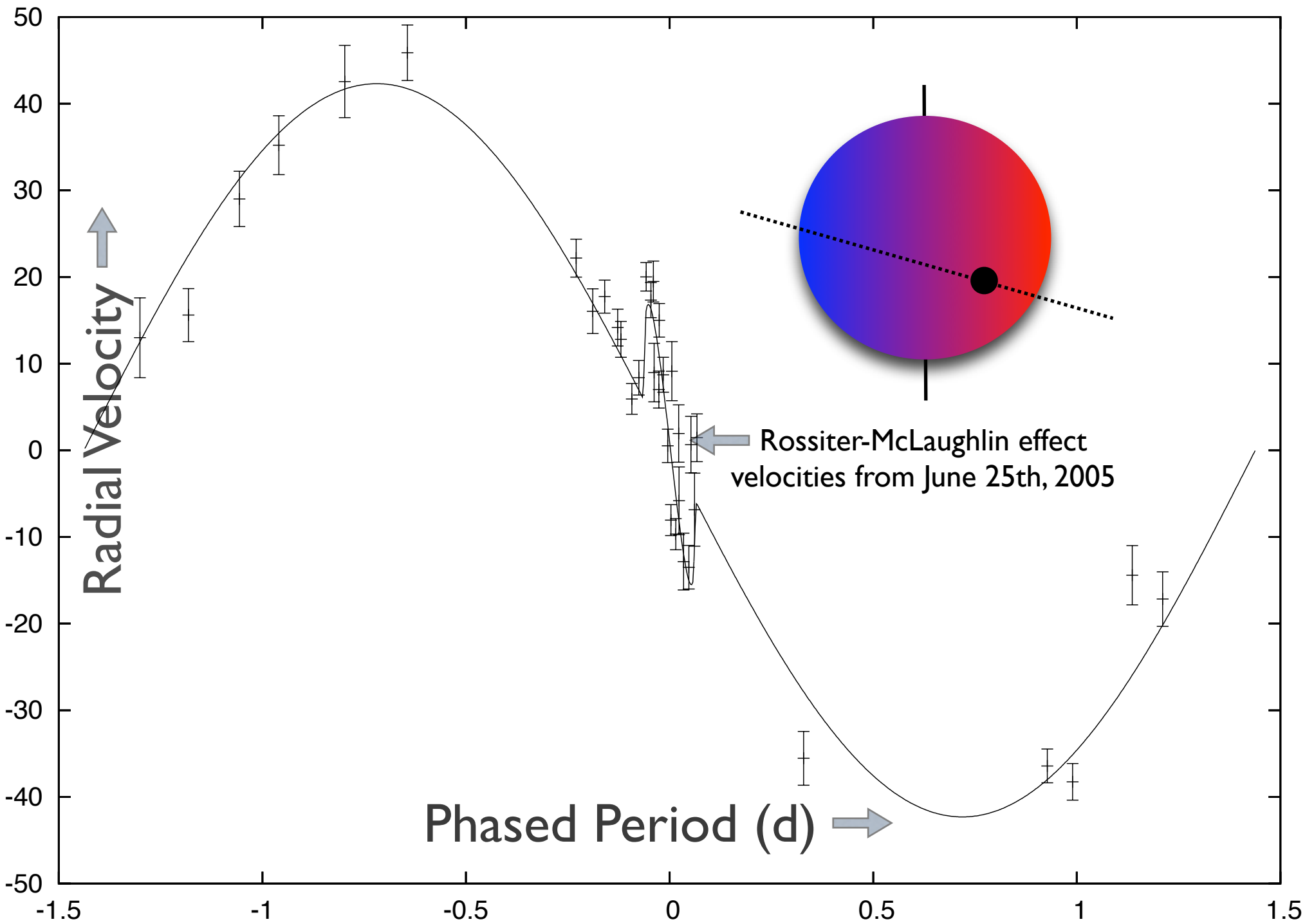


Jupiter

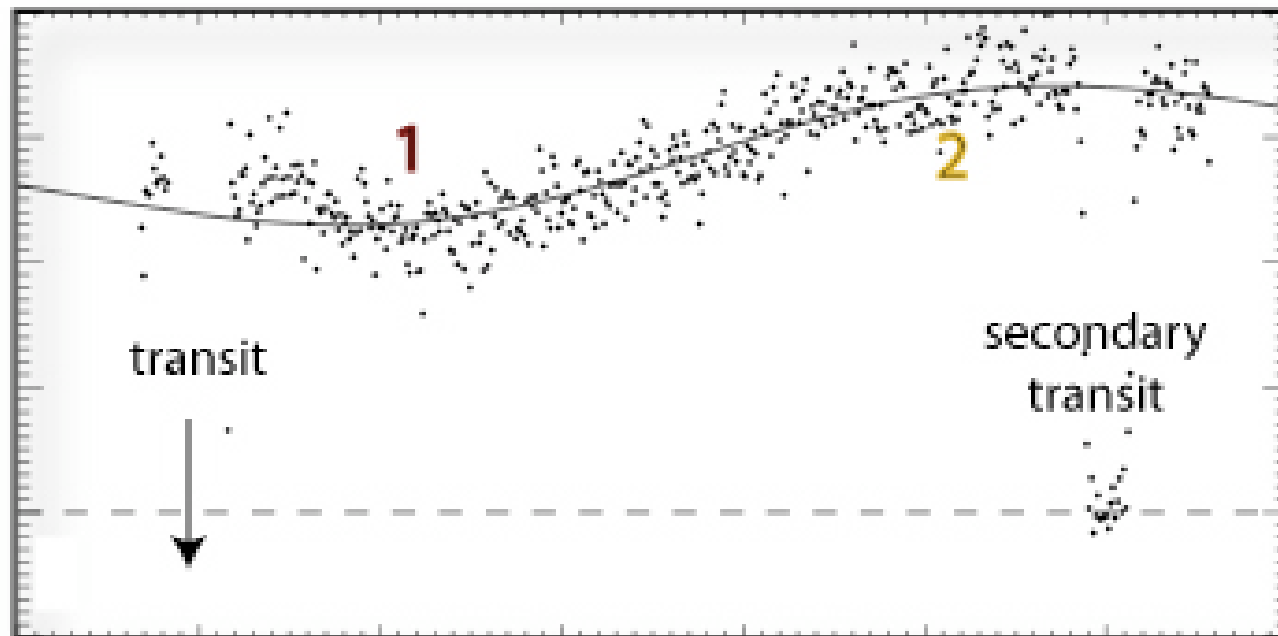
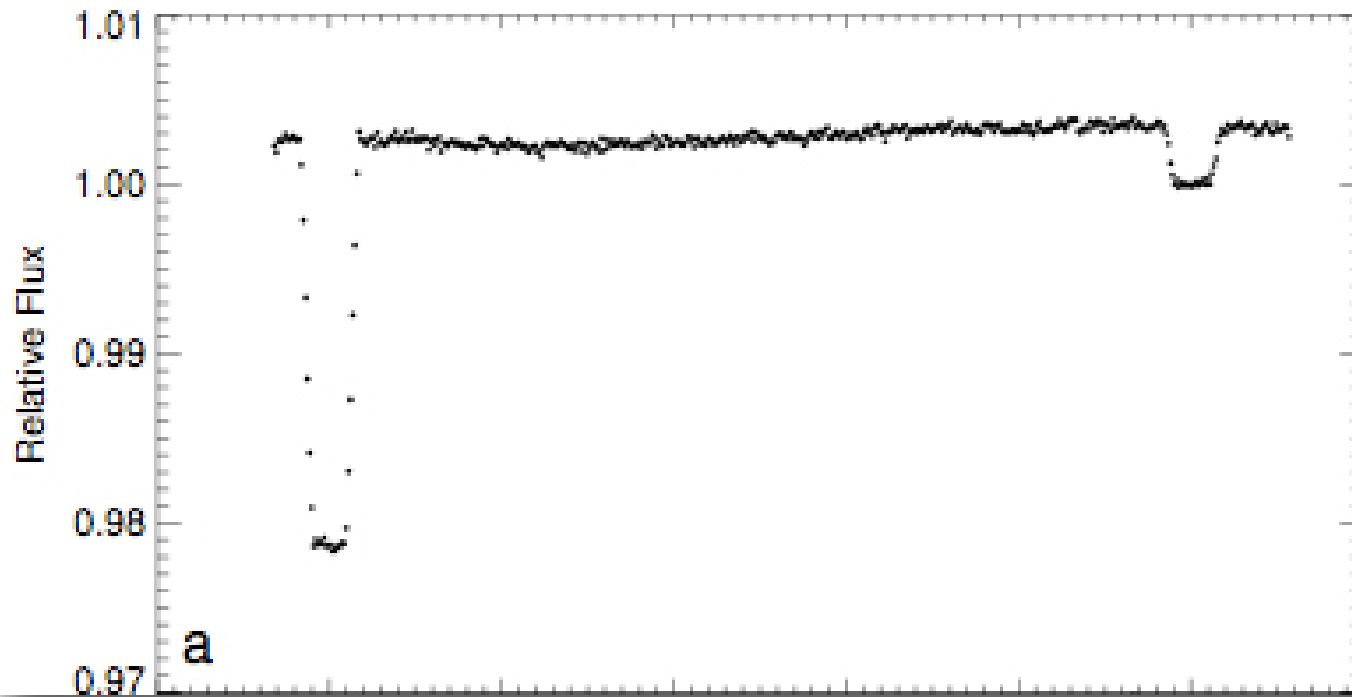
R/R_{jup}	R/R_{jup}	M_{core}
10.5 gm/cc	5.5 gm/cc	
0.594	0.662	89.3
0.681	0.745	74.5
0.769	0.818	60.0
0.866	0.905	
43.6		

-  molecular hydrogen and helium
-  liquid metallic hydrogen
-  heavy element core

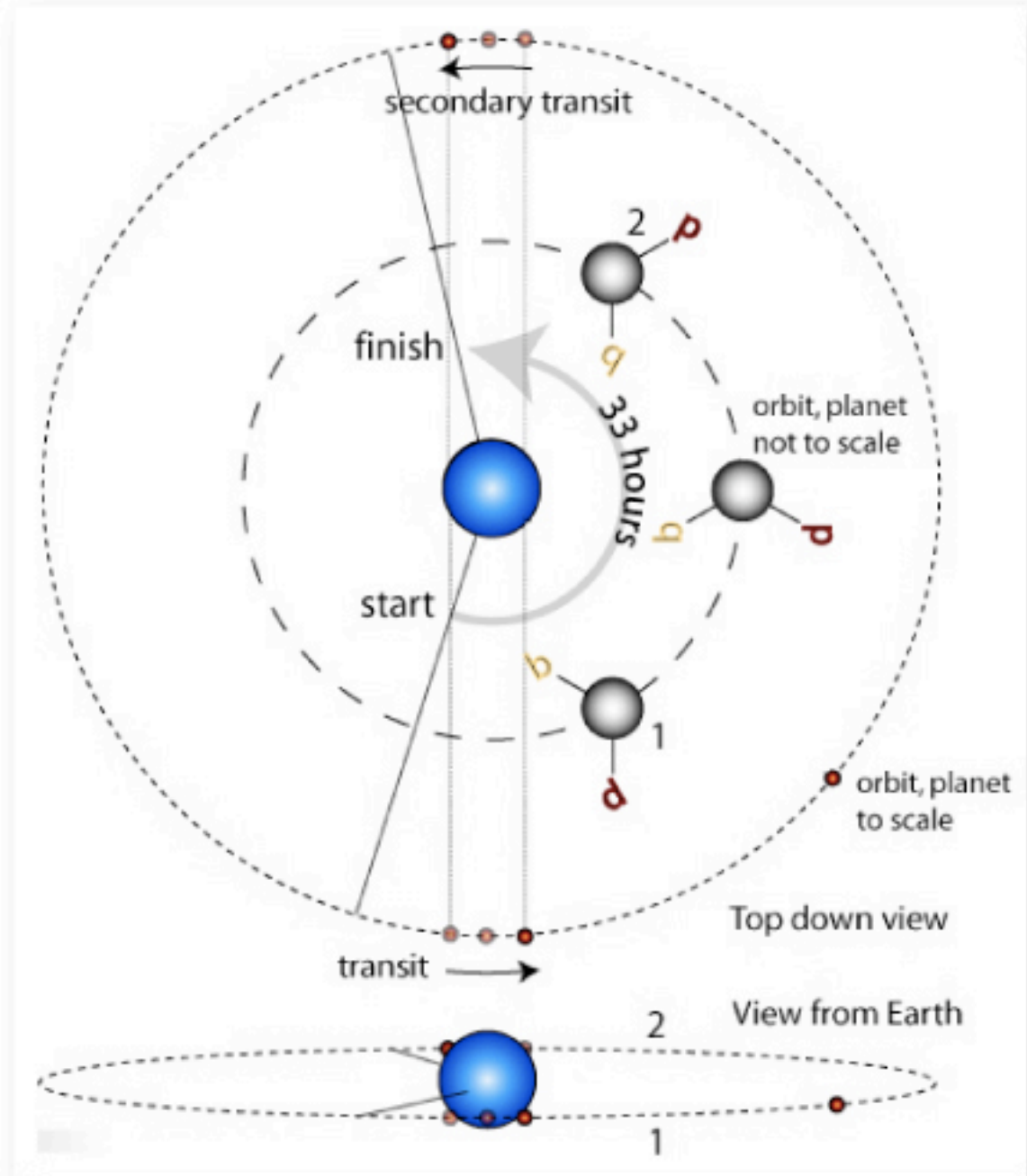
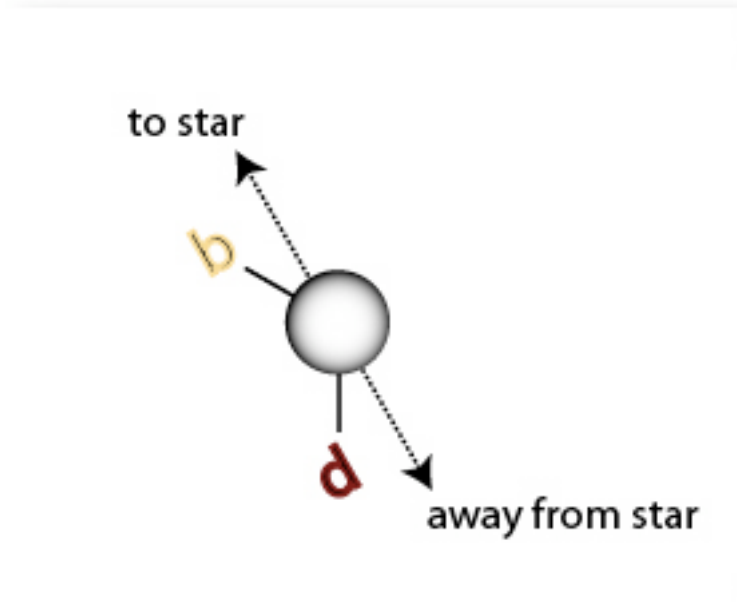
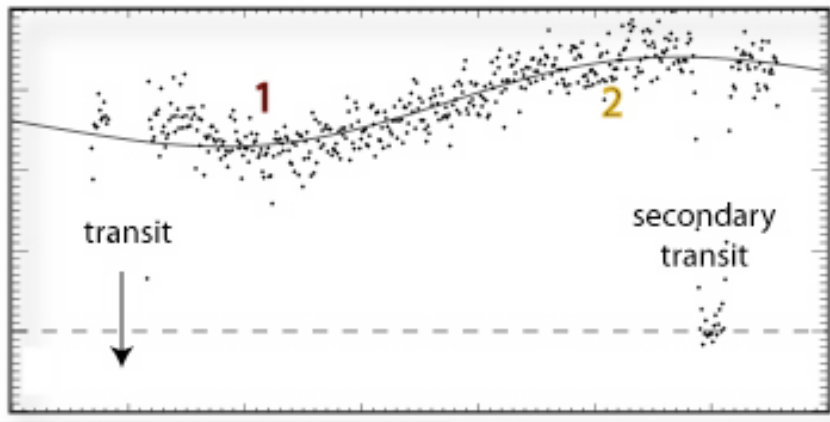




	Planet		Orbit				R
	Mpl [M _J]	Rpl [R _J]	P [days]	Ttr [JD-2450000]	i [°]	a [AU]	
<i>OGLE-TR-10</i>	0.61 (0.13)	1.122 (+0.12-0.07)	3.101278 (_4)	3890.678 (_1)	87.2-90	0.04162 (0.00069)	[Konacki05]Pont0
<i>OGLE-TR-56</i>	1.29 (0.12)	1.30 (0.05)	1.211909 (_1)	3936.598 (_1)	81.0 (2.2)	0.0225 (0.0004)	[K03]Torres04/Po
<i>OGLE-TR-111</i>	0.52 (0.13)	1.01 (0.04)*	4.0144479 (_41)	3799.7516 (_2)	88.1 (0.5)	0.0467 (0.005)	[Pont04]Santos06
<i>OGLE-TR-113</i>	1.32 (0.19)	1.09 (0.03)	1.4324757 (_13)	3464.61665(_10)	88.8-90	0.0229 (0.0002)	[Bouchy04]Bouch
<i>OGLE-TR-132</i>	1.14 (0.12)	1.18 (0.07)	1.689868 (_3)	3142.5912 (_3)	81.5 (1.6)*	0.0299*	[Bouchy04]Gillon
<i>HD189733</i>	1.15 (0.04)	1.156 (0.046)	2.2185733 (_19)	3988.80336 (_23)	85.76 (0.29)	0.031 (0.001)	[Bouchy05]Winn
<i>HD149026</i>	0.330 (0.02)	0.726 (0.064)	2.87598 (_15)	3527.87455 (_90)	85.8 (+1.6-1.3)	0.042	[Sato05]Charbonn
<i>TrES-1</i>	0.76 (0.05)	1.081 (0.029)	3.0300737 (_26)	3186.80603 (_28)	>88.4	0.0393 (0.0011)	[Alonso04]Sozett
<i>TrES-2</i>	1.198 (0.053)	1.220 (+.045-.042)	2.47063 (_1)	3957.6358 (_10)	83.90 (0.22)	0.0367 (+_12-_05)	[ODonovan06] So
<i>TrES-3</i>	1.92 (0.23)	1.295 (0.081)	1.30619 (_1)	4185.9101 (_3)	8215 (0.21)	0.0226 (0.0013)	[ODonovan07]
<i>HD209458</i>	0.657 (0.006)	1.320 (0.025)	3.52474859 (_38)	2826.628521 (_87)	86.929 (0.010)	0.047 (+.001-.003)	[Charbonneau00]
<i>XO-1</i>	0.90 (0.07)	1.184 (+.028-.018)	3.941534 (_27)	3887.74679 (_15)	89.36 (+.46-.53)	0.0488 (0.0005)	[McCullough06]H
<i>XO-2</i>	0.98 (0.02)	0.964 (+.02-.009)	2.615838 (_8)	4147.74902 (_20)	>88.35		[Burke07]
<i>HAT-P-1</i>	0.53 (0.04)	1.36 (+.11-.09)	4.46529 (_9)	3984.397 (_9)	85.9 (0.8)	0.0551 (0.0015)	[Bakos07]
<i>HD147506</i>	8.17 (0.72)	1.18 (0.16)	5.63341 (_13)	4212.8561 (_23)	90.0 (1.0)	0.0685 (0.0017)	[Bakos07]
<i>WASP-1</i>	0.867 (0.073)	1.443 (0.039)	2.519961 (_18)	4013.31269 (_47)	>86.1	0.0382 (0.0013)	[Cameron06]Shpc
<i>WASP-2</i>	0.81-0.95	1.038 (0.050)	2.152226 (_4)	4008.73205 (_28)	84.74 (0.39)	0.0307 (0.0011)	[Cameron06]Char
<i>GJ436</i>	0.071 (0.006)	0.35 (0.03)	2.64385 (_9)	4222.616 (_1)	86.5 (0.2)	0.028 (0.001)	[Gillon07]

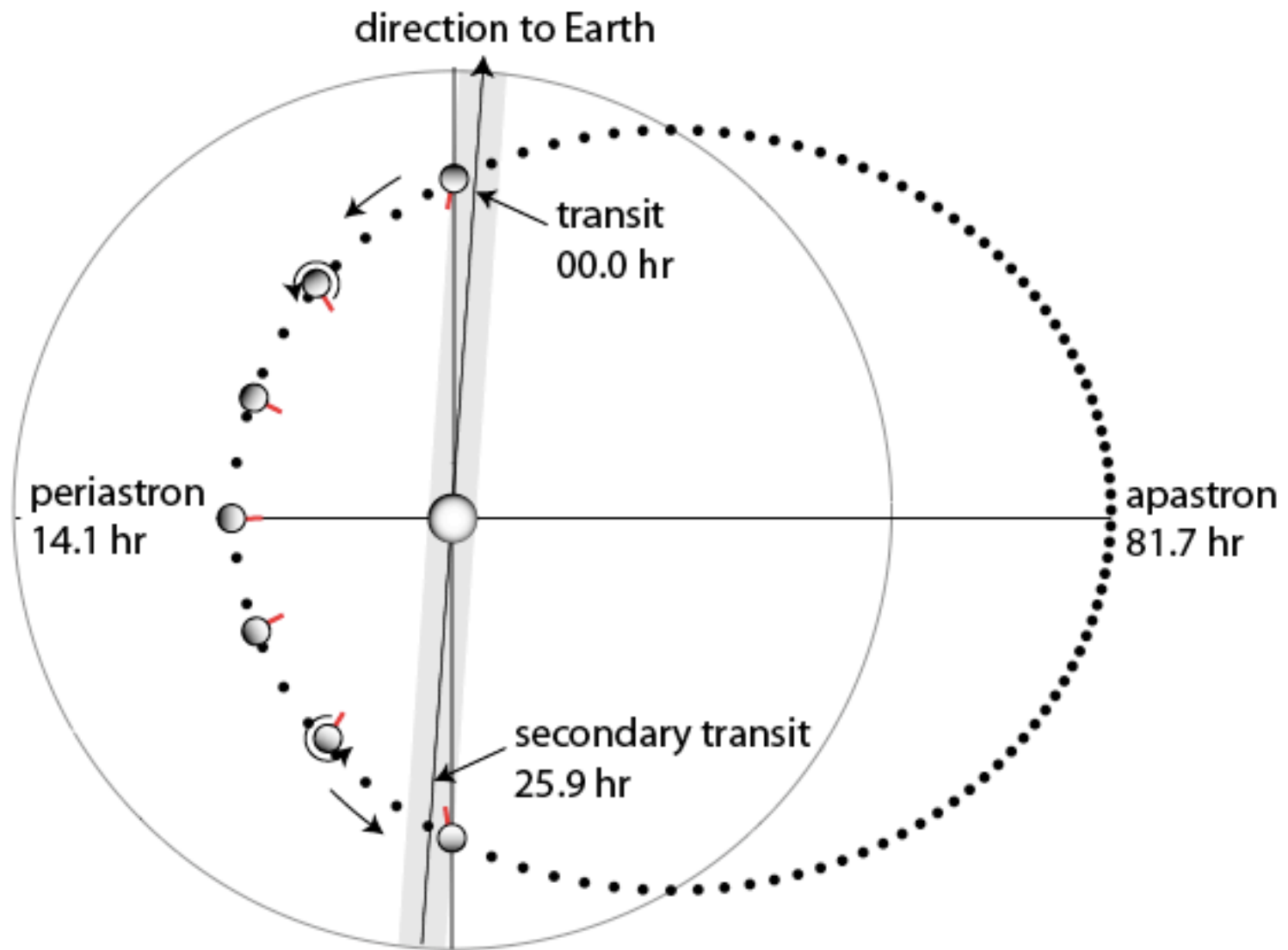


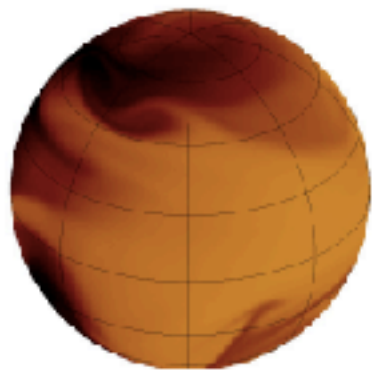
Incredible follow-up observations are being made with Spitzer. These observations of HD 189733 come from Knutson et al. 2007.



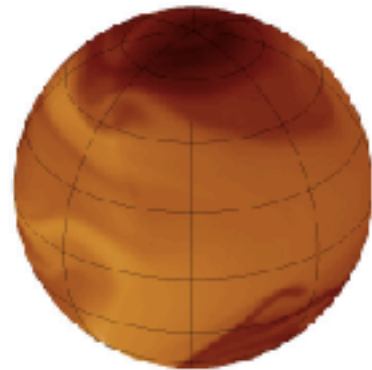
Interpretation of the result: Hottest and coldest spots are on the same side of the planet.

HAT-P-2b

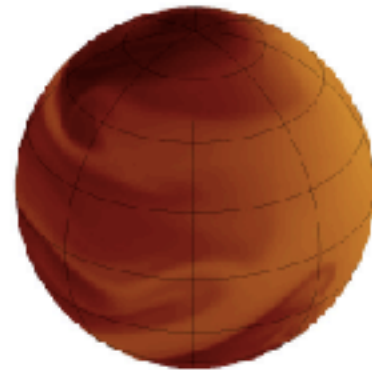




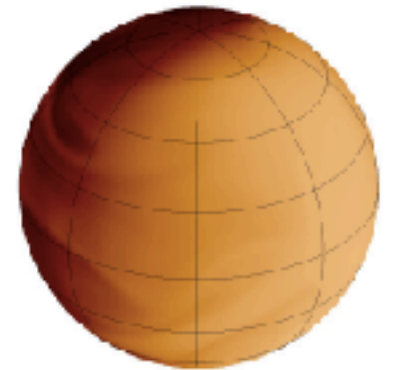
0.00 hr
(apastron)



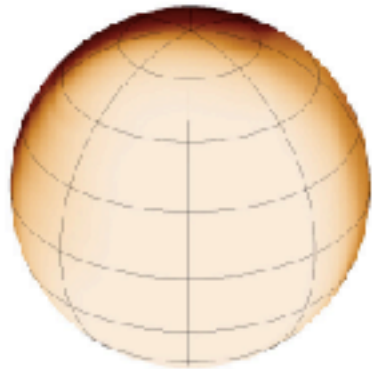
19.2 hr



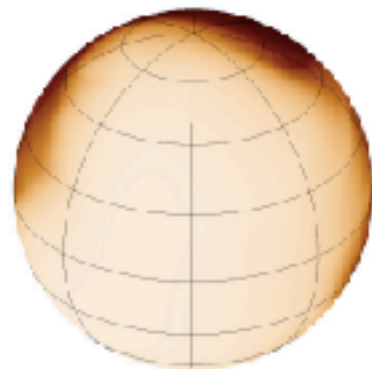
38.4 hr



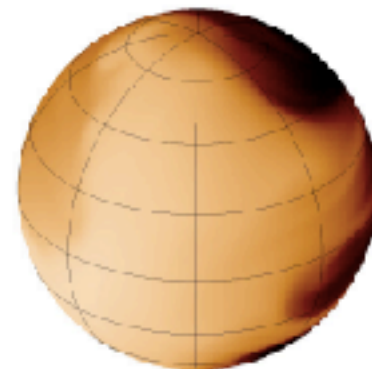
76.8 hr



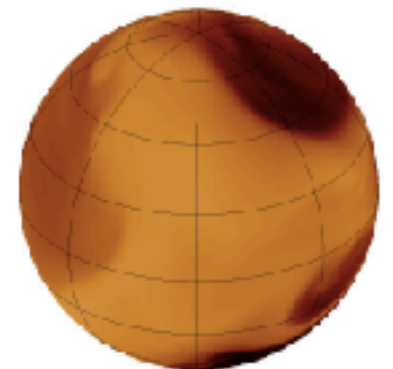
96.0 hr



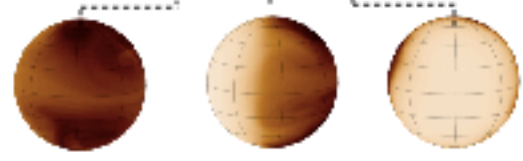
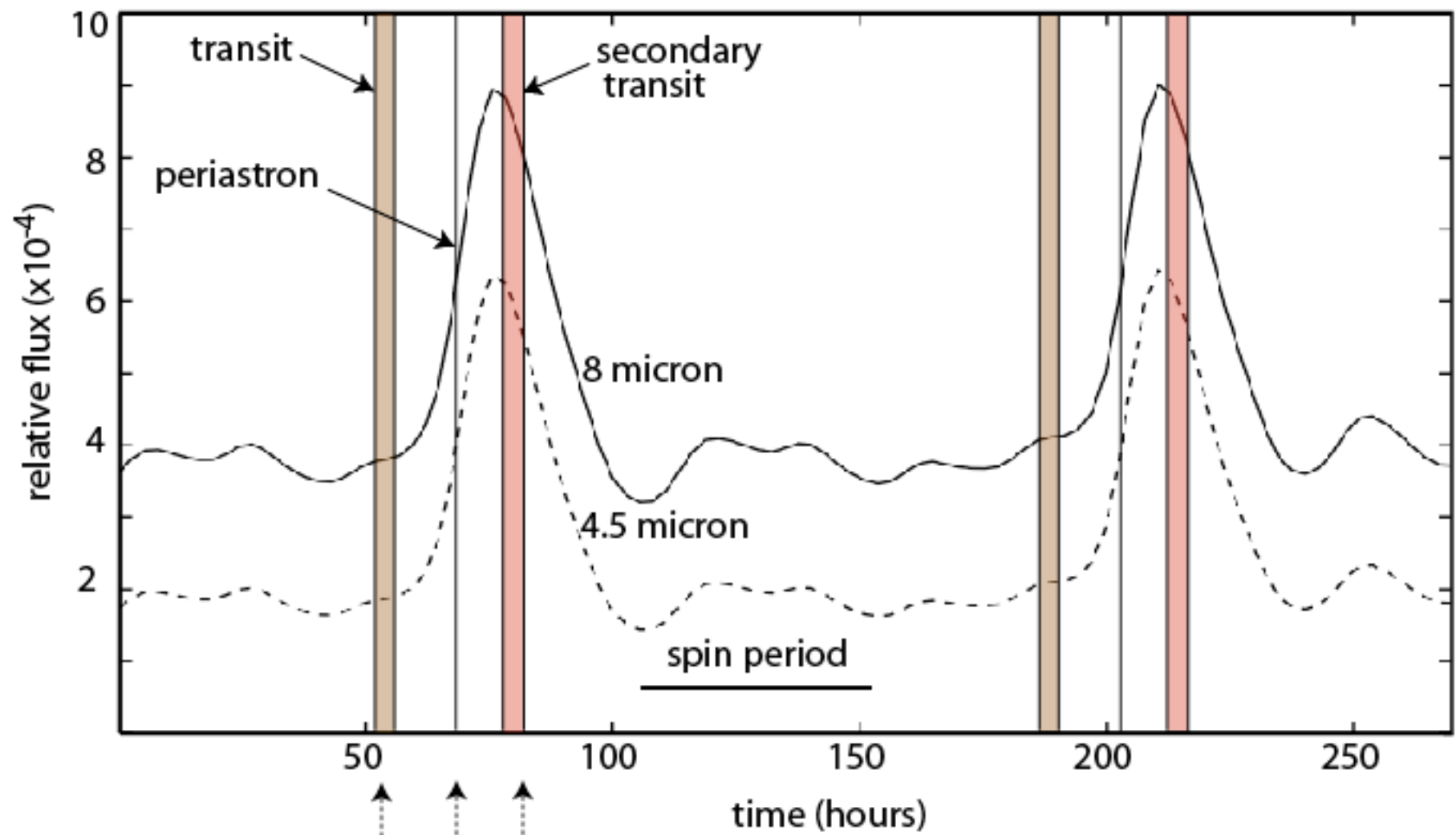
115.2 hr



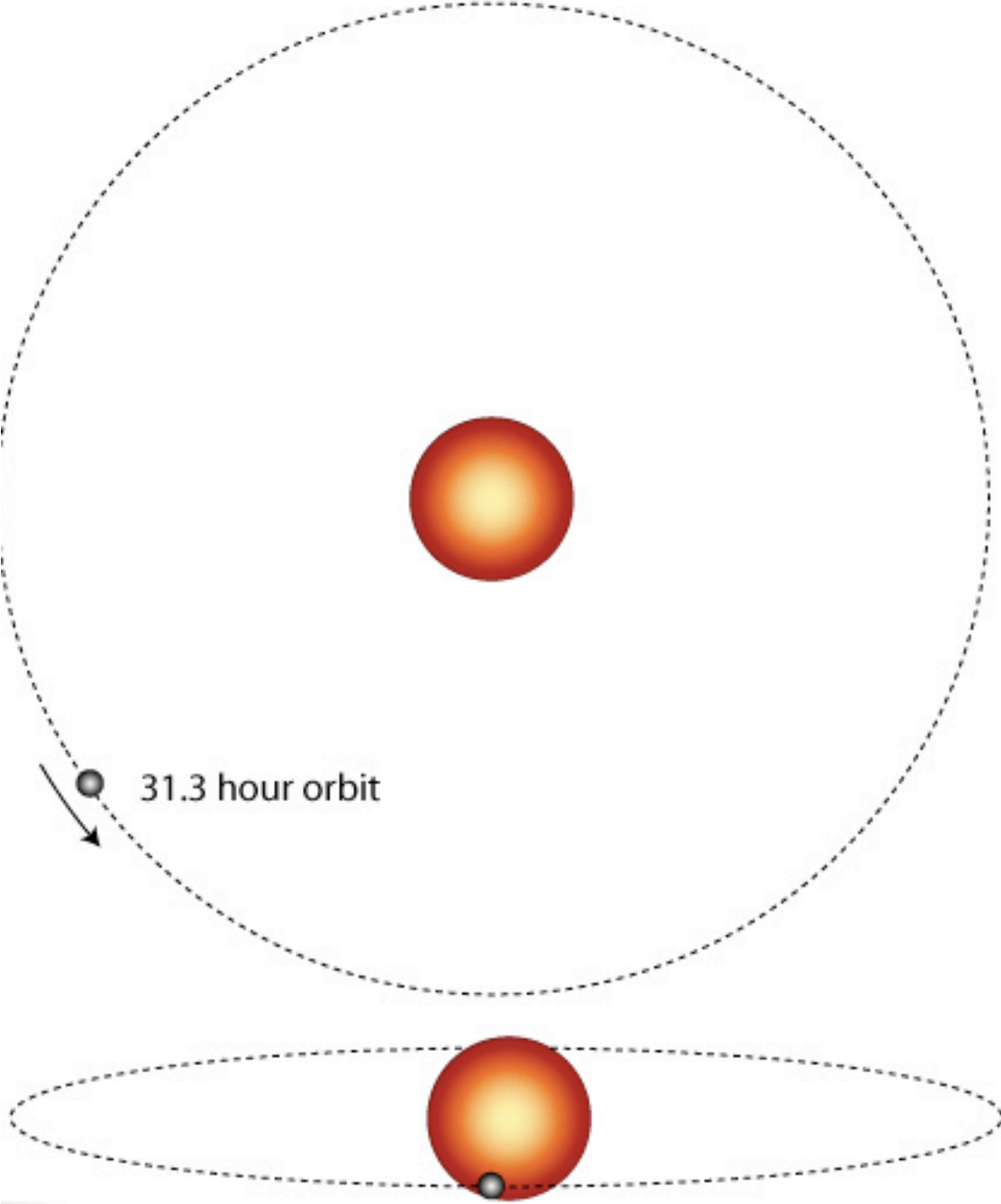
134.4 hr

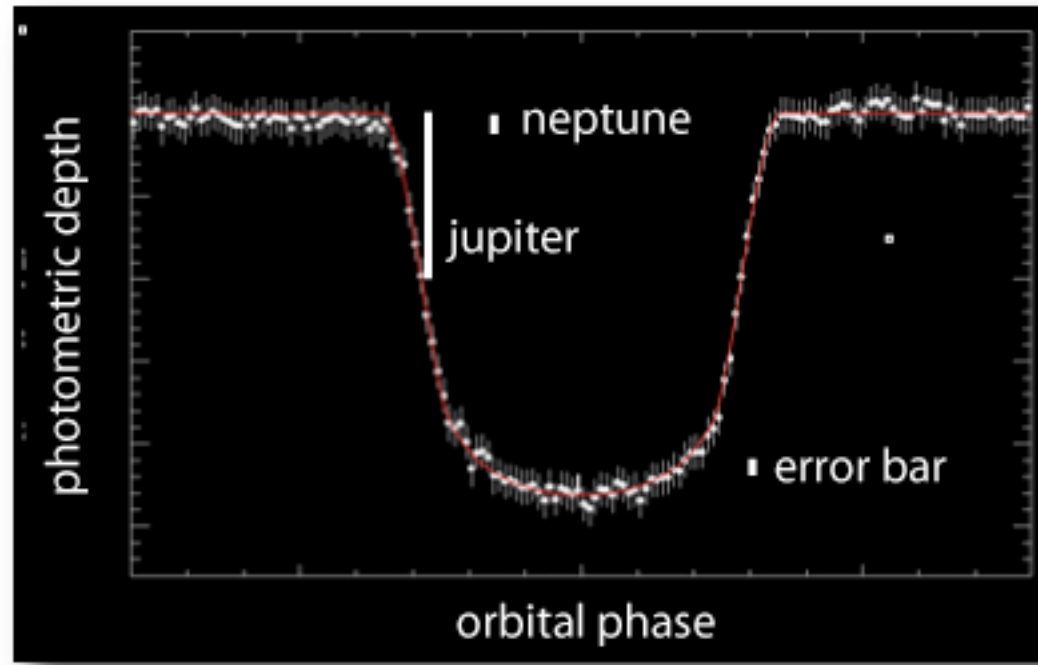


153.6 hr



TrES-3b to Scale

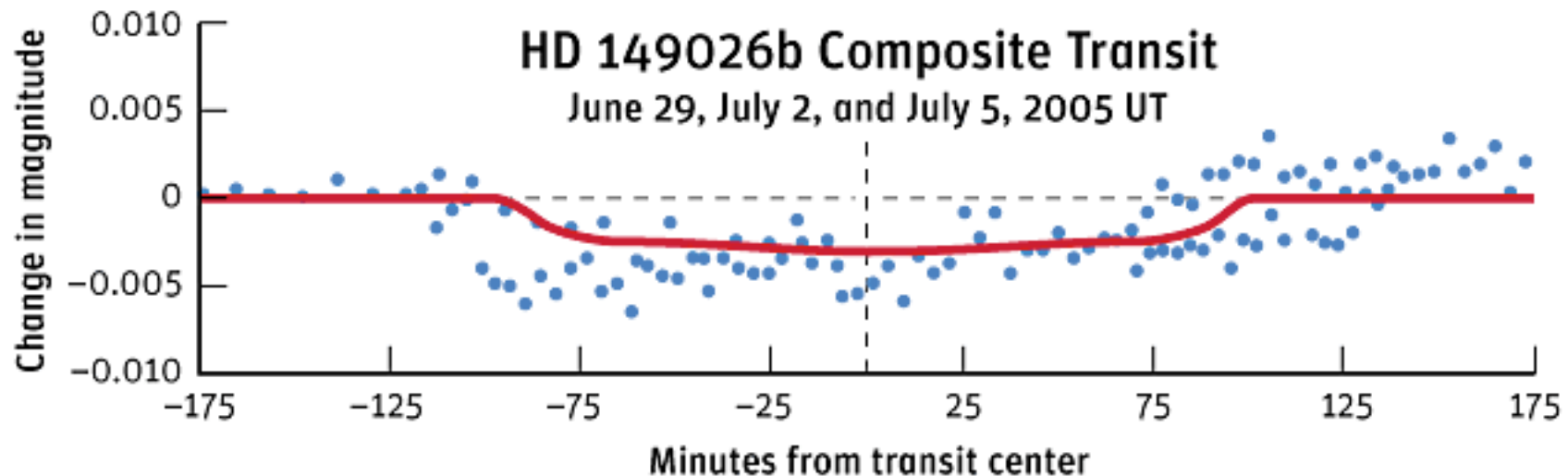




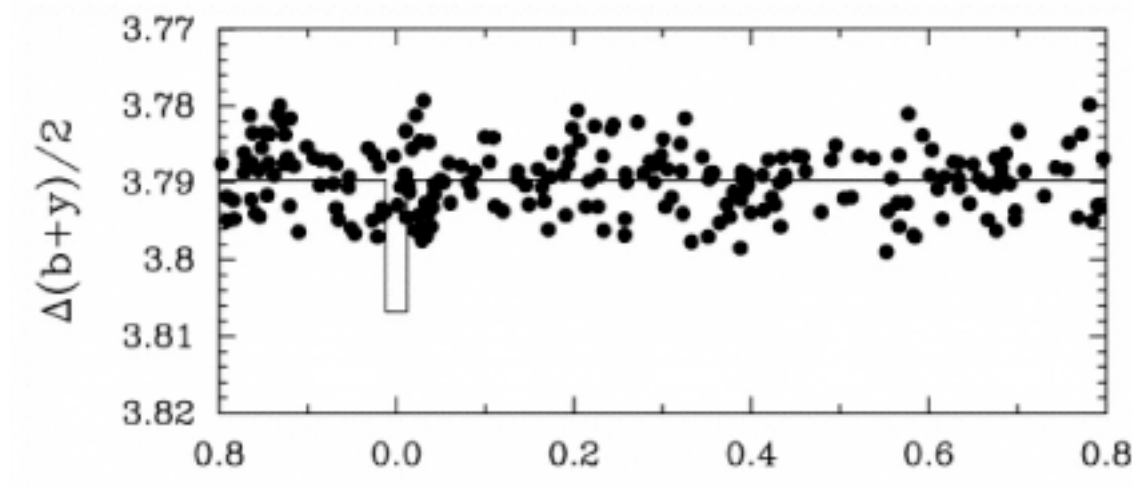
CoRoT's precision is turning out to be excellent...



Amateur astronomer Ron Bissinger observed the HD 149026b transit from his backyard in Pleasanton as soon as the transit was announced



GI 436 was the first Neptune-mass planet discovered
(Butler et al. 2004)



Folded photometry (taken over a baseline of several years)
showed no indication of a transit.

Detection of transits of the nearby hot Neptune GJ 436 b

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S. Udry¹, C. Vuissoz⁵

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⁴ School of Physics and Astronomy, Raymond and Beverly Sackler Faculty of Exact Sciences, Tel Aviv University, Tel Aviv, Israel

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Received date / accepted date

Abstract. This Letter reports on the photometric detection of transits of the Neptune-mass planet orbiting the nearby M-dwarf star GJ 436. It is by far the closest, smallest and least massive transiting planet detected so far. Its mass is slightly larger than Neptune's at $M = 22.6 \pm 1.9 M_{\oplus}$. The shape and depth of the transit lightcurves show that it is crossing the host star disc near its limb (impact parameter 0.84 ± 0.03) and that the planet size is comparable to that of Uranus and Neptune, $R = 25200 \pm 2200 \text{ km} = 3.95 \pm 0.35 R_{\oplus}$. Its main constituent is therefore very likely to be water ice. If the current planet structure models are correct, an outer layer of H/He constituting up to ten percent in mass is probably needed on top of the ice to account for the observed radius.

Key words. planetary systems – stars: individual: GJ 436 – techniques: photometry



OBSERVATOIRE

FRANÇOIS-XAVIER BAGNOUD

ST-LUC

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[What's new ?](#)

Welcome to the new OFXB website !

Location & Organisation

The François-Xavier Bagnoud Observatory (OFXB) is located above Saint-Luc, a small village laying in Val d'Anniviers - swiss Alps, nearby Sierre. OFXB is managed by a non-profit-making foundation. This project became reality in 1995 thanks to the generosity of the [FXB foundation](#).

What OFXB offers...

The site where OFXB has been built benefits from the Alps legendary tranquility and beauty. Several summits above 4000m are easily visible, especially the Matterhorn, providing scenic landscapes. Furthermore, it is famous for pure and steady nights, especially suited for astronomy observing. From experimented amateur astronomers to schoolchildren, the Observatory welcomes all and features a full range of activities thanks to available facilities : 60cm reflector equipped with an high performance CCD camera, 15cm apochromatic refractor and a fully equipped auditorium for 3D shows and conferences. Kitchen and lavatories are available for visitors. A funicular links the Observatory from the village.

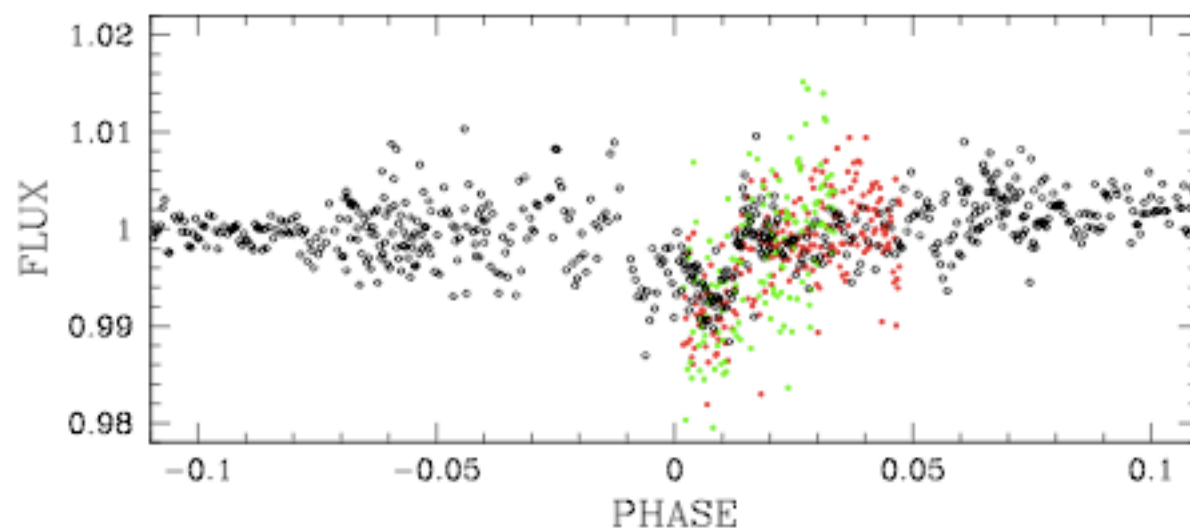


Fig. 1. OFXB (*black*) and Wise (*red: 1m, green: 46cm*) photometry phase-folded using the ephemerids and period presented in Maness et al. (2007).

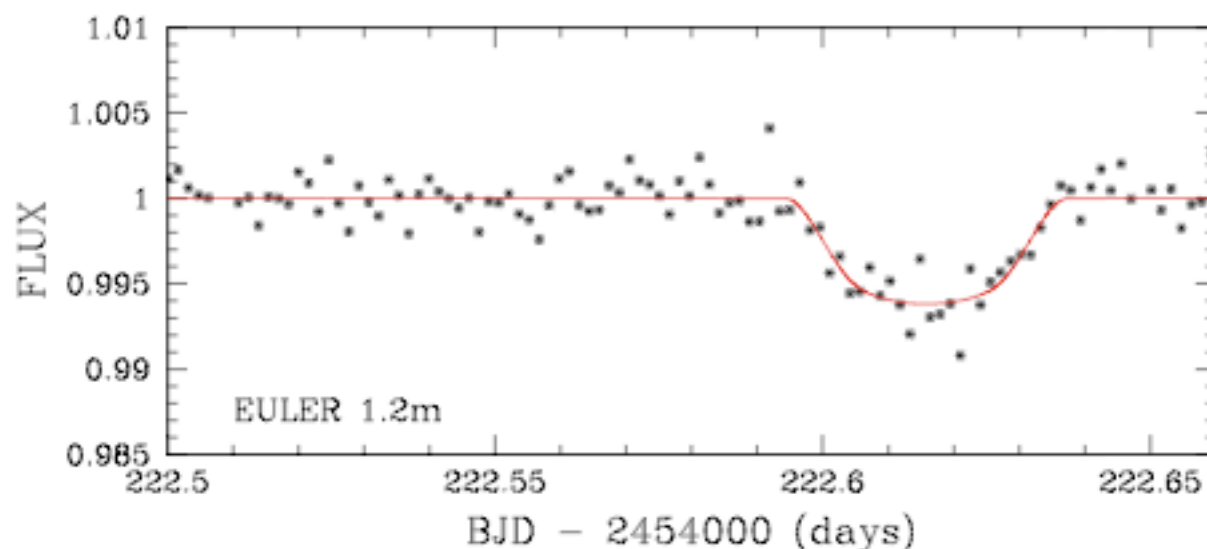
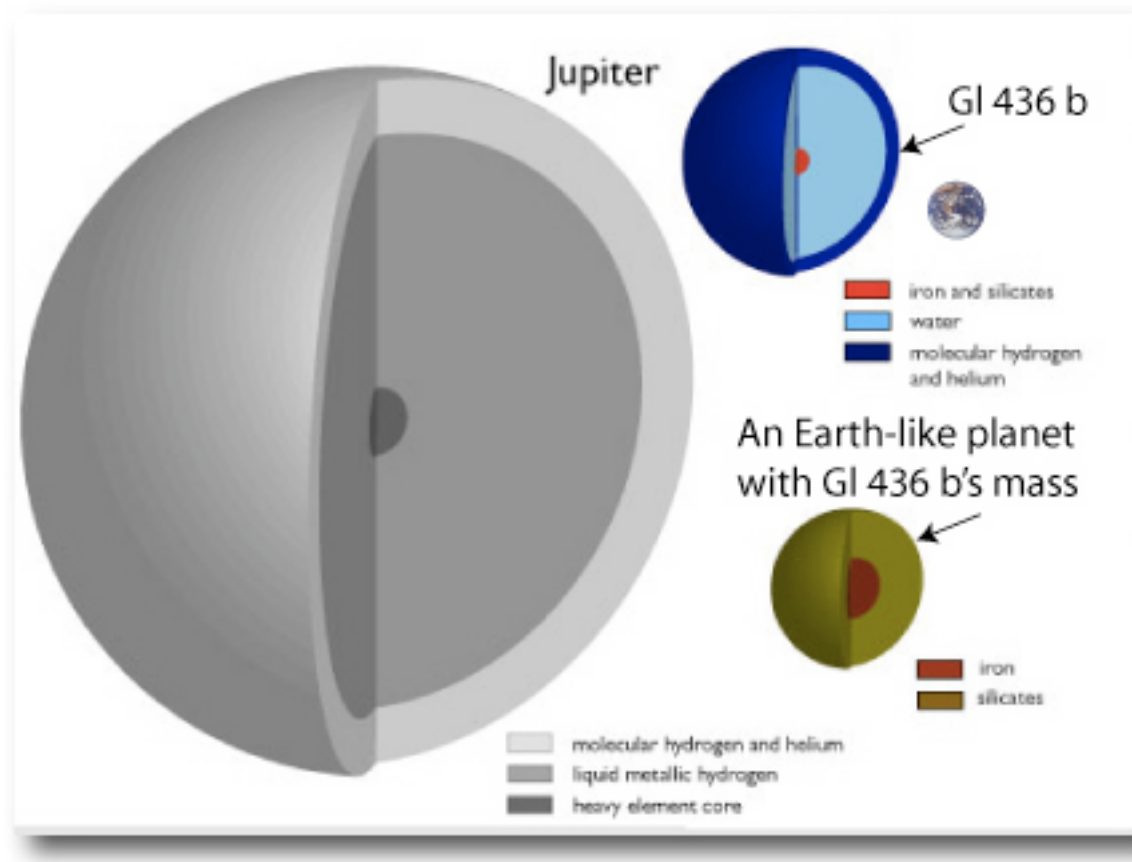
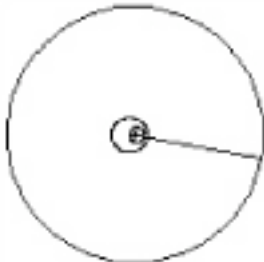

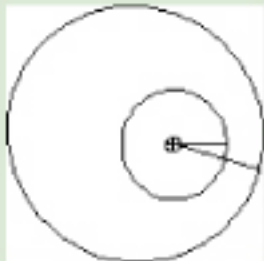

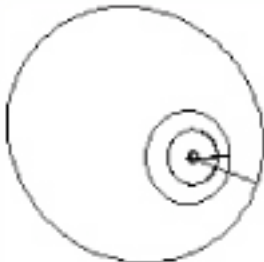

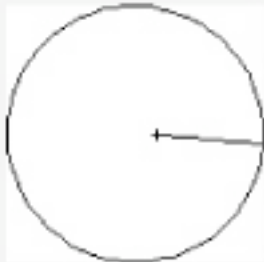



Fig. 2. Euler V-band transit photometry. The best-fit transit curve is superimposed in red.



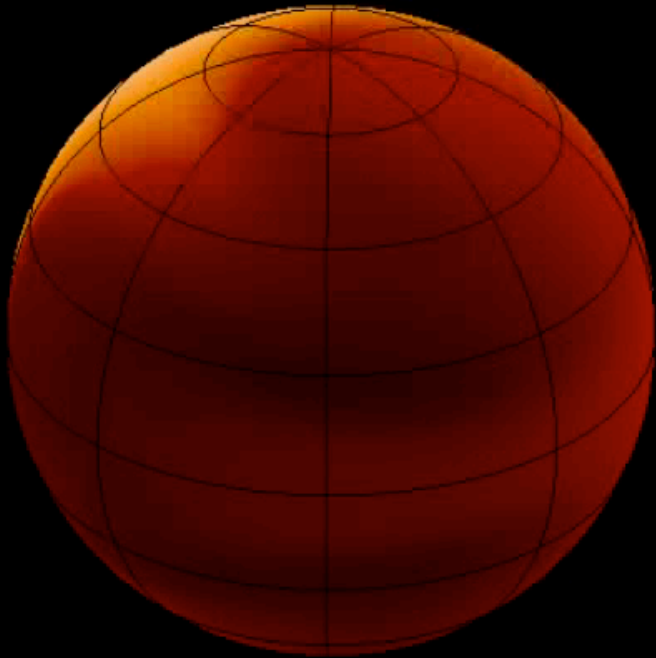
Gl 436 is made mostly of water. It migrated to its current location

Stable fits for gj436_M07K

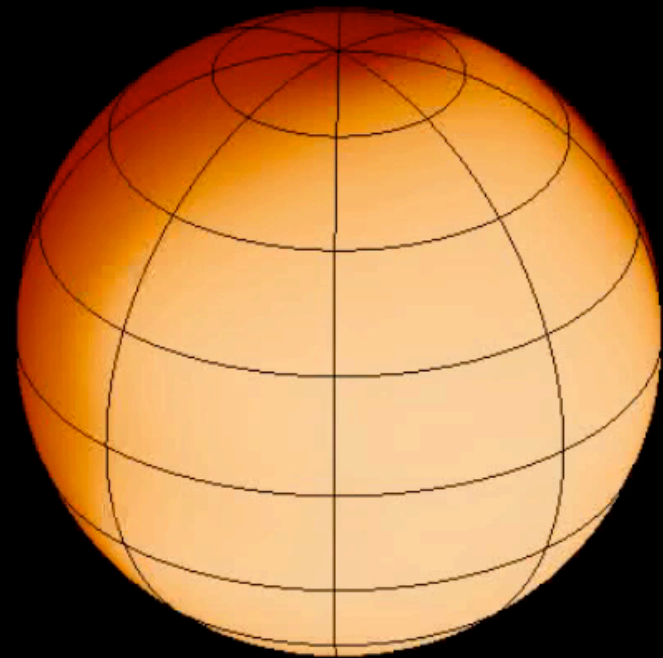
	χ^2	Planets	Uploaded on	by
	2.46	4	2006-12-16, 08:47:45	flanker
			 Stable for at least 1000 years	
	2.72	3	2007-04-28, 02:59:25	schneidi
			 Stable for at least 100 years	
	3.71	4	2006-12-14, 18:55:48	EricFDiaz
			 Stable for at least 1000 years	
	4.40	1	2007-04-24, 05:36:14	eugenio
			 Stable for at least 100 years	

There are strong indications (from radial velocity fitting) that the Gl 436 system contains multiple planets.

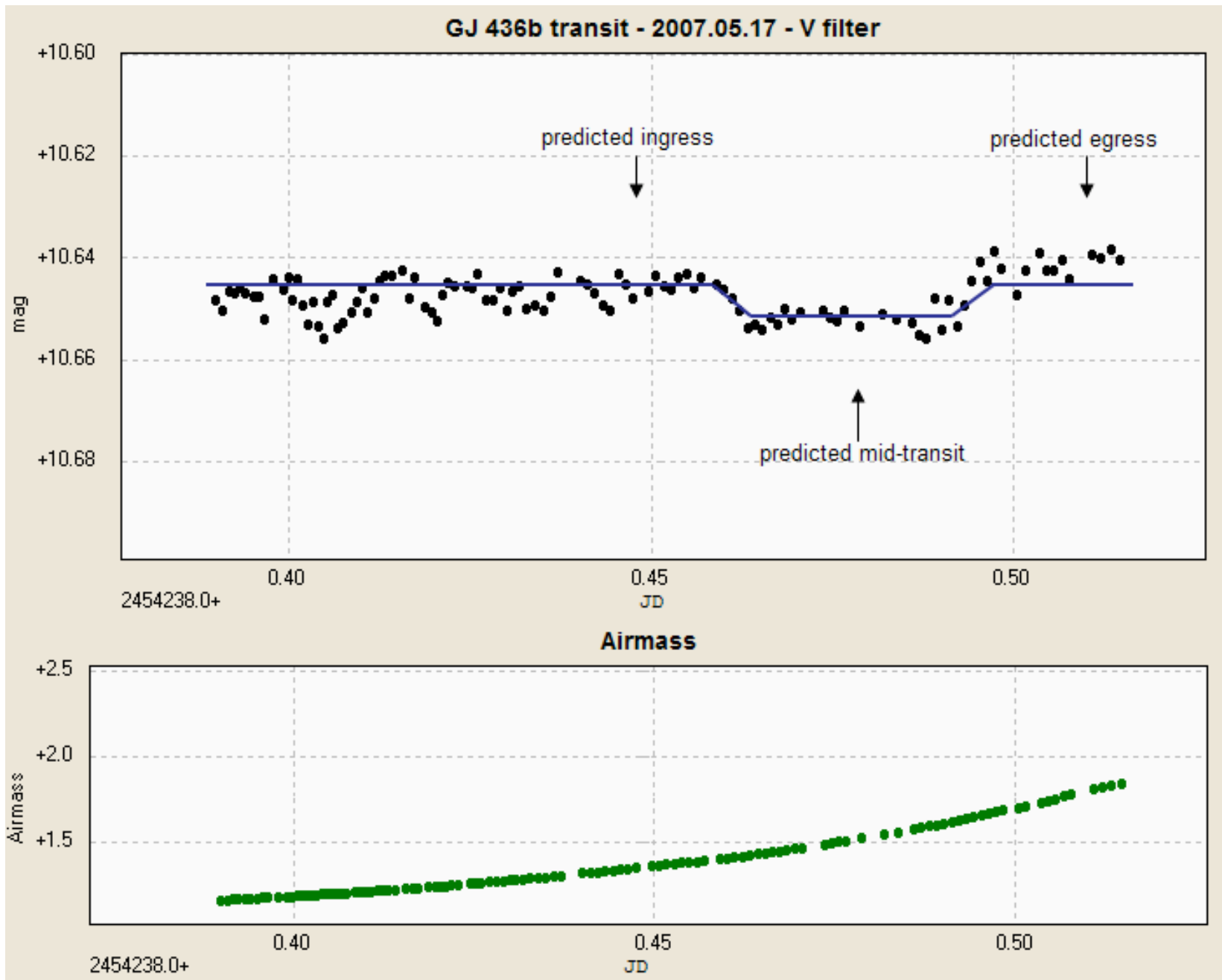
Weather forecast for Gl 436b (2 full orbits)



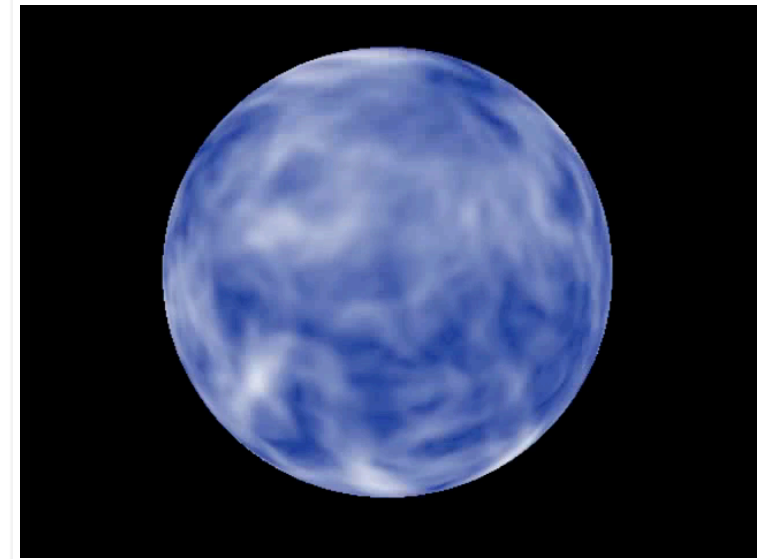
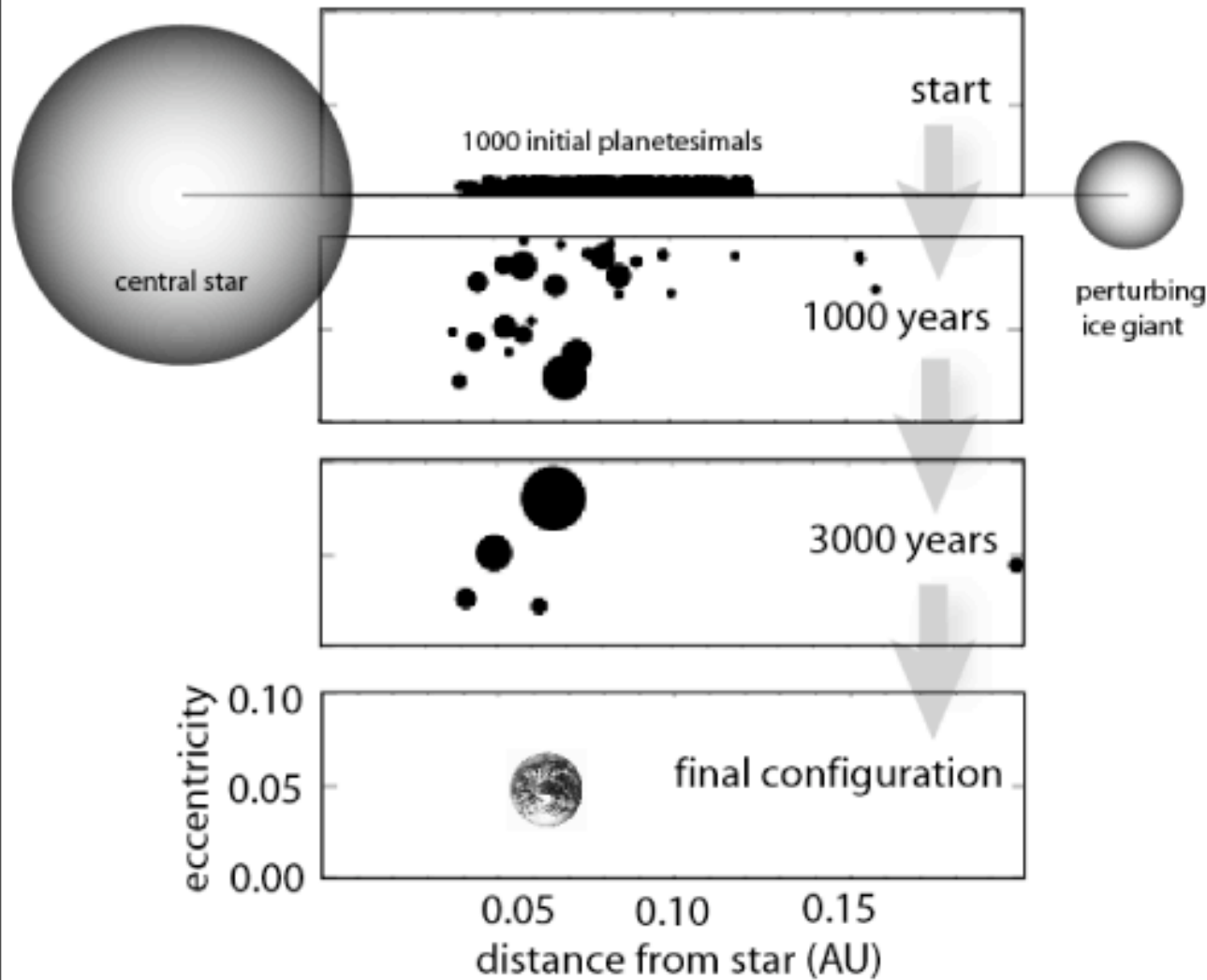
Western Hemisphere



Eastern Hemisphere



Data taken last night by Tonny Vanmunster (Belgium)



Hydrodynamical simulation of the atmospheric flow on Gl 581

Our simulations of planet formation are indicating that it's very likely that Earth-size planets are common on short-period orbits around low-mass stars.

I predict that within a year, there will be an RV+photometric ground-based detection of a potentially habitable planet transiting an M dwarf.

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