the new CoRoT planets

CoRoT Exoplanet Science Team

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introduction

the Team

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Brazil		S. Ferraz-Mello

introduction

the new CoRoT planets

1. CoRoT-20c: see talk by **F. Bouchy/G. Montagnier**
2. LRa02 E1 1475: see talk **by F. Bouchy/G. Montagnier**
3. CoRoT-24: update on the drift
4. CoRoT-25b: Saturn-like exoplanet
5. CoRoT-26b: low mass hot Jupiter
6. CoRot-27b: massive and dense super Jupiter
7. CoRoT-28b: low mass hot Jupiter around a old star
8. CoRoT-29b: hot Jupiter around faint star
9. CoRoT-30b: hot Jupiter, 9 days orbit
10. CoRoT-31b: hot Jupiter around faint star
11. CoRoT-32b: interesting case $\rightarrow$ see talk by **D. Gandolfi**

CoRoT-24

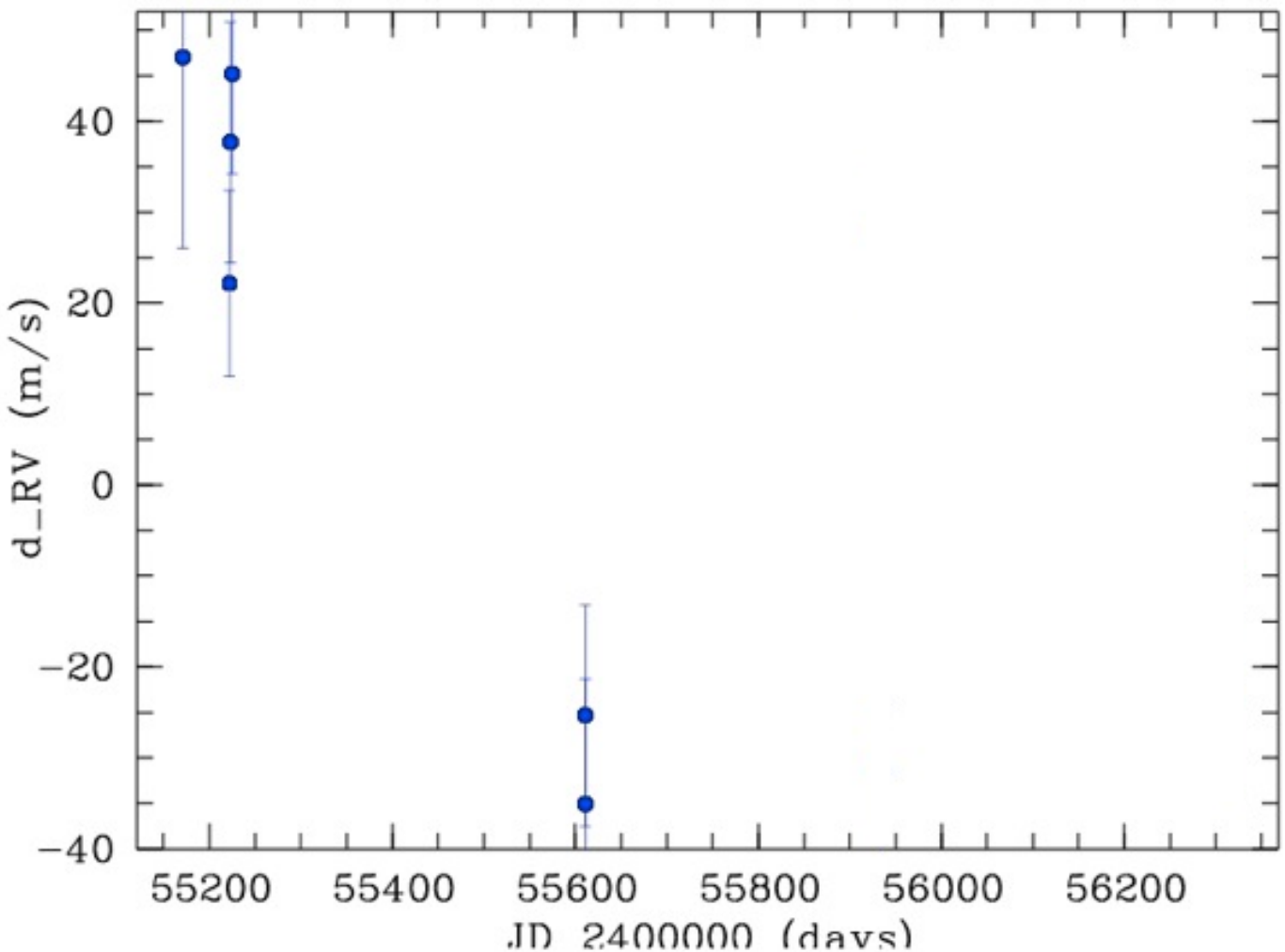
what you already know

Alonso et al. in preparation

- system of two transiting planets, sizes of Neptune
- planet b, period 5.1d; planet c, period 11.8
- host star K1V, solar metallicity, $\log g = 4.6$, V=15.1 mag
- discovered in LRa02 (winter 2008/09) 115 days of observation
- many HARPS and Keck measurements unable to fully constrain masses
- long term drift in RV

CoRoT-24

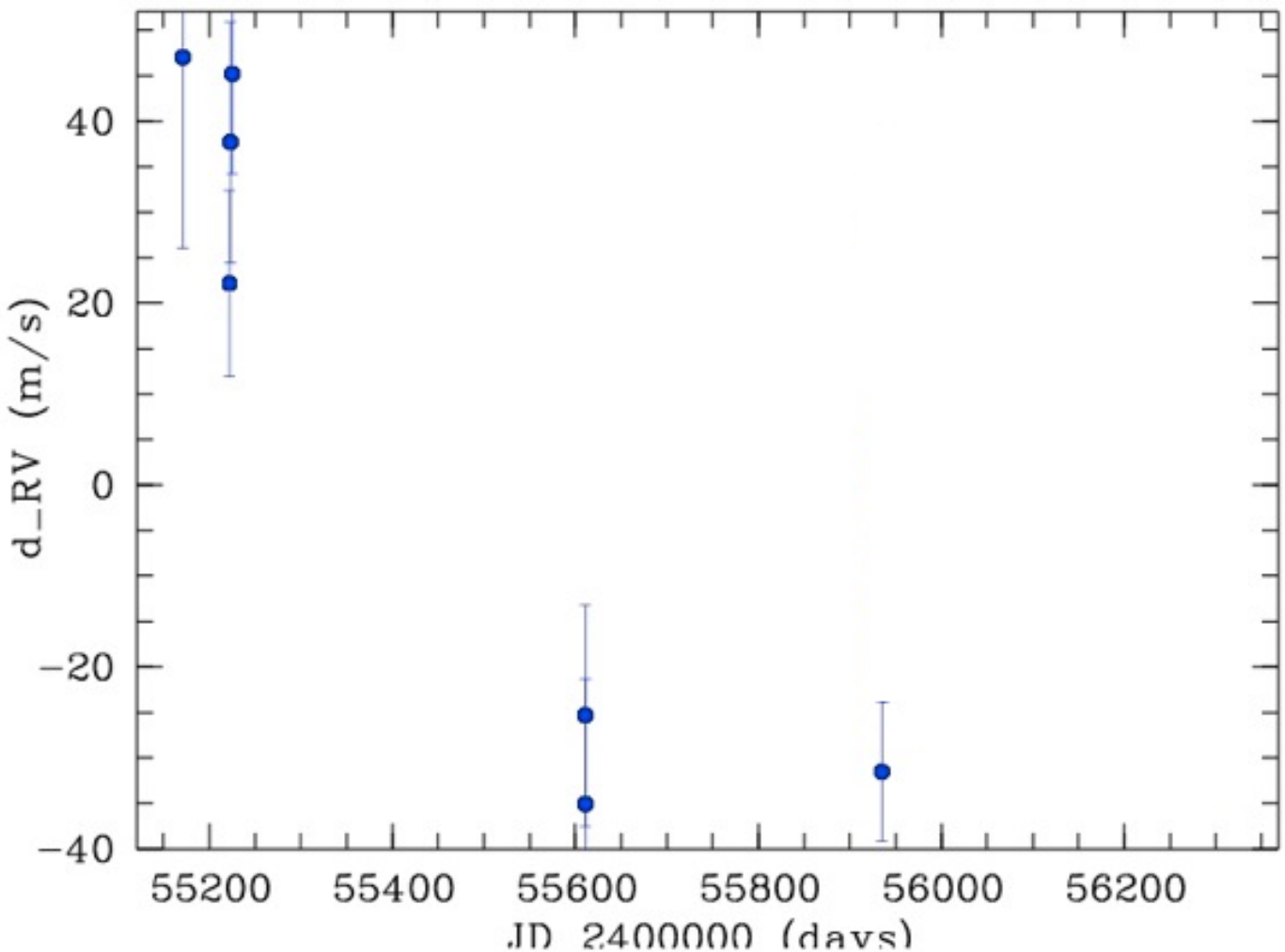
update on the drift



Keck measurements courtesy M. Endl

CoRoT-24

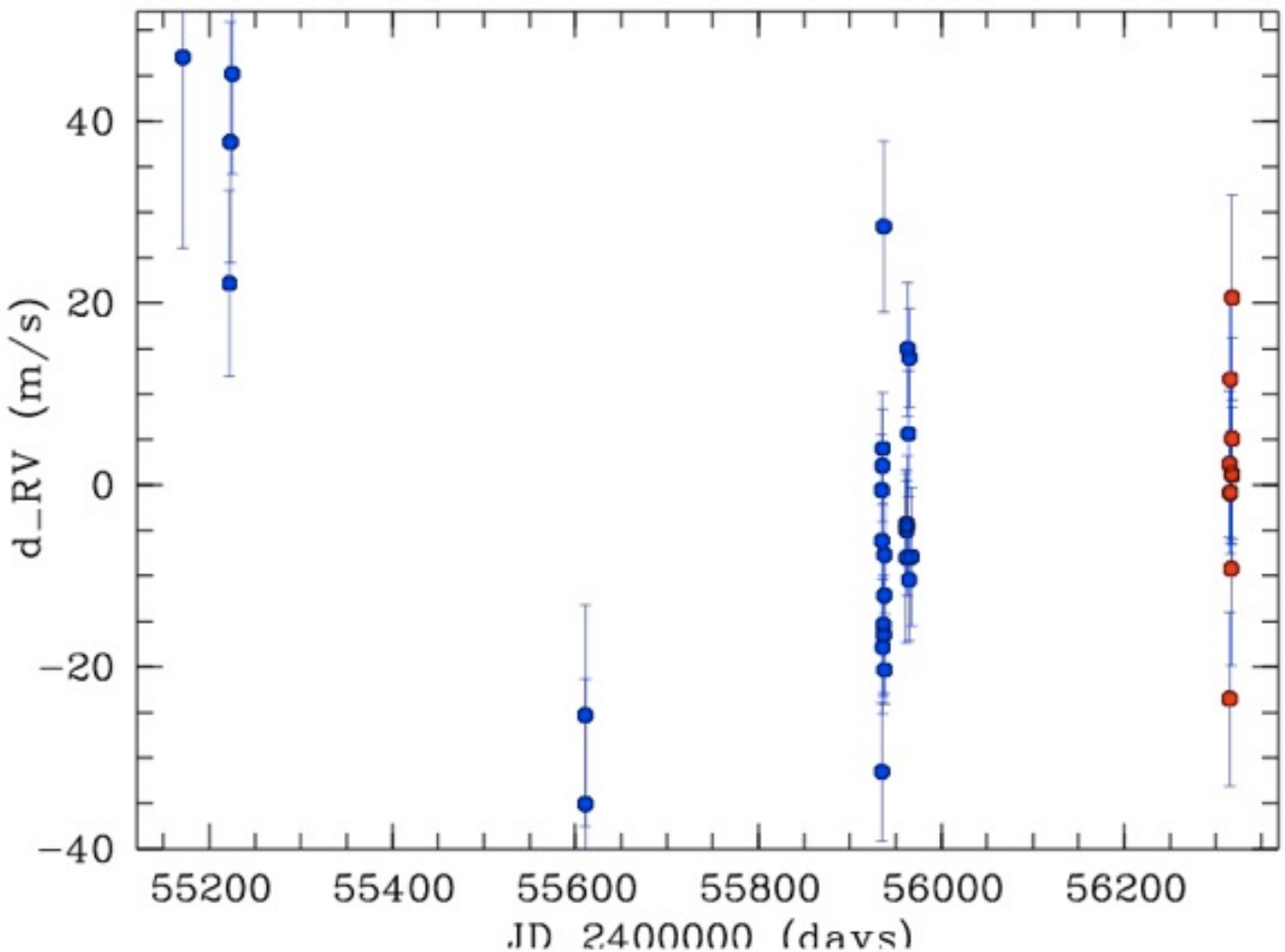
update on the drift



Keck measurements courtesy M. Endl

CoRoT-24

update on the drift



Keck measurements courtesy M. Endl

CoRoT-25b

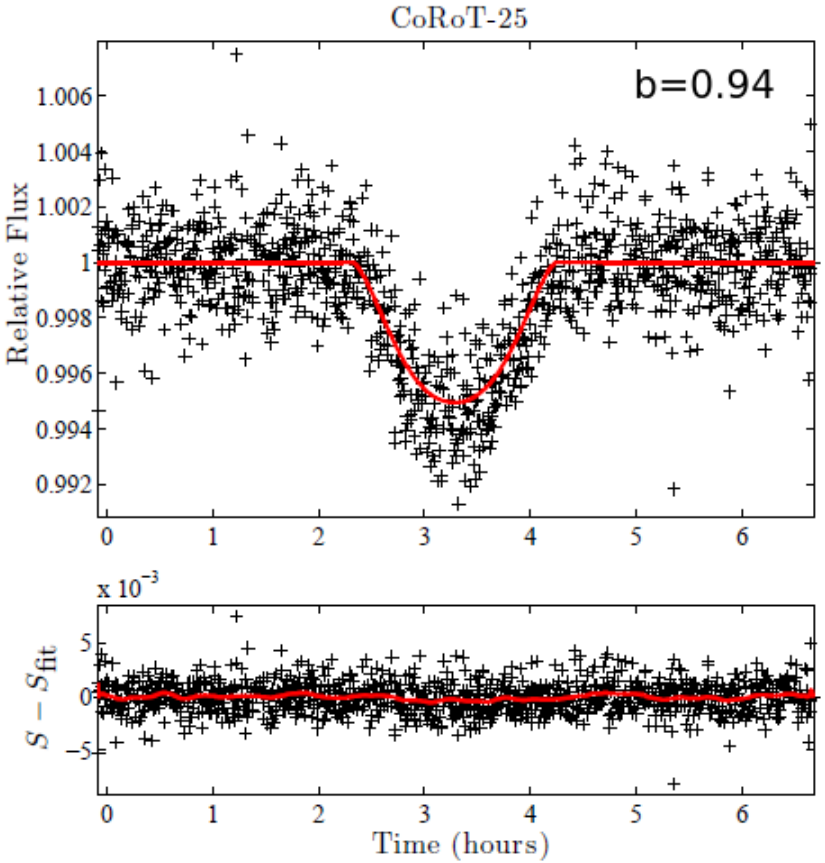
Saturn-like planet

Almenara et al. A&A, submitted

- Saturn-like exoplanet in short period orbit
- 4.9d period, 0.3 Jupiter masses, 1.1 Jupiter radii (0.15 g cm^{-3})
- evolved F9 host star, 4.5Gyr, solar metallicity, $\log g = 4.3$, $A_V = 0.7$, 1kpc, V=15.0 mag
  - see talk by **G. Wuchterl**
- discovered in LRc02 (summer 2008) 145 days of observation
- core of tenths of Earth masses, heavy element fraction 0.52
  - see talk by **M. Havel**
- 28 HARPS measurements (9 double 1h consecutive exposures), 6 HIRES (2 double)
- K 30m/s, circular orbit

CoRoT-25b

Saturn-like planet



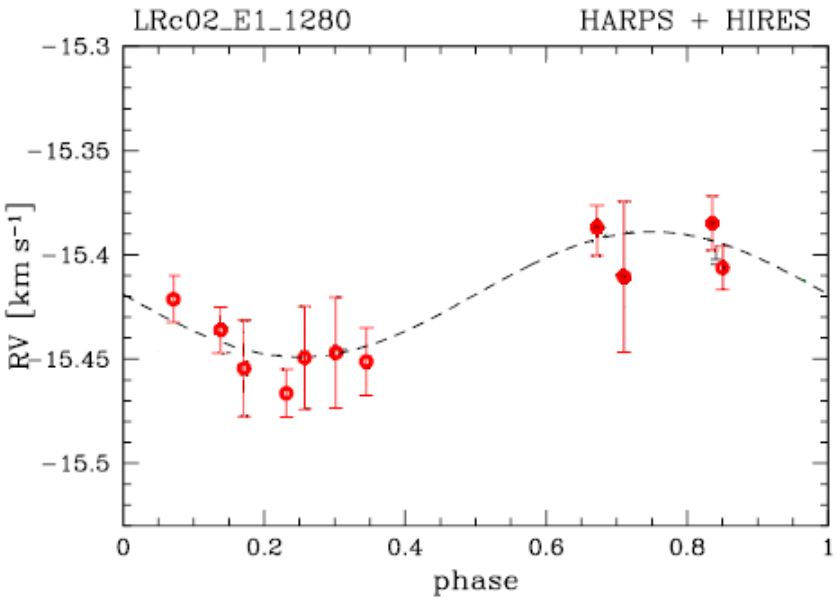


Fig. 3. Phase folded radial velocities of CoRoT-25. The black circle and green square correspond respectively to HARPS and HIRES measurements. The red open circle correspond to the averaged of the double measurements.

Almenara et al. 2013, A&A, submitted

CoRoT-26b

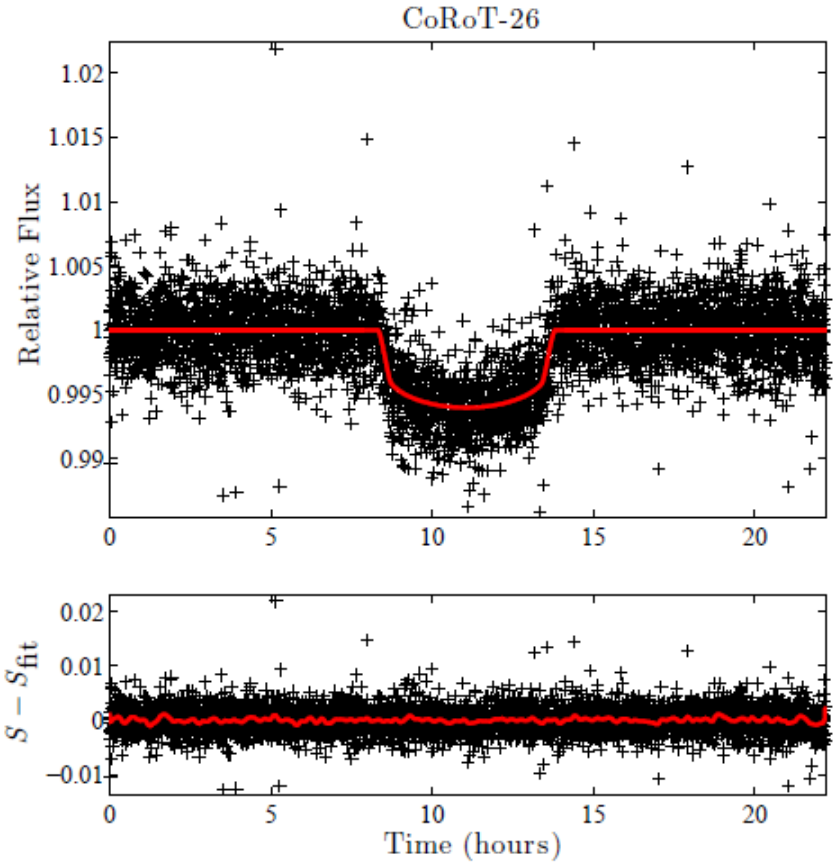
low mass hot Jupiter

Almenara et al. A&A, submitted

- low mass hot Jupiter
- 4.2d period, 0.5 Jupiter masses, 1.3 Jupiter radii (0.28 g cm^{-3})
- slightly evolved G5 host star, 9.1Gyr, solar metallicity, $\log g = 4.0$, $A_V = 0.85$, 1.7kpc, V=15.8 mag
  - see talk by **G. Wuchterl**
- discovered in LRc02 (summer 2008) 145 days of observation
- core of tenths of Earth masses, heavy element fraction 0.26
  - see talk by **M. Havel**
- 24 HARPS measurements (7 double 1h consecutive exposures)
- K 57m/s, circular orbit

CoRoT-26b

low mass hot Jupiter



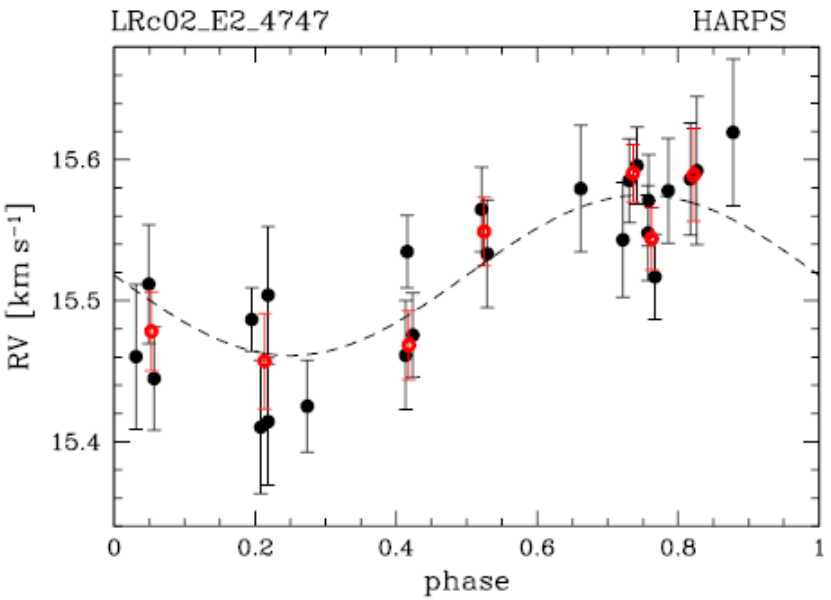


Fig. 5. Phase folded radial velocities of CoRoT-26. The black circle correspond respectively to HARPS. The red open circle correspond to the averaged of the double measurements.

Almenara et al. 2013, A&A, submitted

CoRoT-27b

the massive and dense super Jupiter

Parviainen et al. in preparation

- massive and dense super Jupiter in a short orbit
- 3.6d period, 10.4 Jupiter masses, 1.01 Jupiter radii (12.6 g cm^{-3})
- G2 host star, 4.2Gyr, solar metallicity, $\log g = 4.4$
  - see talk by **G. Wuchterl**
- discovered in LRc08 (summer 2011) 84 days of observation
- 13 HARPS measurements
- K 8.5 km/s, circular orbit

CoRoT-27b

the massive and dense super Jupiter

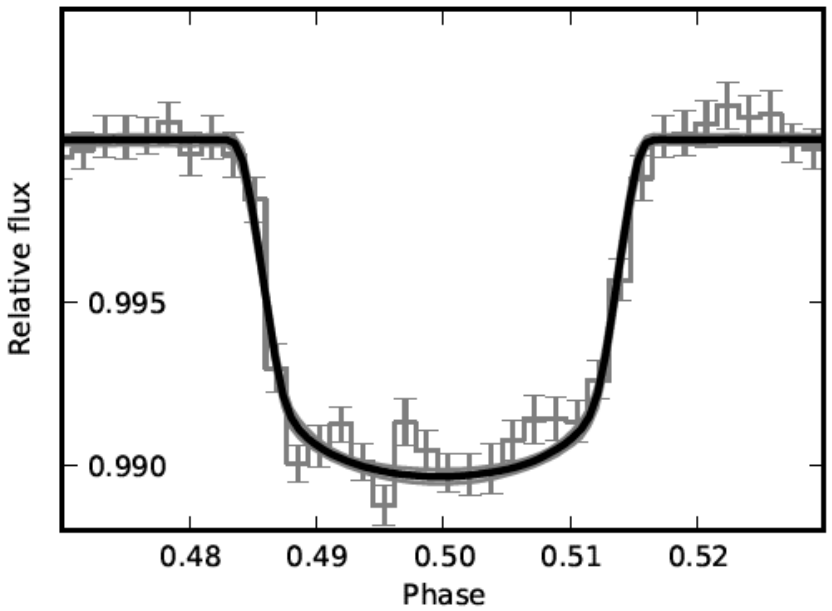


Fig. 7. Phase-folded and binned light curve with a transit model fit.

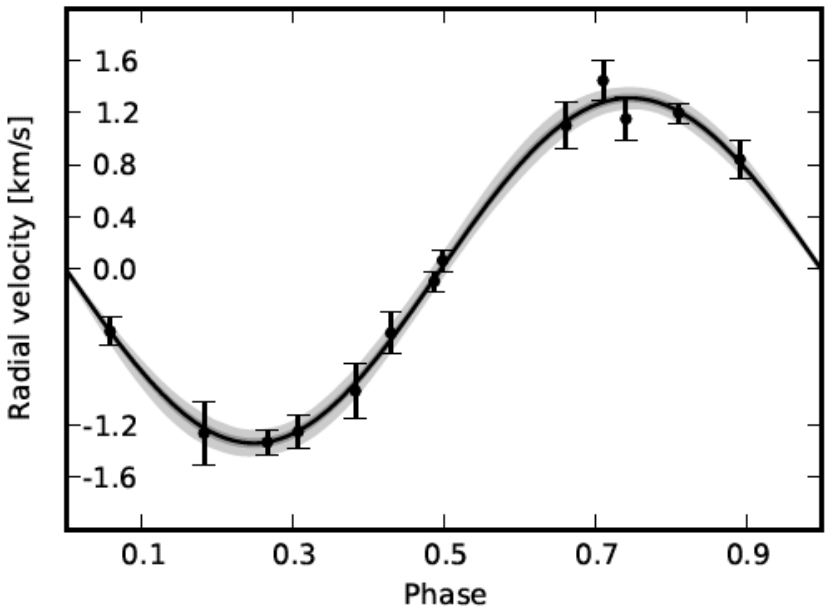


Fig. 6. Phase-folded radial velocity points with a radial velocity fit.

Parviainen et al. 2013, in preparation

CoRoT-27b

the massive and dense super Jupiter

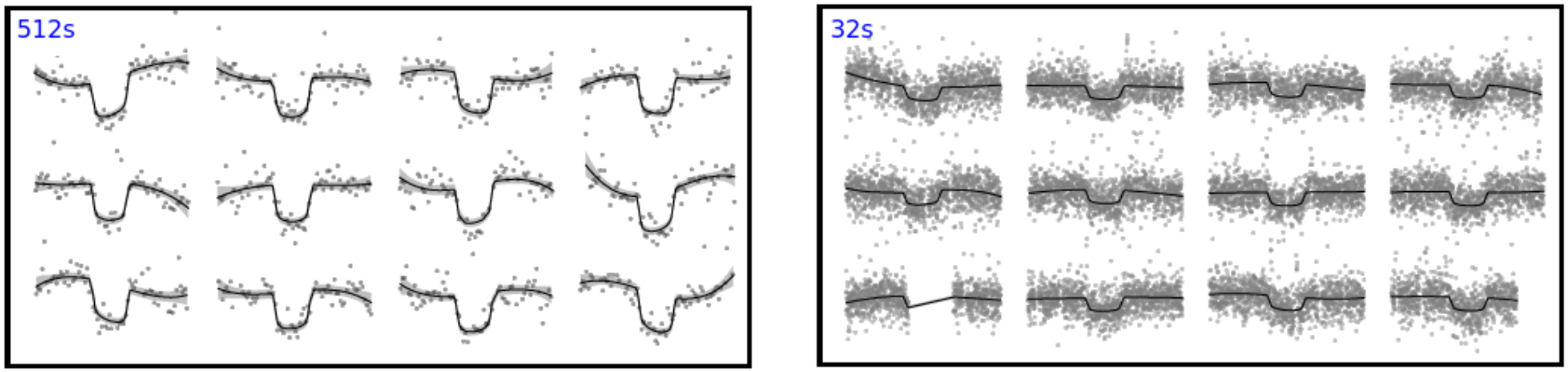


Fig. 8. Individual transits with the median transit models and 95% confidence limits.

Parviainen et al. 2013, in preparation

- see how to hunt for secondary eclipses

  Parviainen et al. 2013 A&A, 550, A67

CoRoT-28b

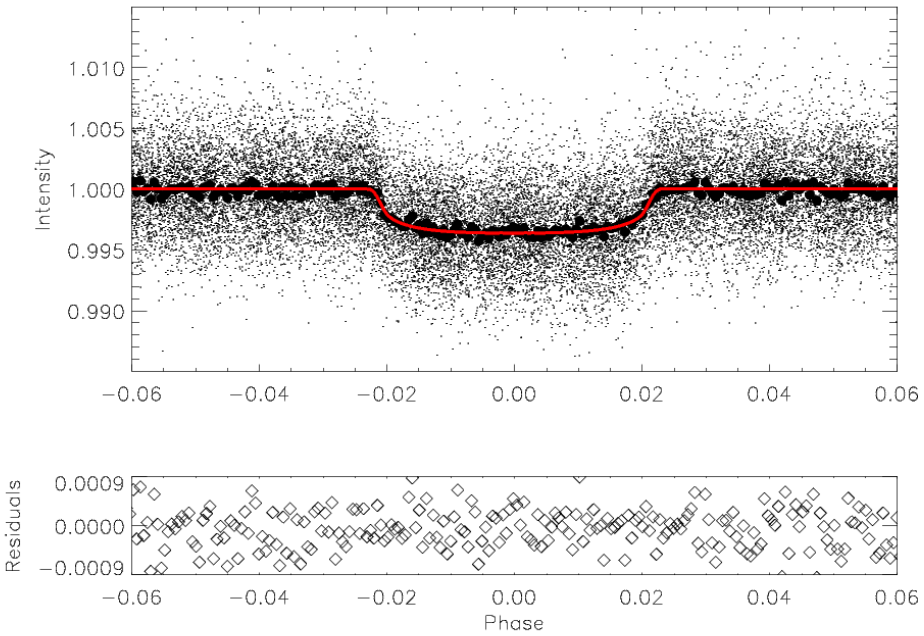
the old, low mass hot Jupiter

Cabrera et al. in preparation

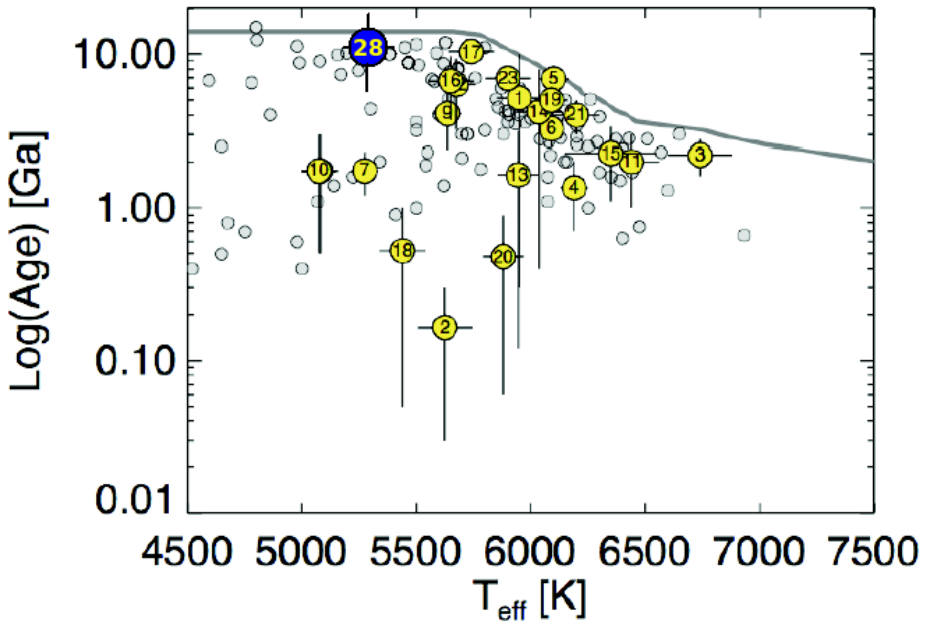
- old, low mass hot Jupiter
- 5.2d period, 0.5 Jupiter masses, 0.97 Jupiter radii (0.7 g cm^{-3}), V=13.8
- solar-like host star, **12Gyr**, $\log g = 3.9$
  - see talk by **G. Wuchterl**
- discovered in LRc08 (summer 2011) 84 days of observation
- 25 SOPHIE, 6 HARPS measurements
- circular orbit

CoRoT-28b

the old, low mass hot Jupiter



courtesy Sz. Csizmadia



Moutou et al. (2013) Icarus, in press

CoRoT-29b

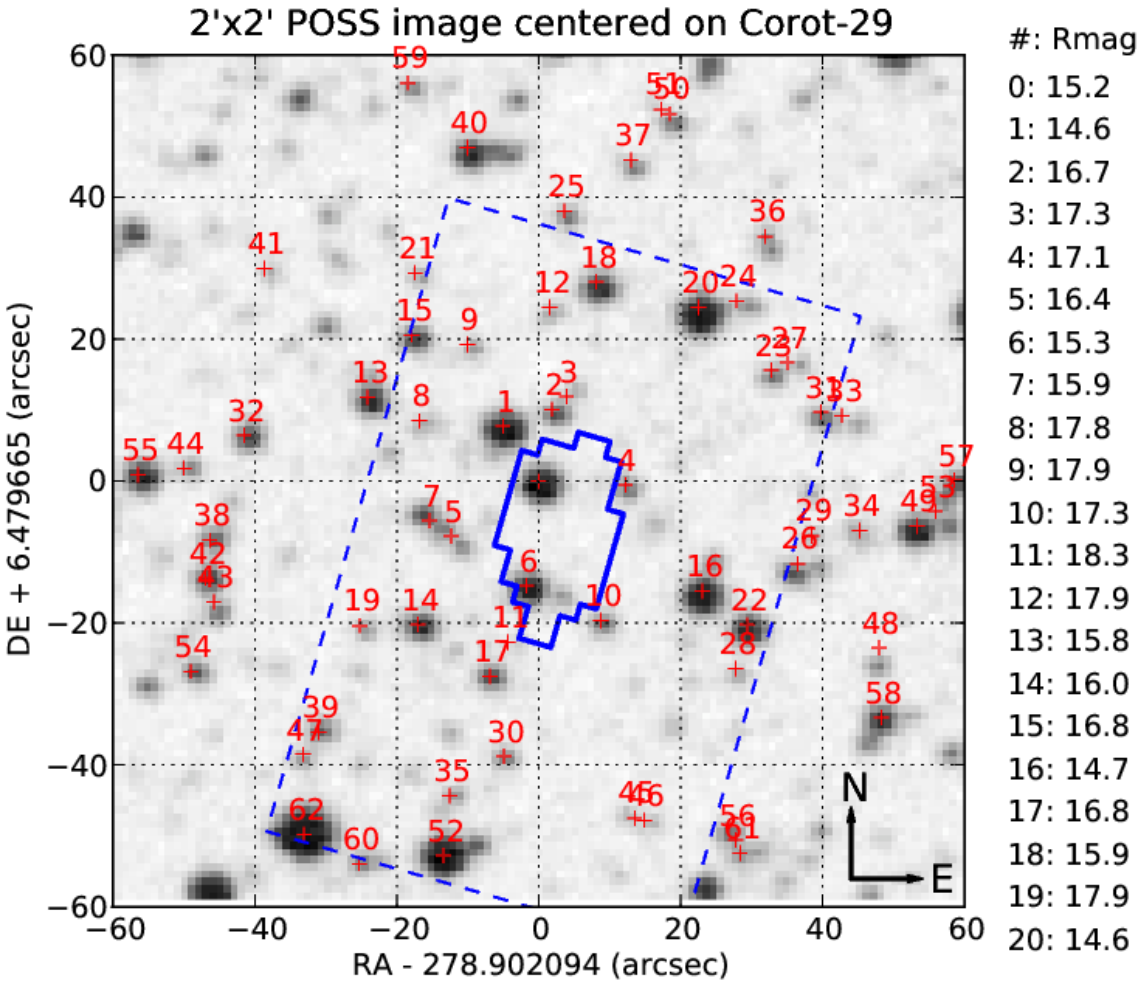
the challenging hot Jupiter

Cabrera et al. in preparation

- hot Jupiter in a crowded environment
- 2.9d period, *0.9* Jupiter masses, *0.8* Jupiter radii (*2.1* g cm^{-3}), V=15.6
- solar-like host star, solar metallicity, $\log g = 4.5$
- discovered in LRc08 (summer 2011) 84 days of observation
- 13 HARPS measurements
- circular orbit

CoRoT-29b

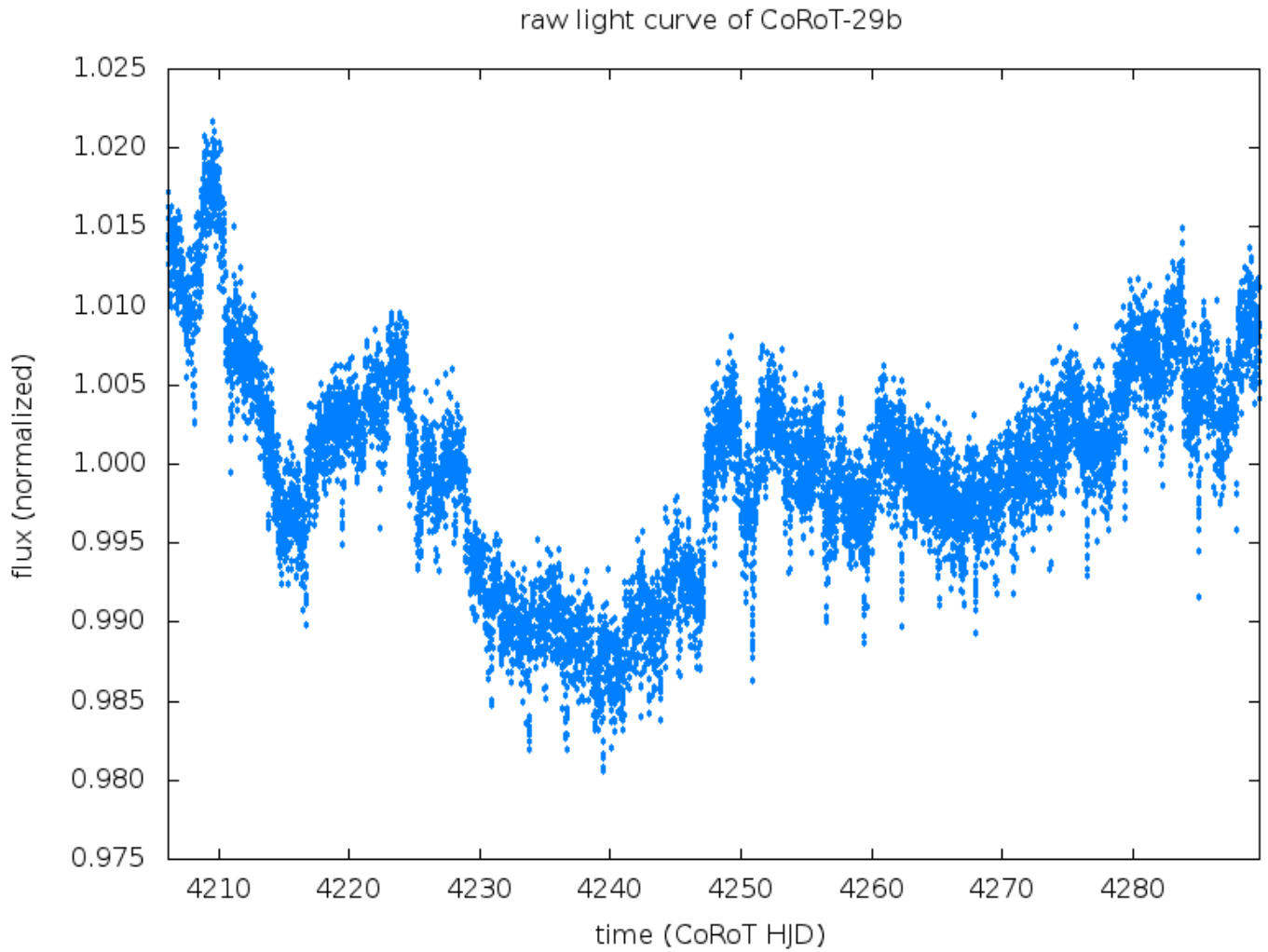
the challenging hot Jupiter



courtesy Sz. Csizmadia

CoRoT-29b

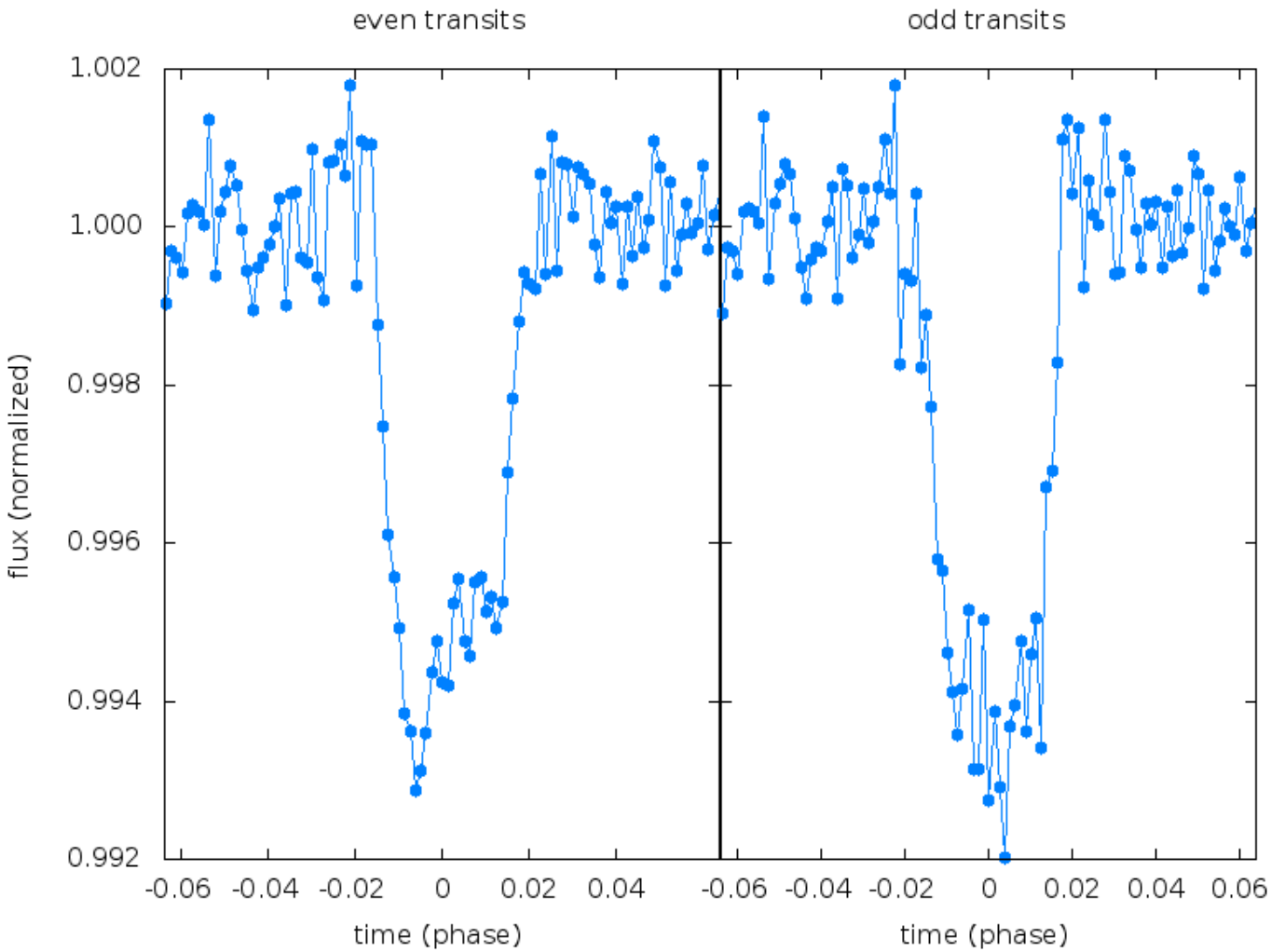
the challenging hot Jupiter



DLR

CoRoT-29b

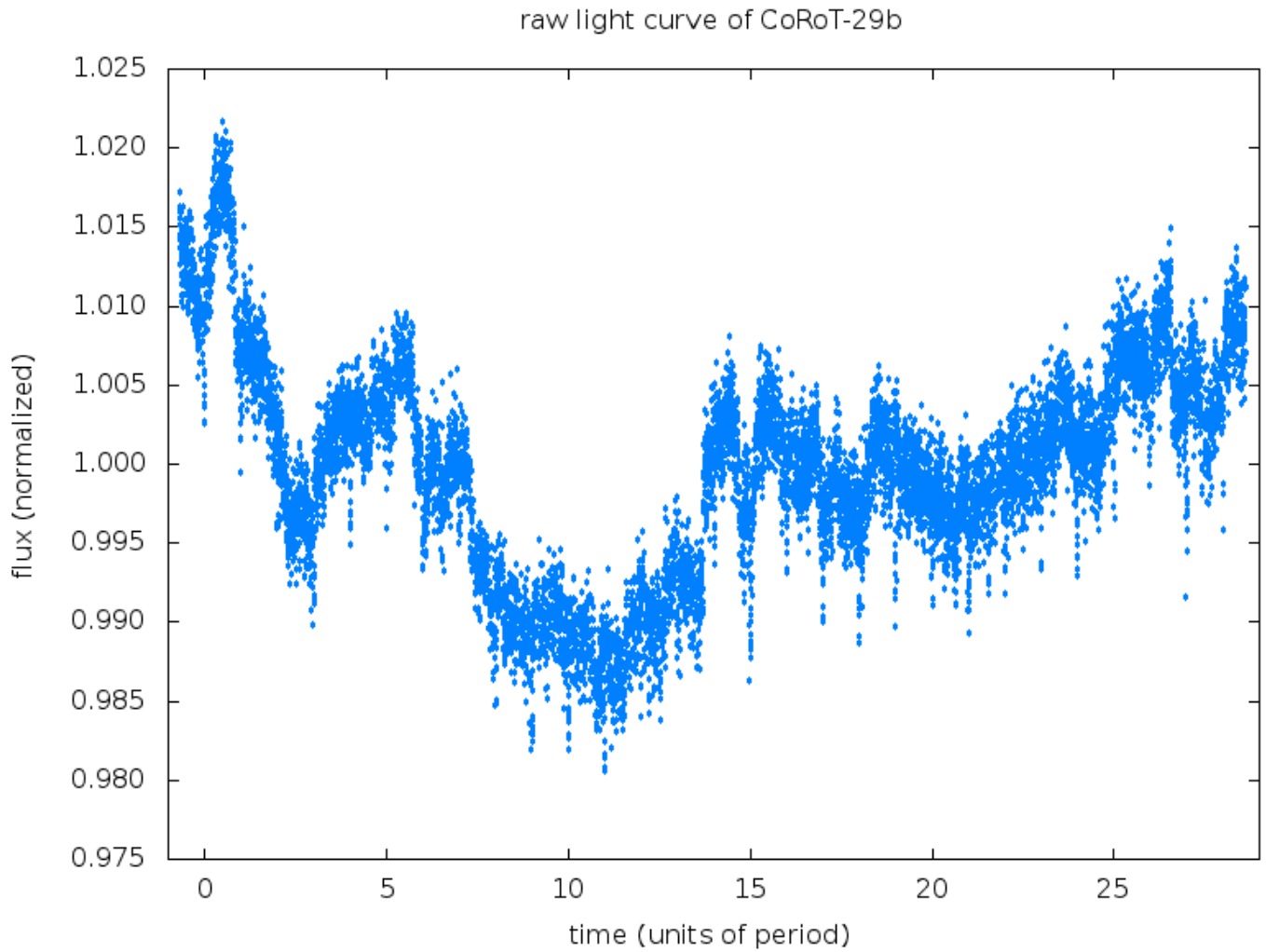
the challenging hot Jupiter



DLR

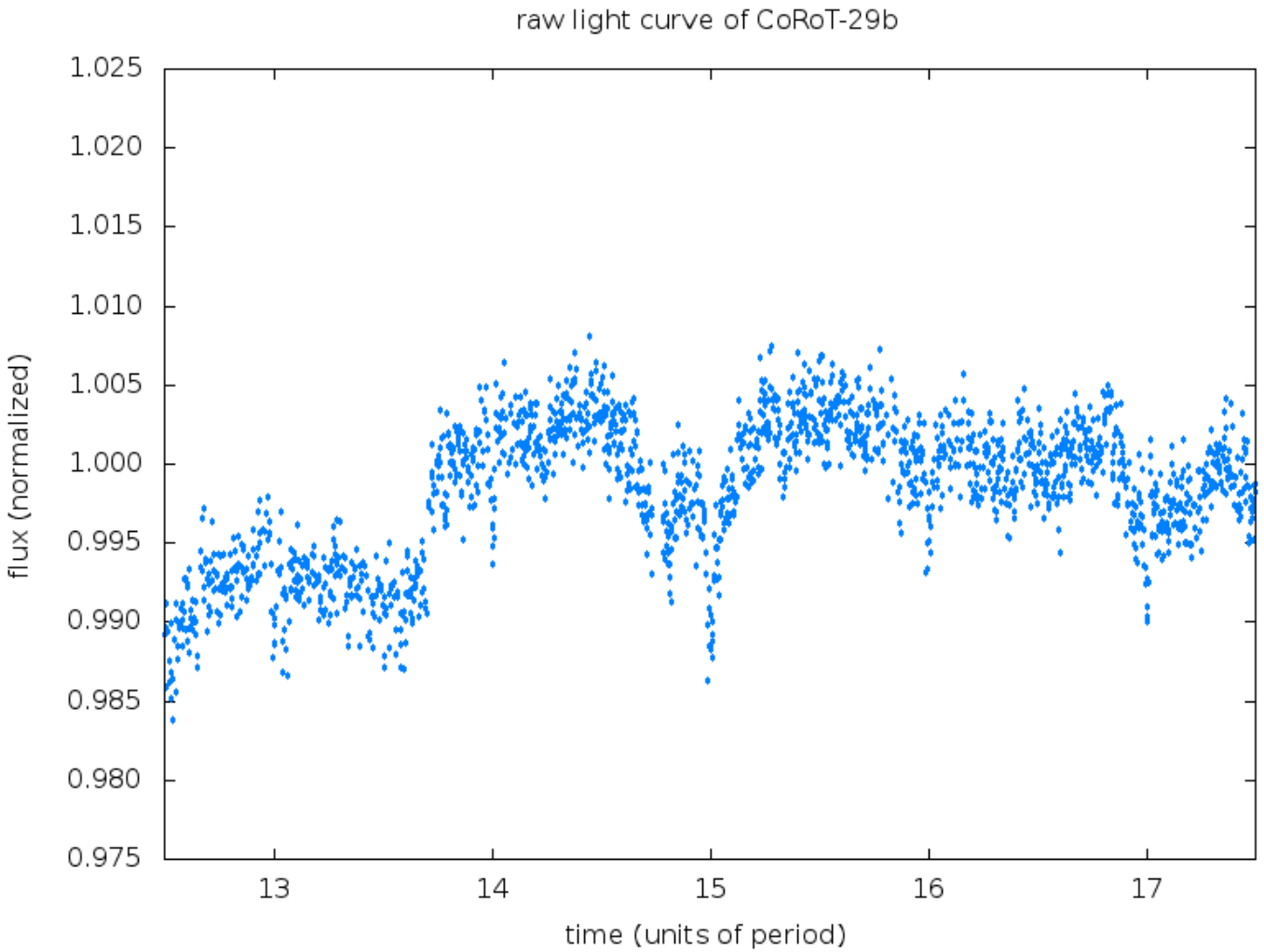
CoRoT-29b

the challenging hot Jupiter



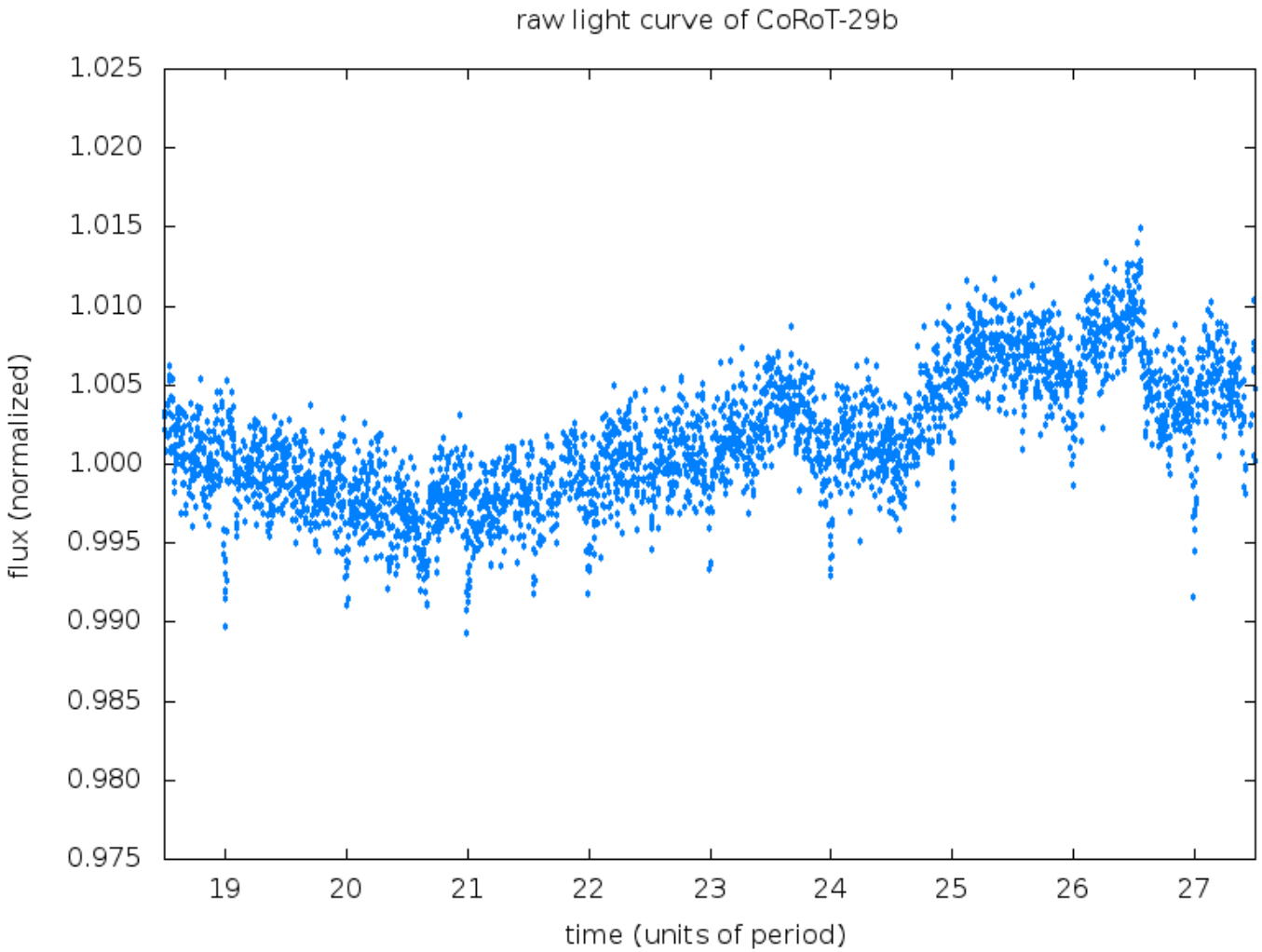
CoRoT-29b

the challenging hot Jupiter



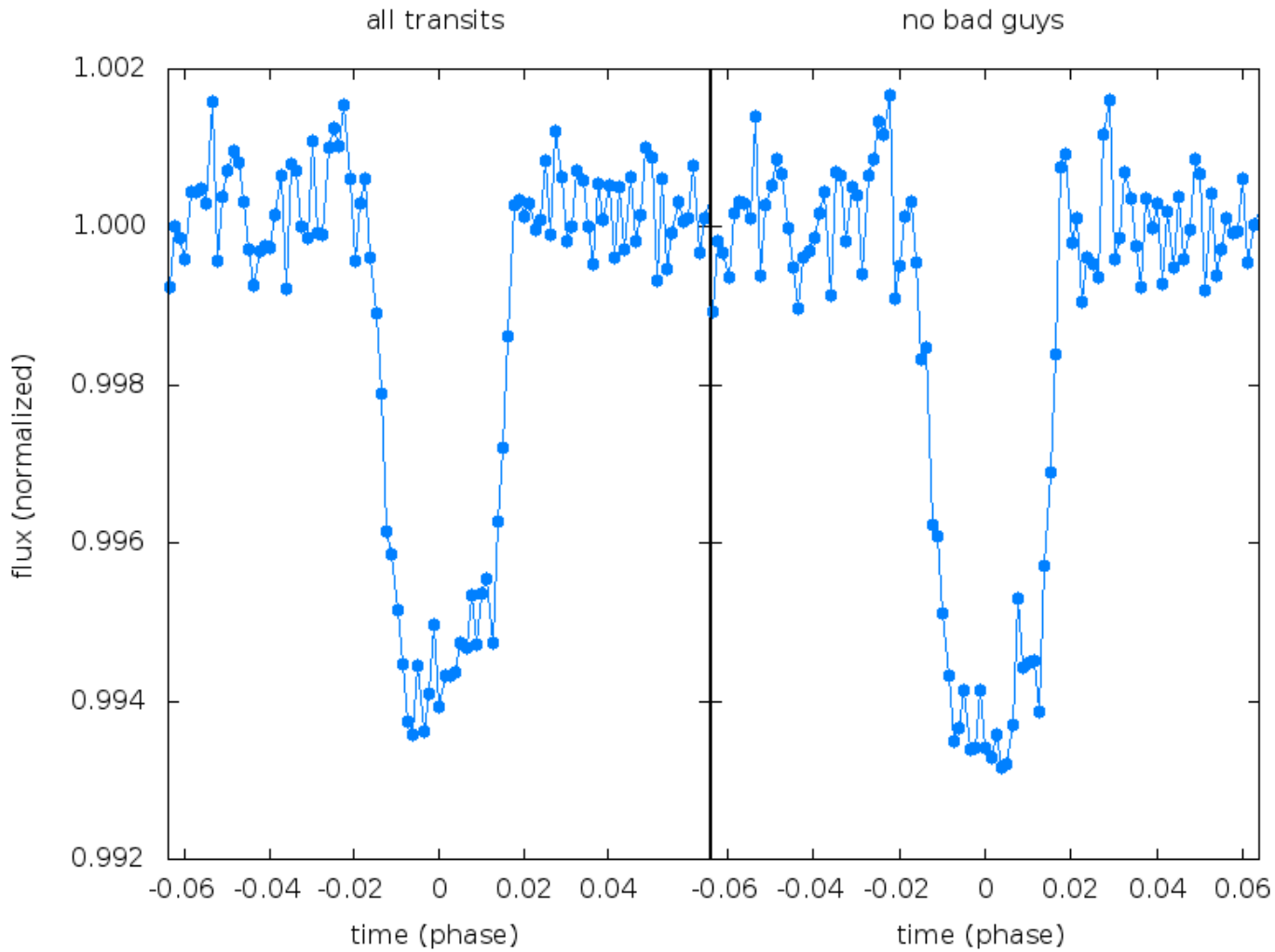
CoRoT-29b

the challenging hot Jupiter



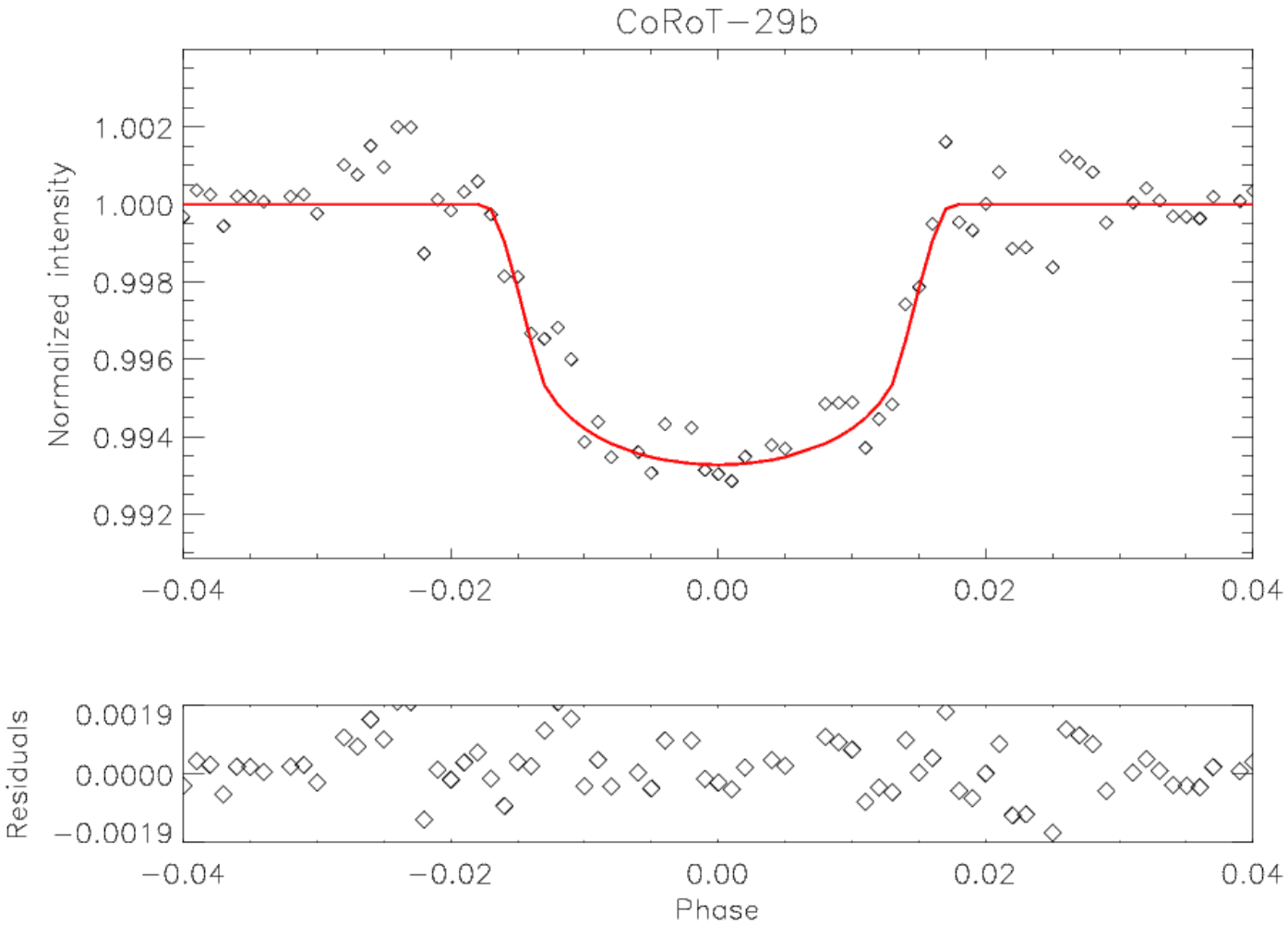
CoRoT-29b

the challenging hot Jupiter



CoRoT-29b

the challenging hot Jupiter



courtesy Sz. Csizmadia

CoRoT-30b

hot Jupiter in 9 days orbit

Bordé et al. in preparation

- 9.1d period, 2.9 Jupiter masses, 1.1 Jupiter radii (2.6 g cm^{-3}), V=15.6
- solar-like host star, solar metallicity, $\log g = 4.5$
- discovered in LRc07 (summer 2011) 84 days of observation
- K280 m/s, circular orbit

CoRoT-31b

challenging hot Jupiter

Bordé et al. in preparation

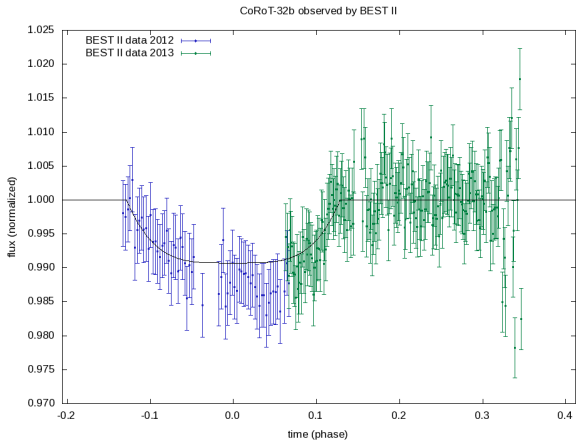
- 4.6d period, *0.9* Jupiter masses, *0.7* Jupiter radii (3.7 g cm^{-3}), V=15.5
- solar-like host star
- discovered in SRa04 (winter 2011/12) 52 days of observation

CoRoT-32b

the most exciting system of today

Gandolfi et al. in preparation

- discovered in SRa04 (winter 2011/12) 52 days of observation
- see next talk by **D. Gandolfi**



- see also poster by R. Titz-Weider about BEST II follow-up

the characterization of planetary systems

the CoRoT legacy

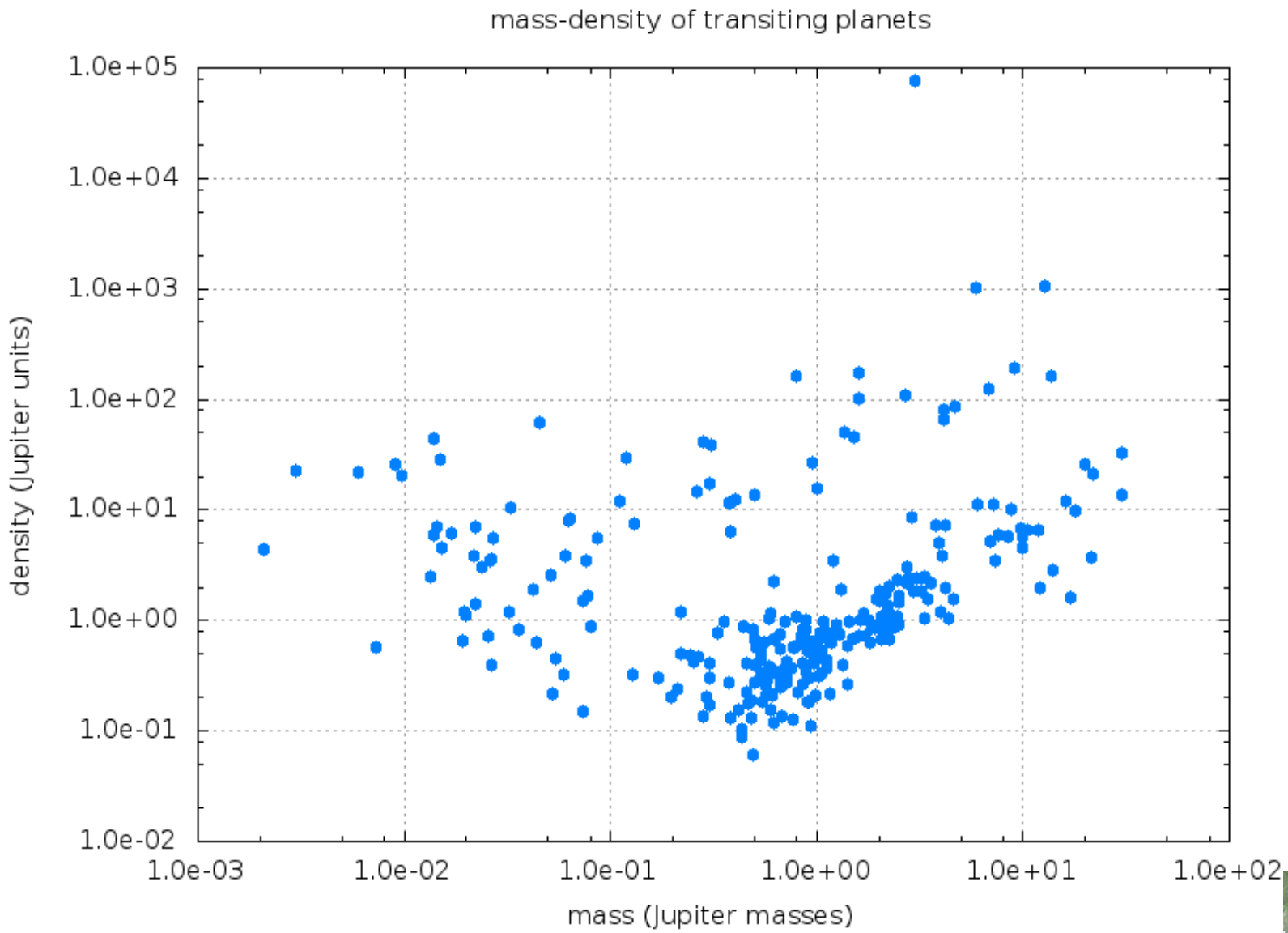
- in the program for the CoRoT extension we wrote

  we have now entered the period of data interpretation

Another important asset of the CoRoT exoplanet program is the accompanying follow-up process. It allows not only to filter out stellar systems that mimic planet transit but mainly to characterize the planet. Getting the mass and the eccentricity of the planet in addition to its radius is of prime interest to discern its internal structure and to better understand the planet formation process.

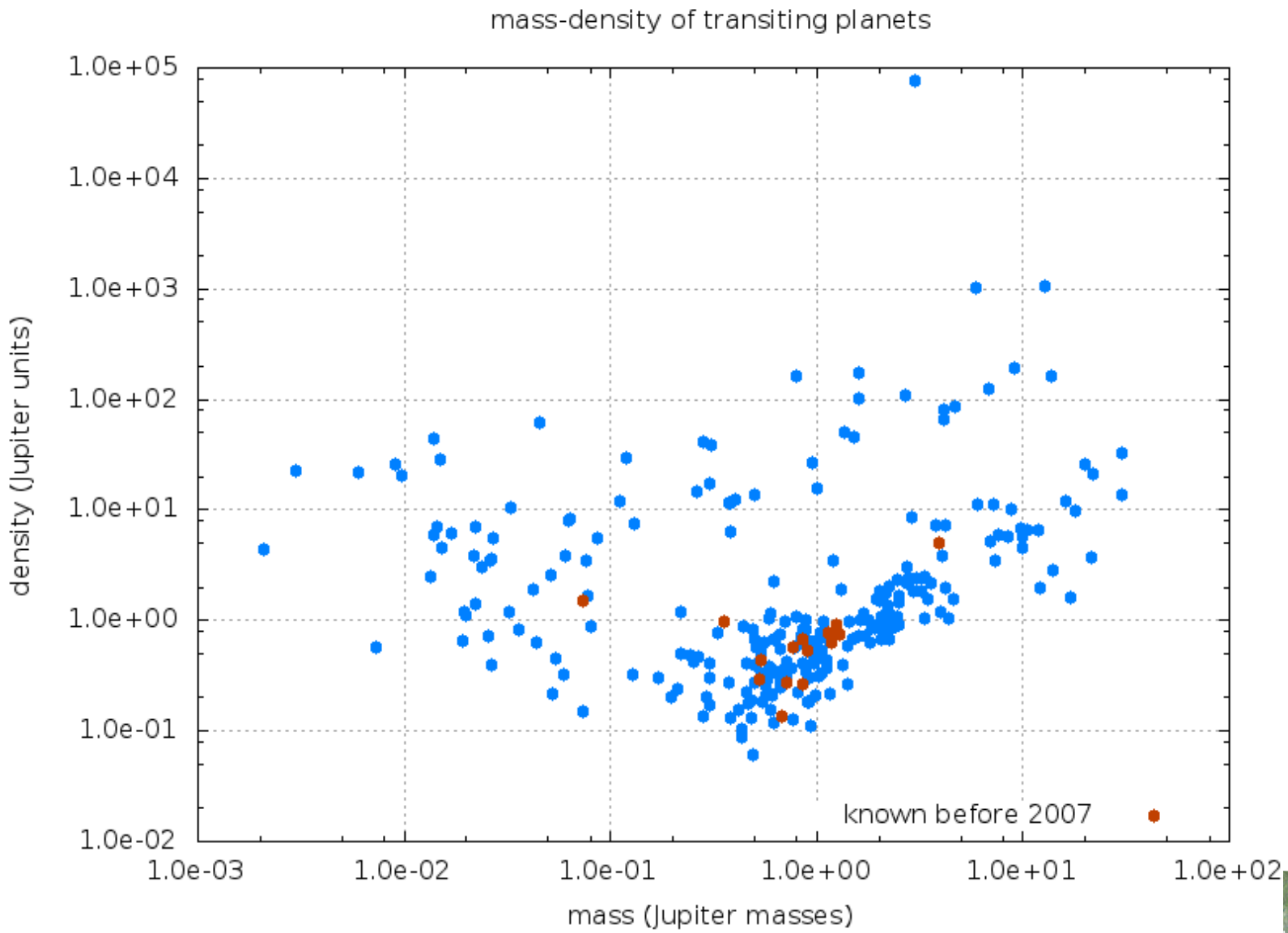
the characterization of planetary systems

mass and density of transiting planets



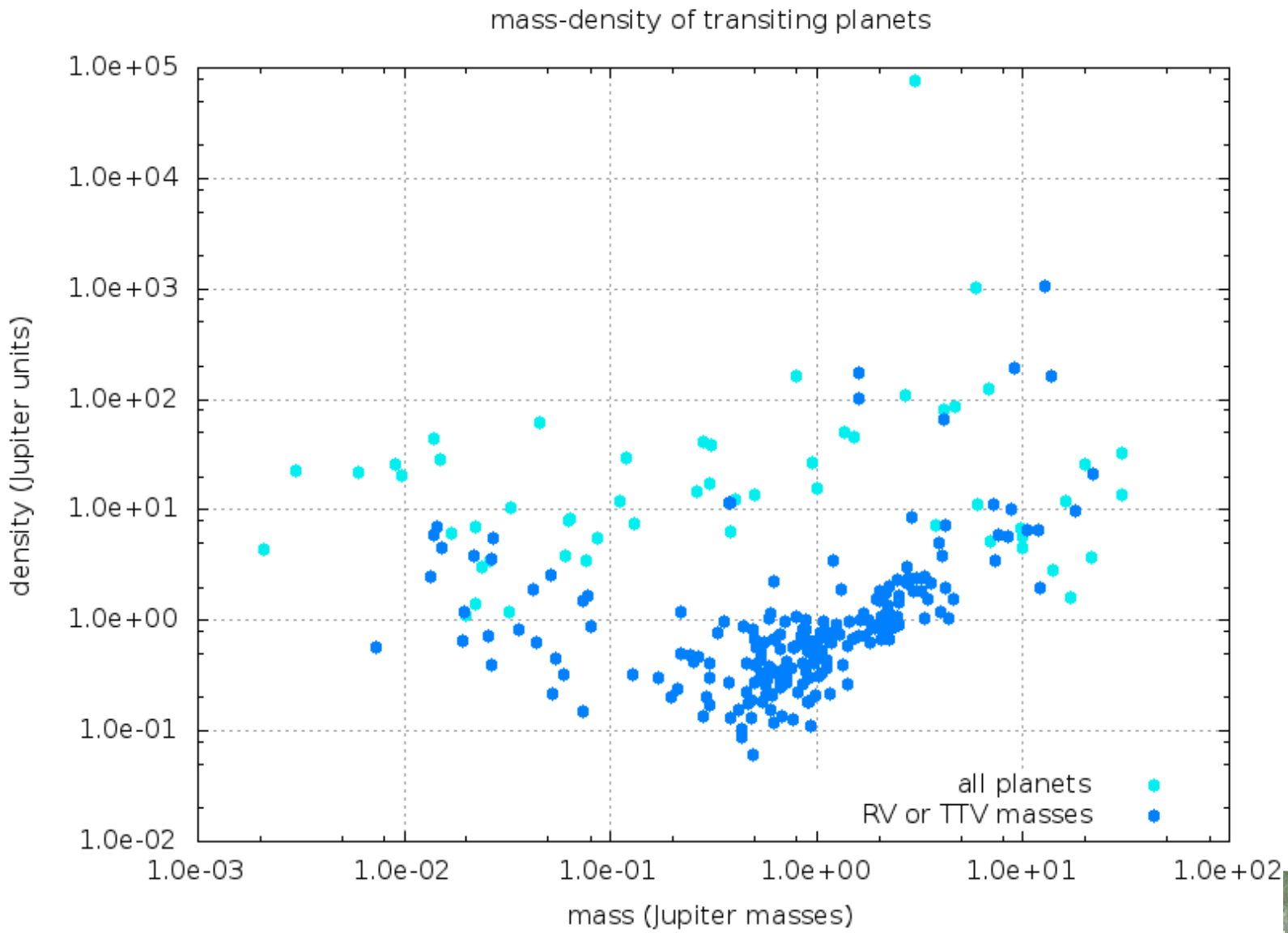
the characterization of planetary systems

mass and density of transiting planets



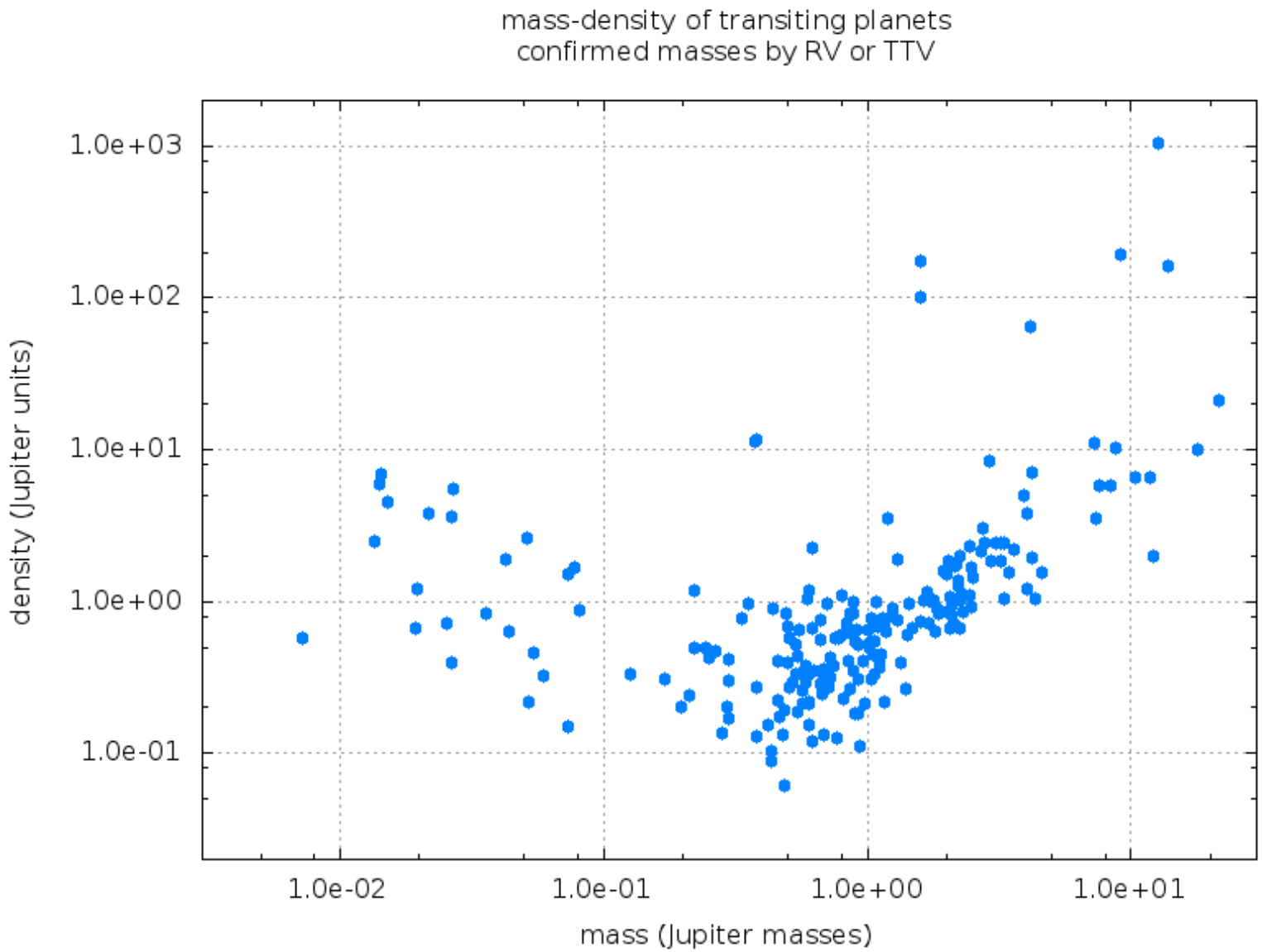
the characterization of planetary systems

mass and density of transiting planets



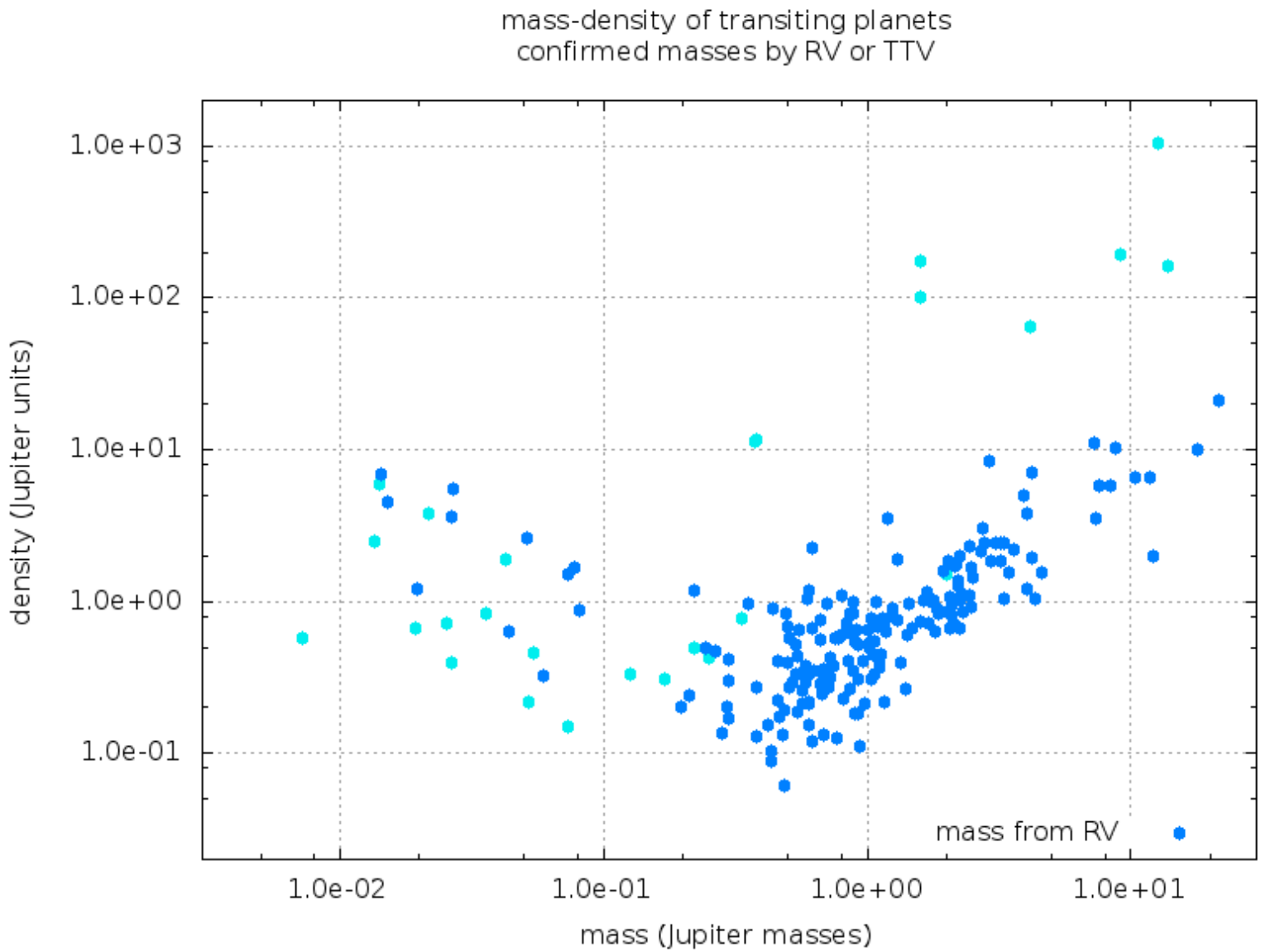
the characterization of planetary systems

mass and density of transiting planets with known mass



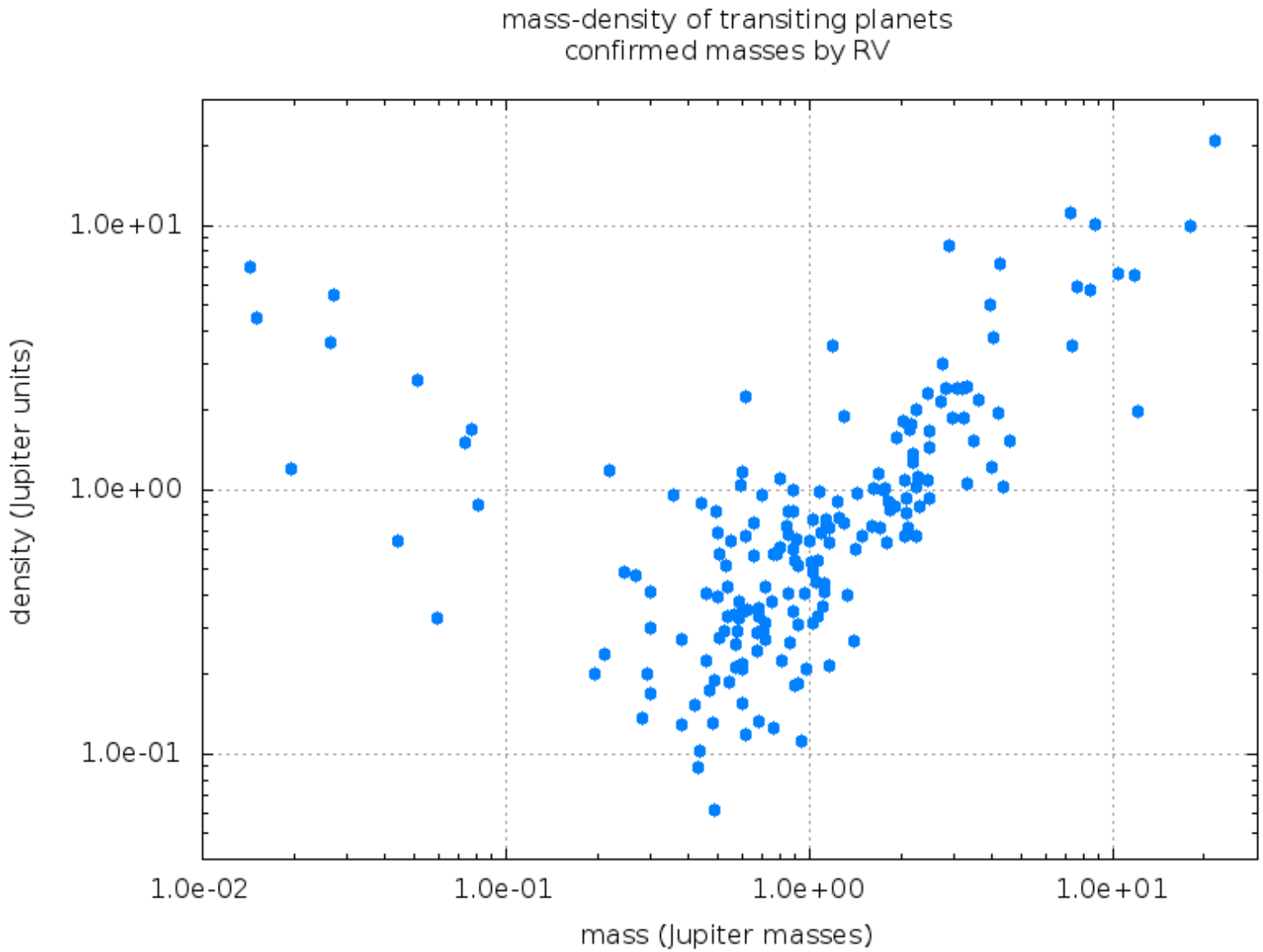
the characterization of planetary systems

mass and density of transiting planets with known mass



the characterization of planetary systems

mass and density of transiting planets with measured mass from RV



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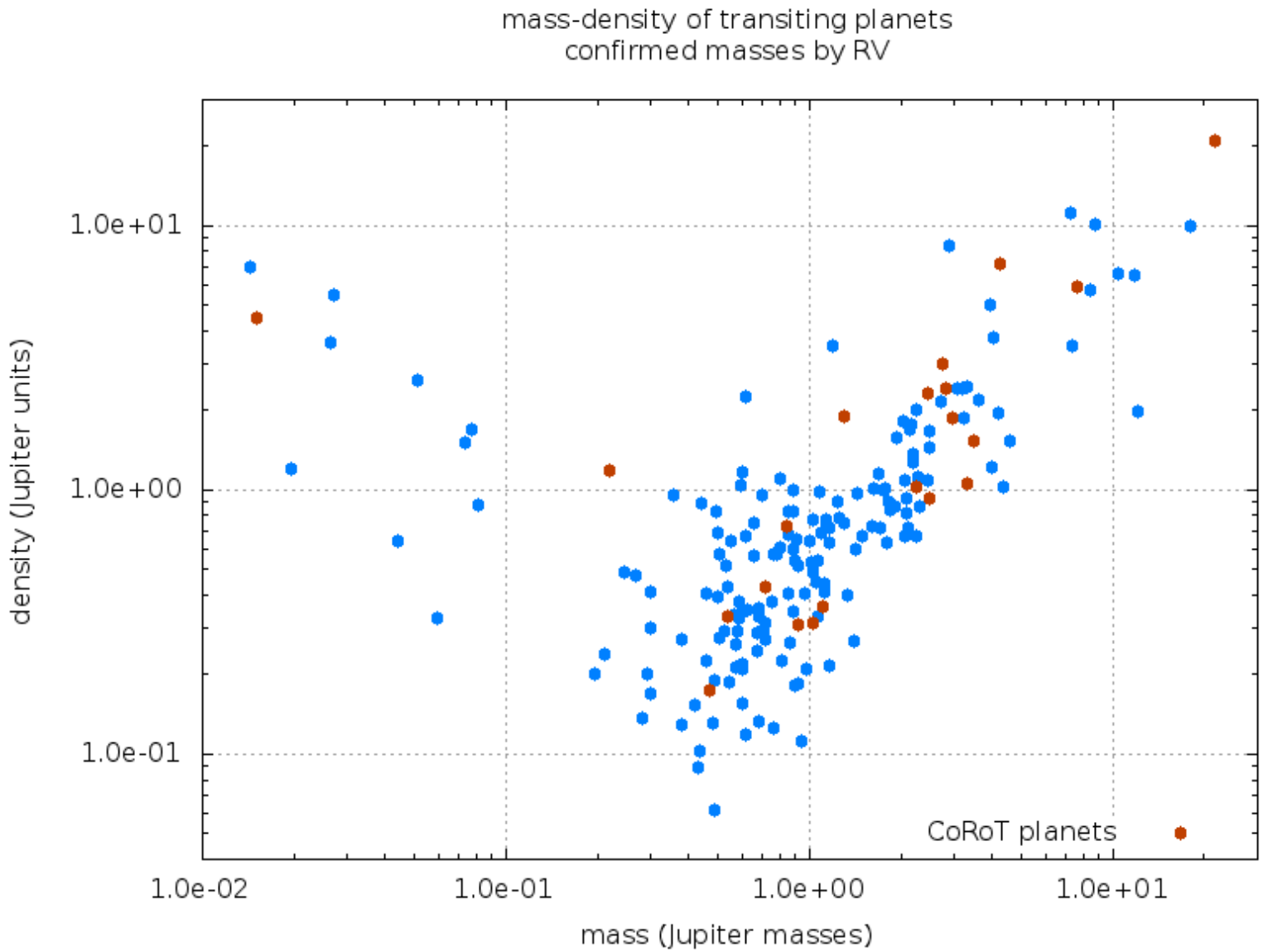

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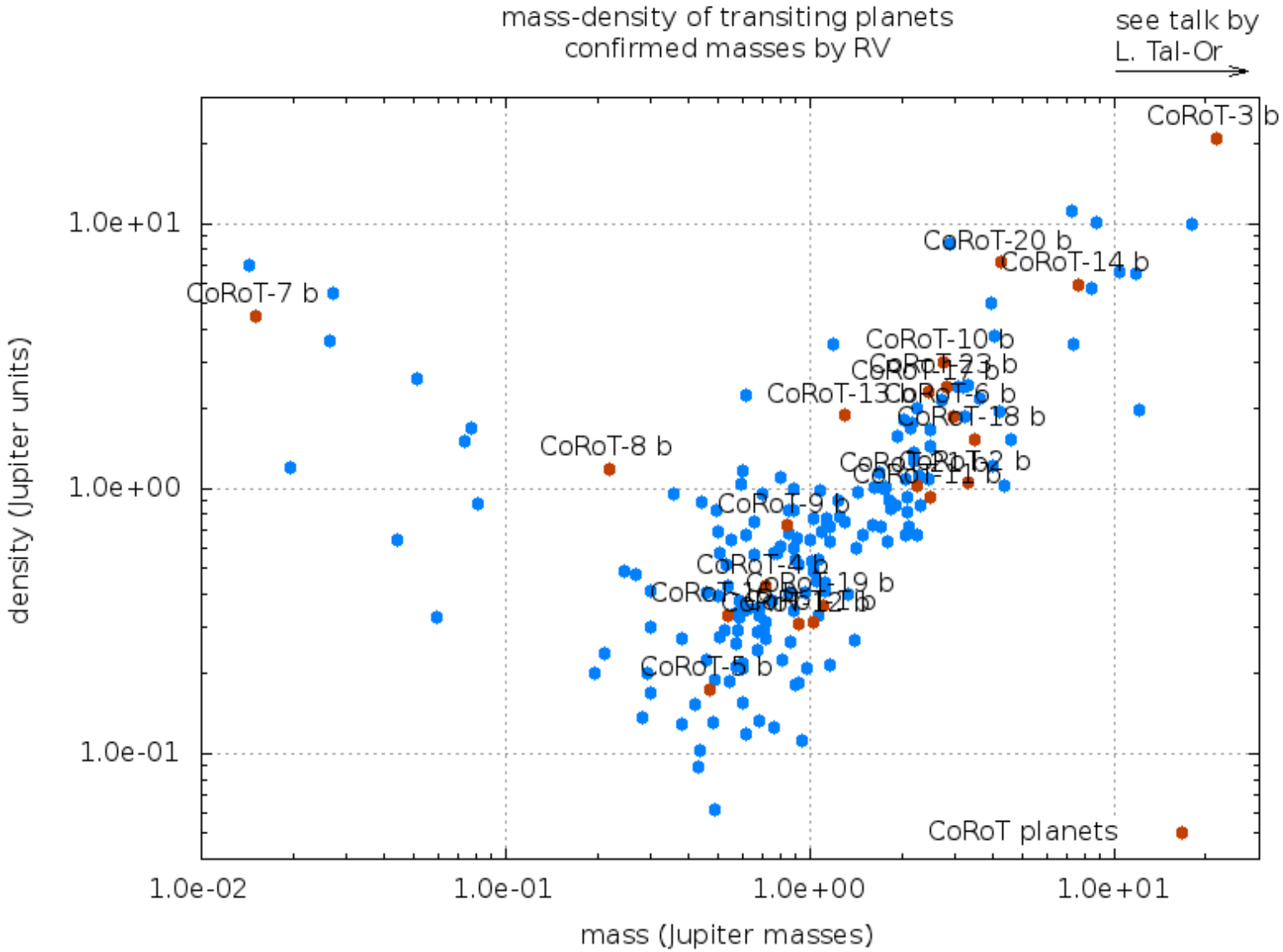

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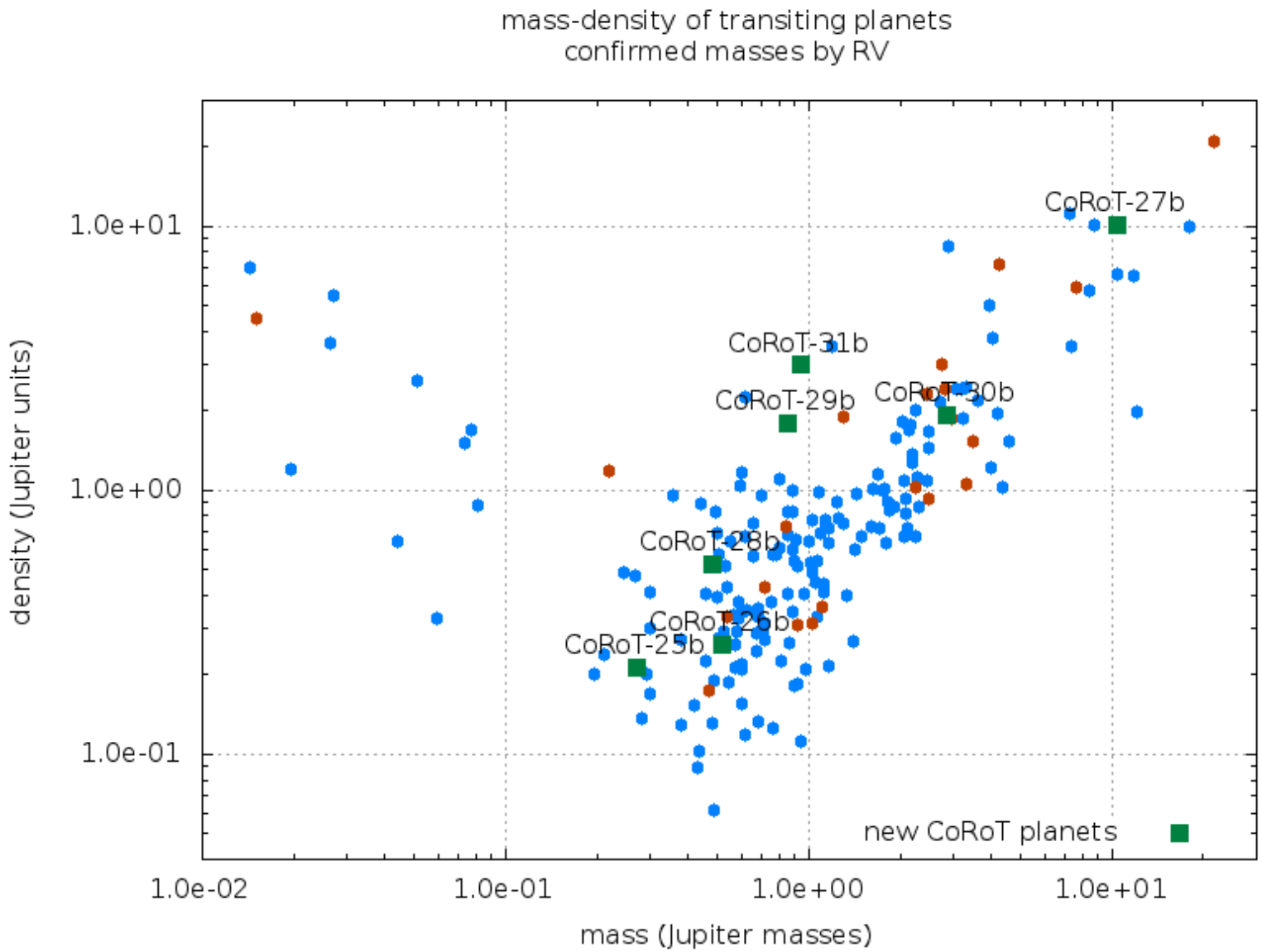
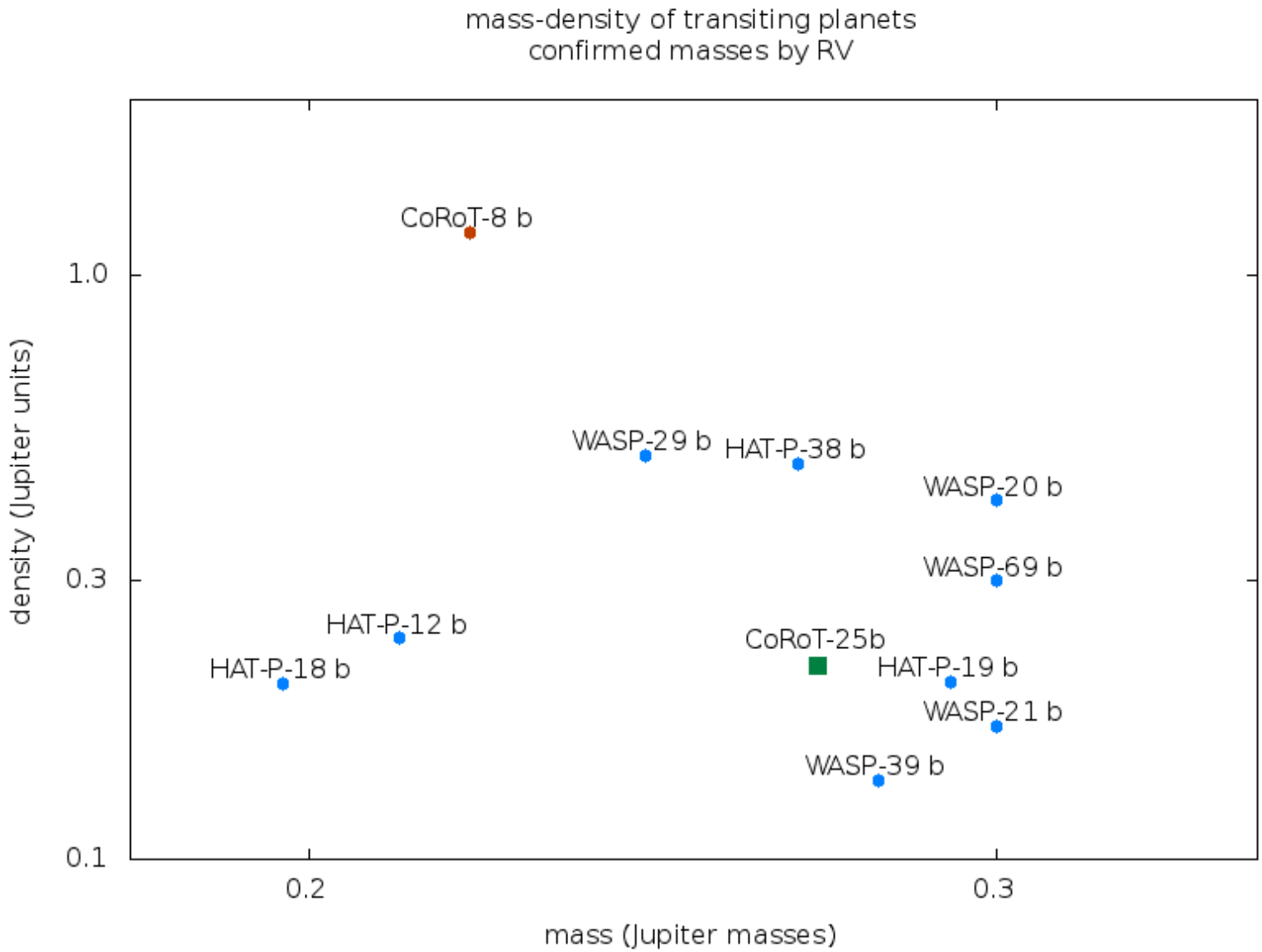
mass and density of transiting planets with measured mass from RV



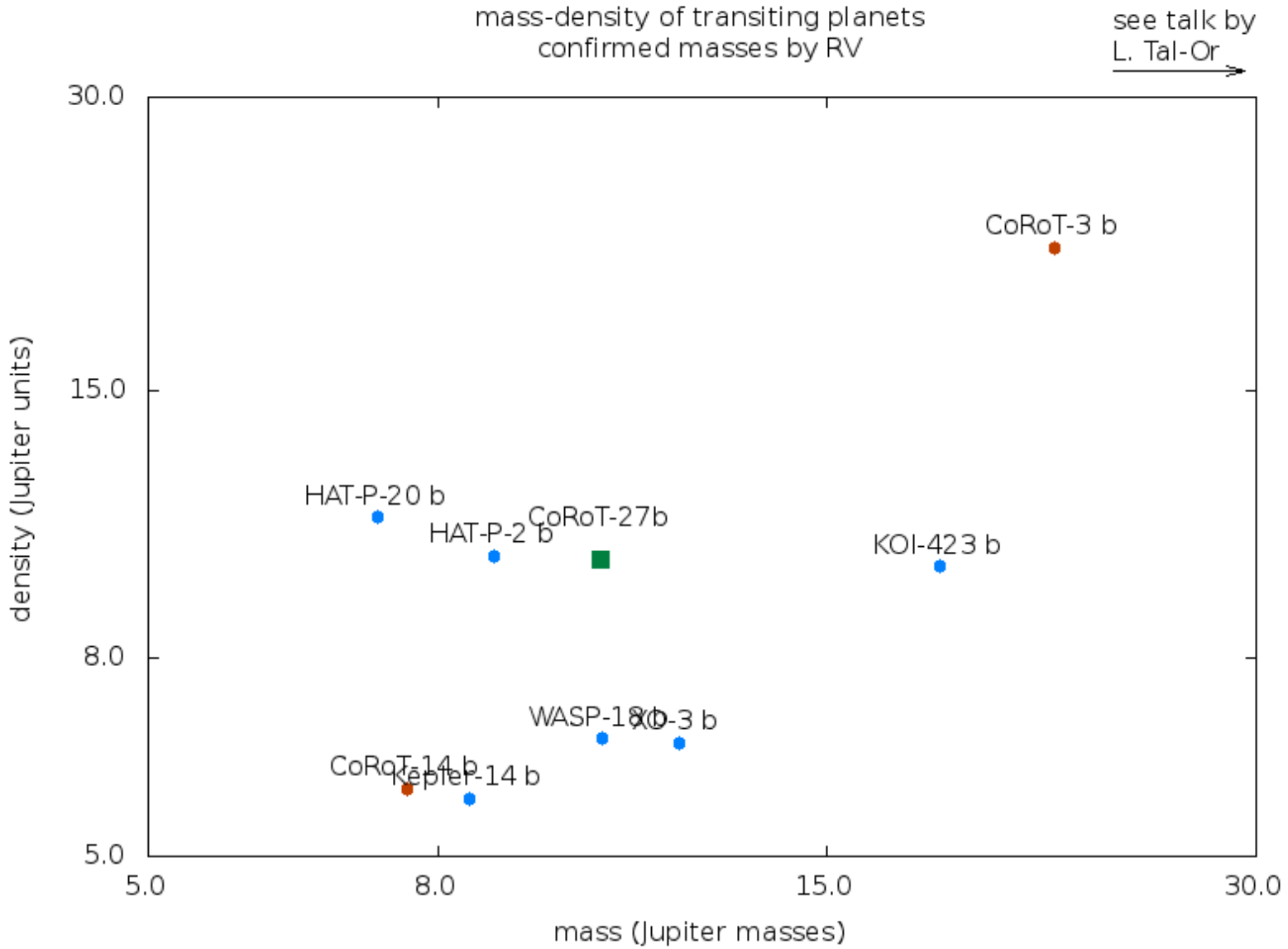
the characterization of planetary systems

mass and density of CoRoT-25b



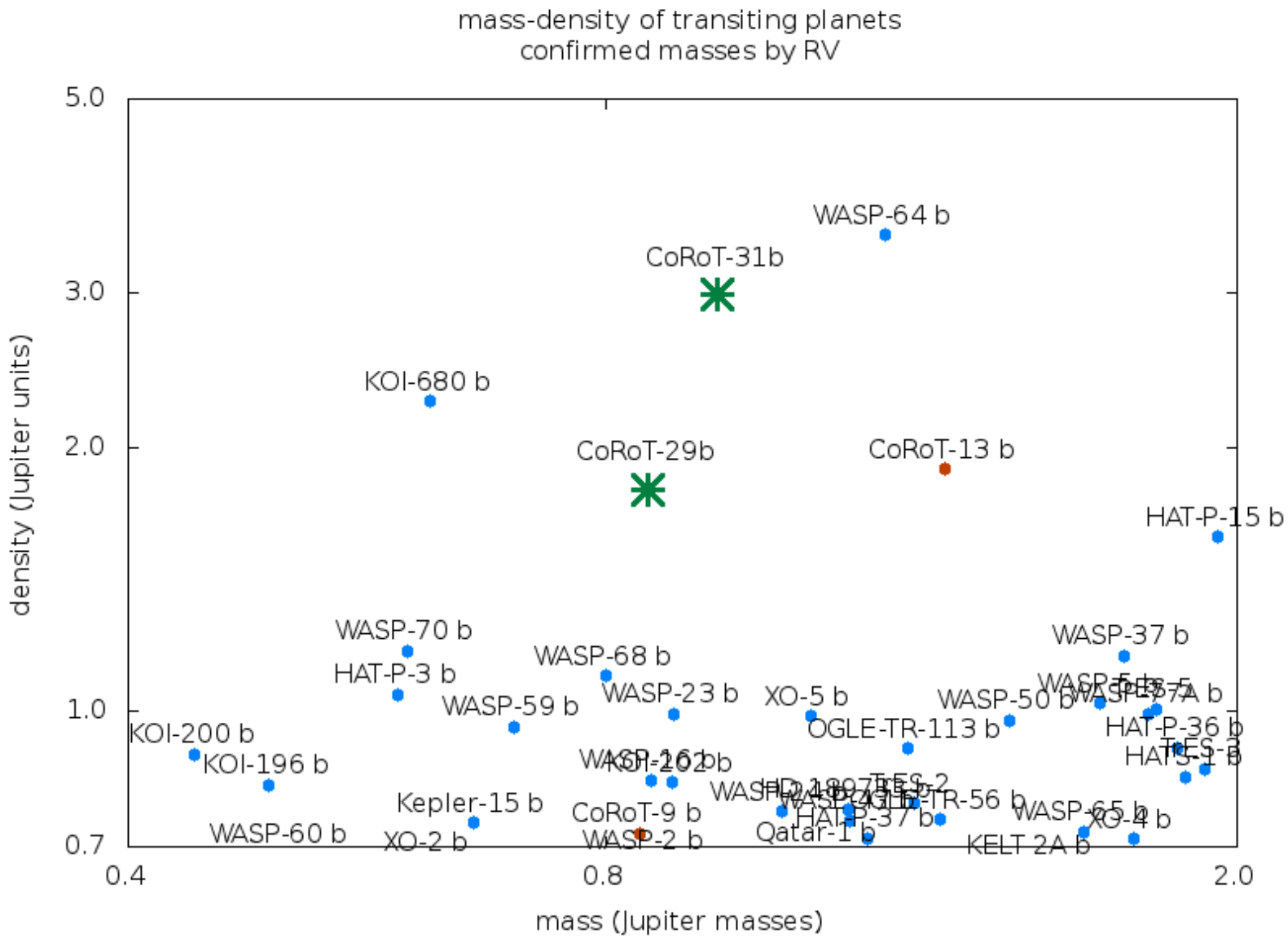
the characterization of planetary systems

mass and density of CoRoT-27b



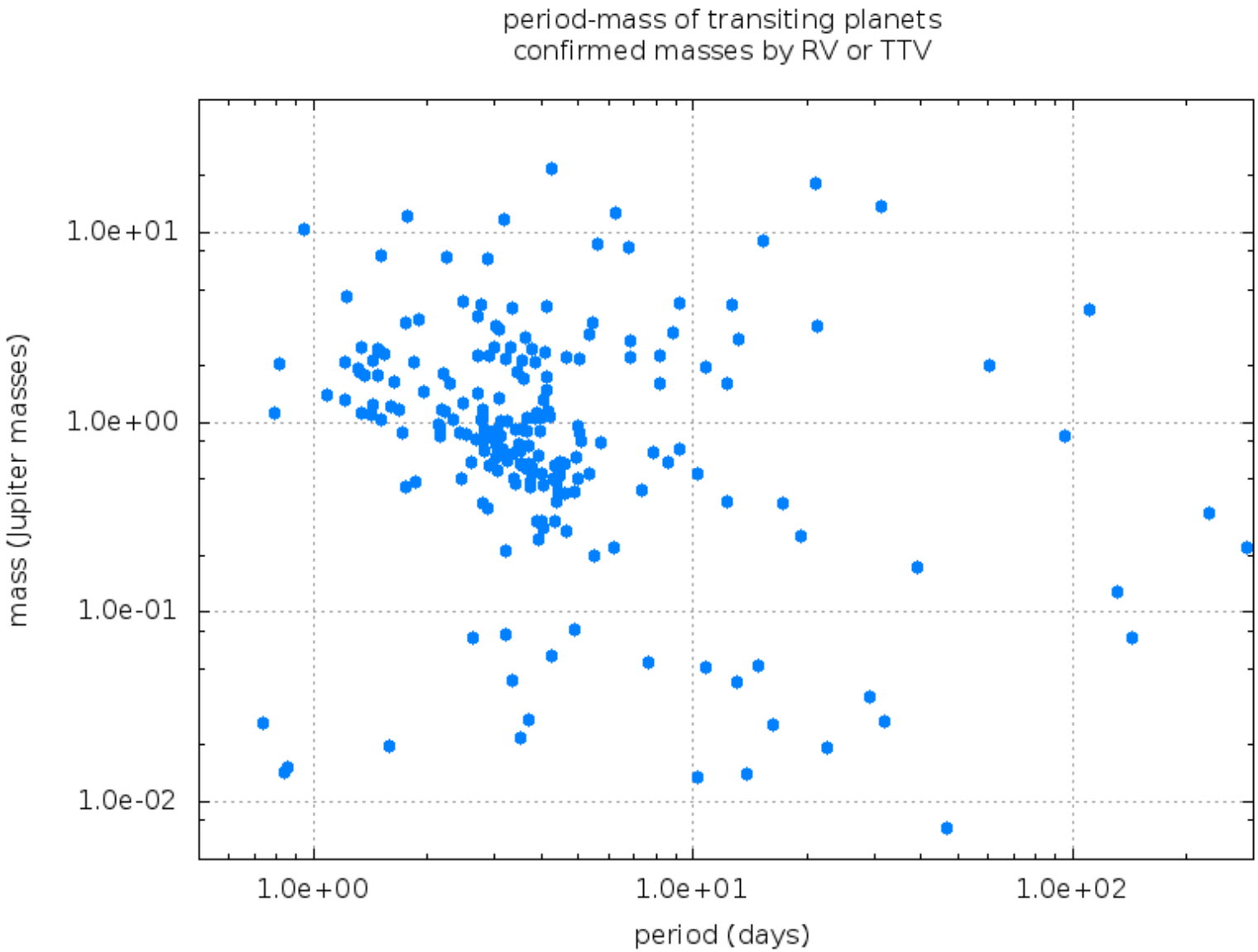
the characterization of planetary systems

mass and density of CoRoT-29b and CoRoT-31b



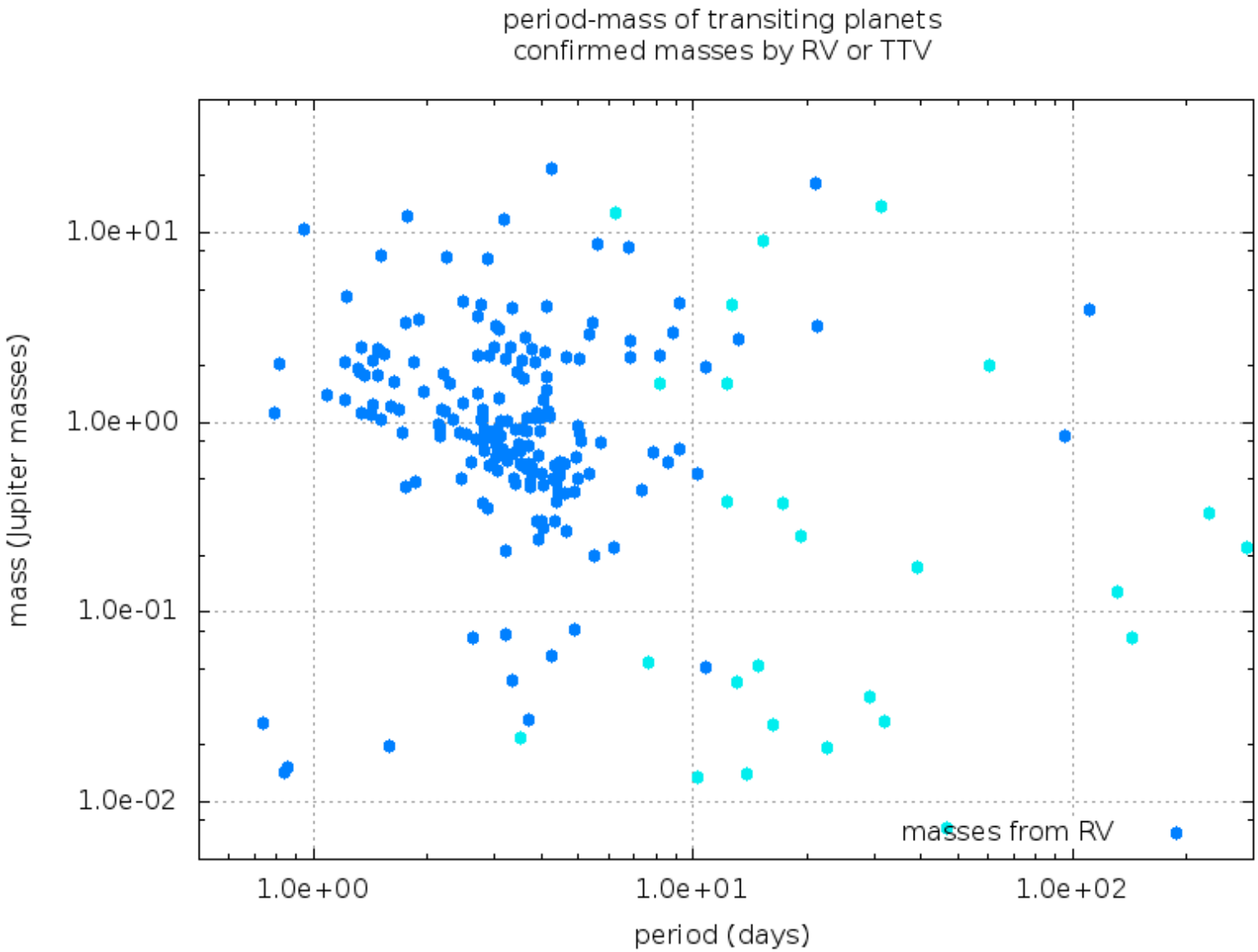
the characterization of planetary systems

period and mass of transiting planets with known mass



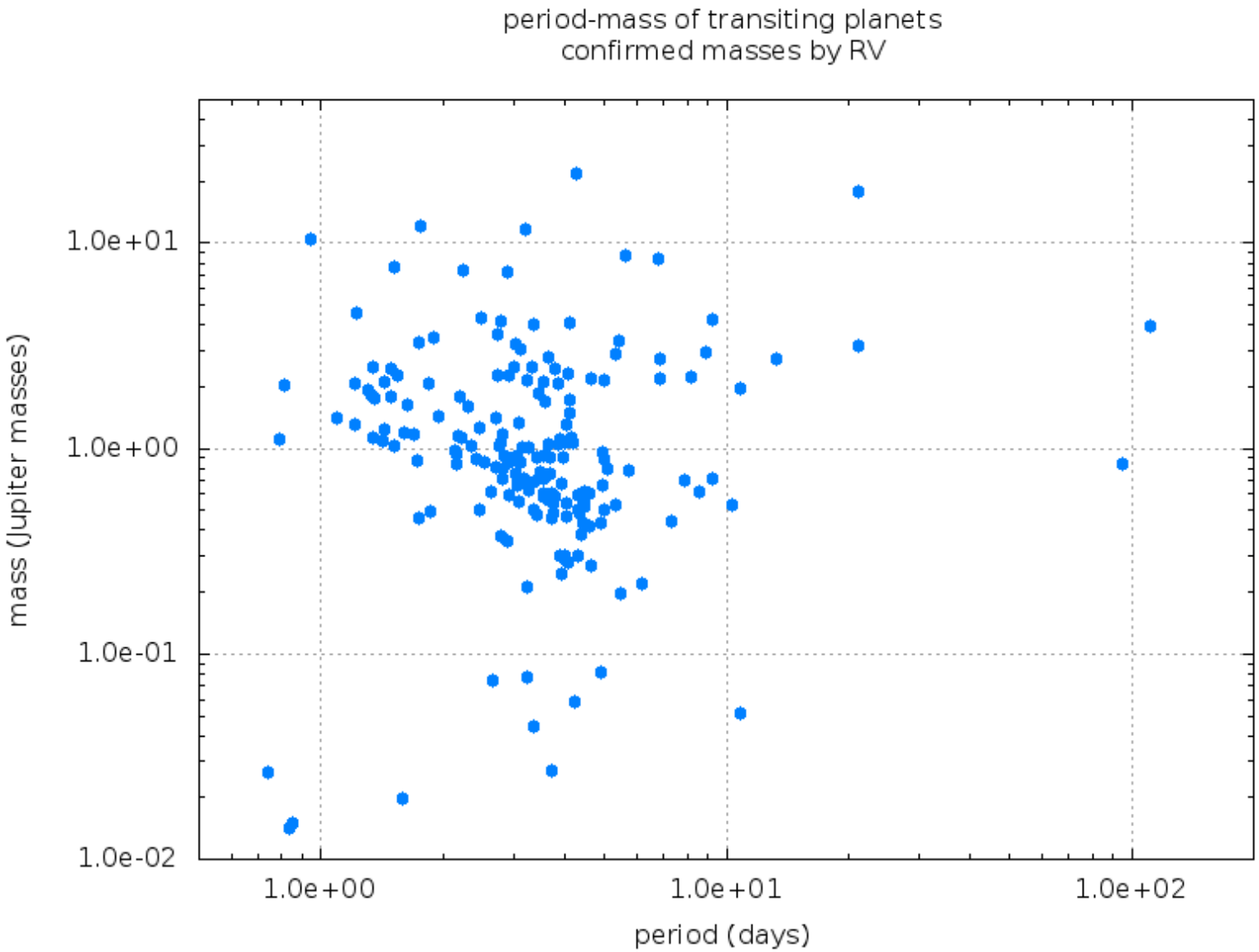
the characterization of planetary systems

period and mass of transiting planets with known mass



the characterization of planetary systems

period and mass of transiting planets with measured mass from RV



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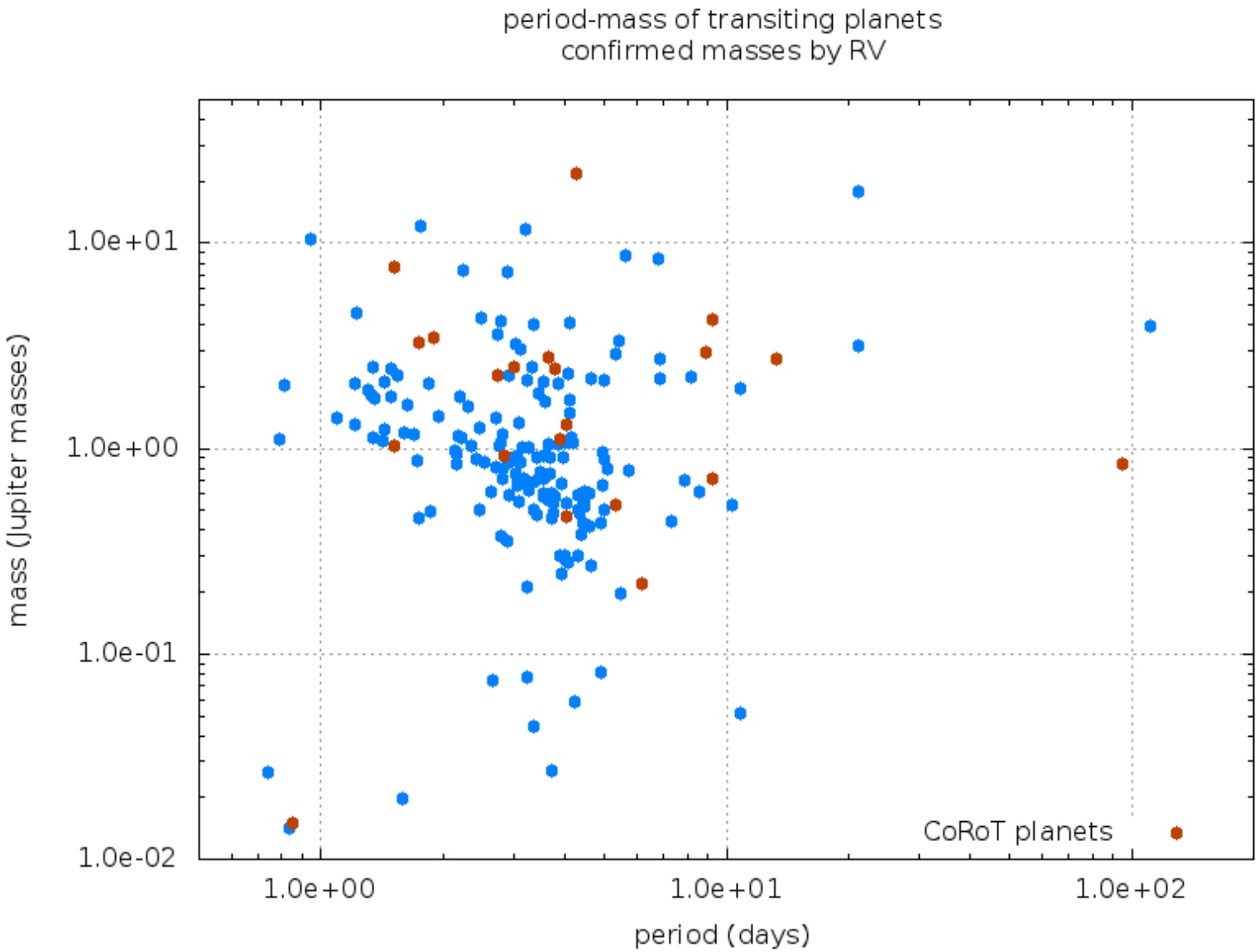

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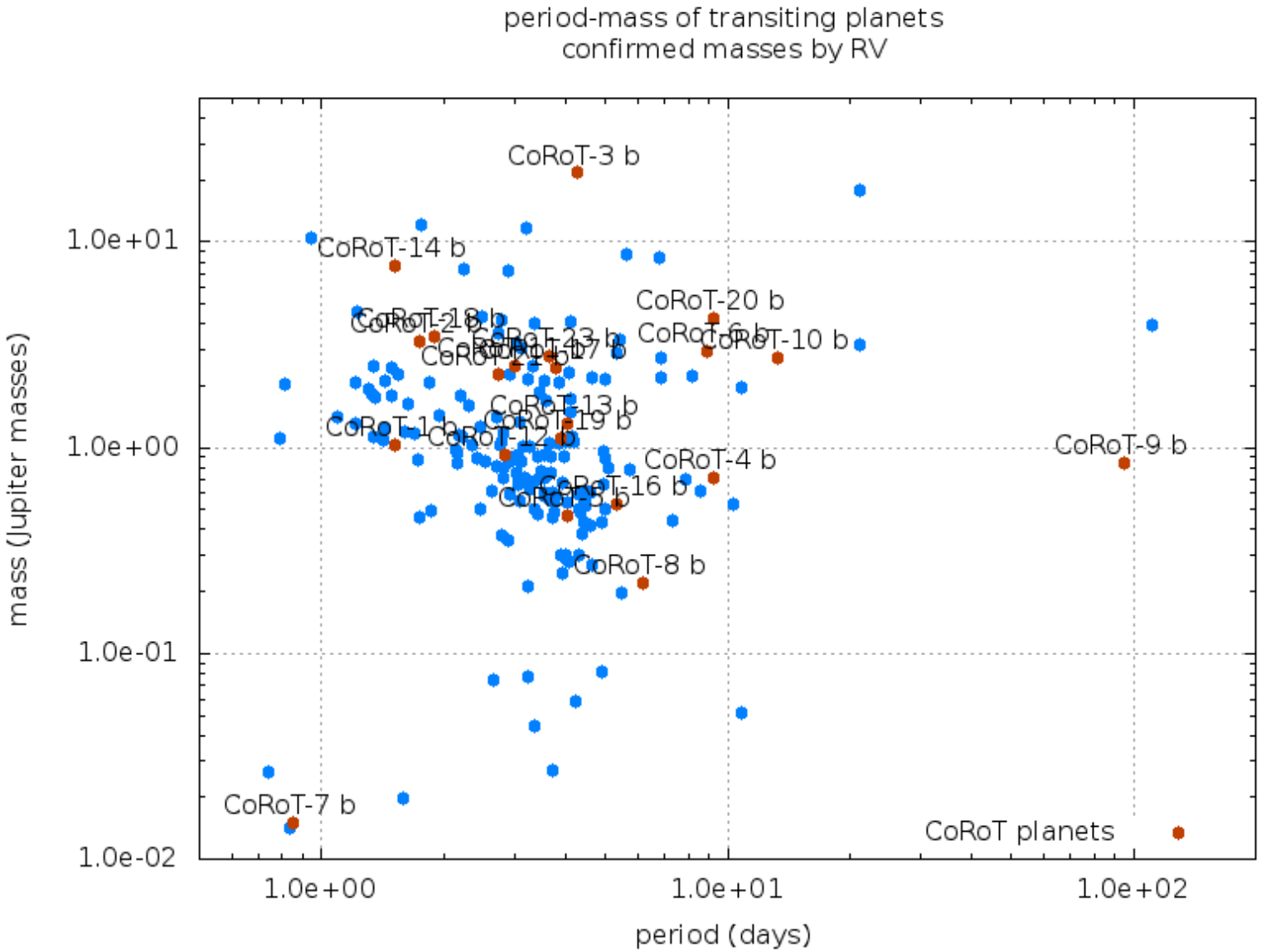
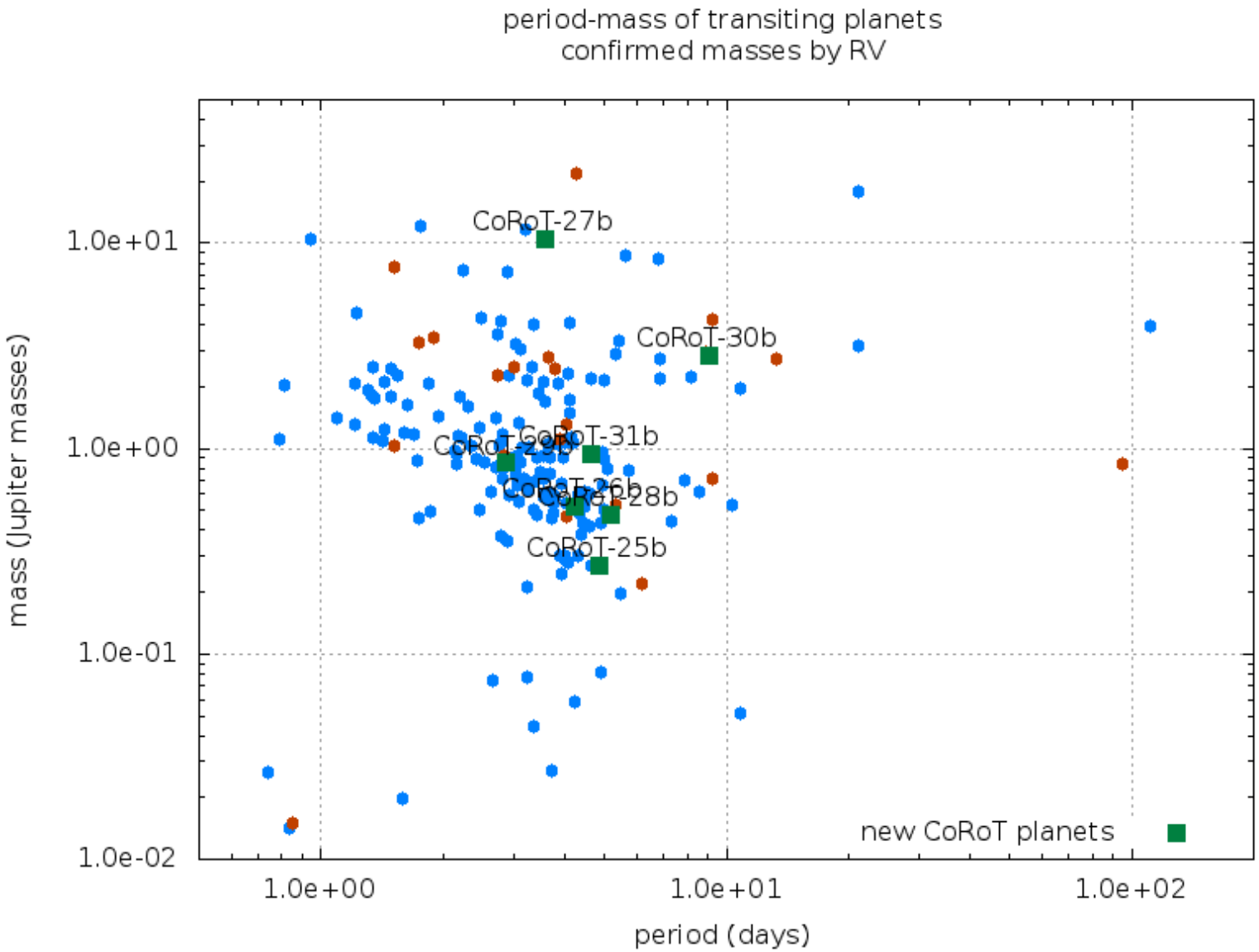


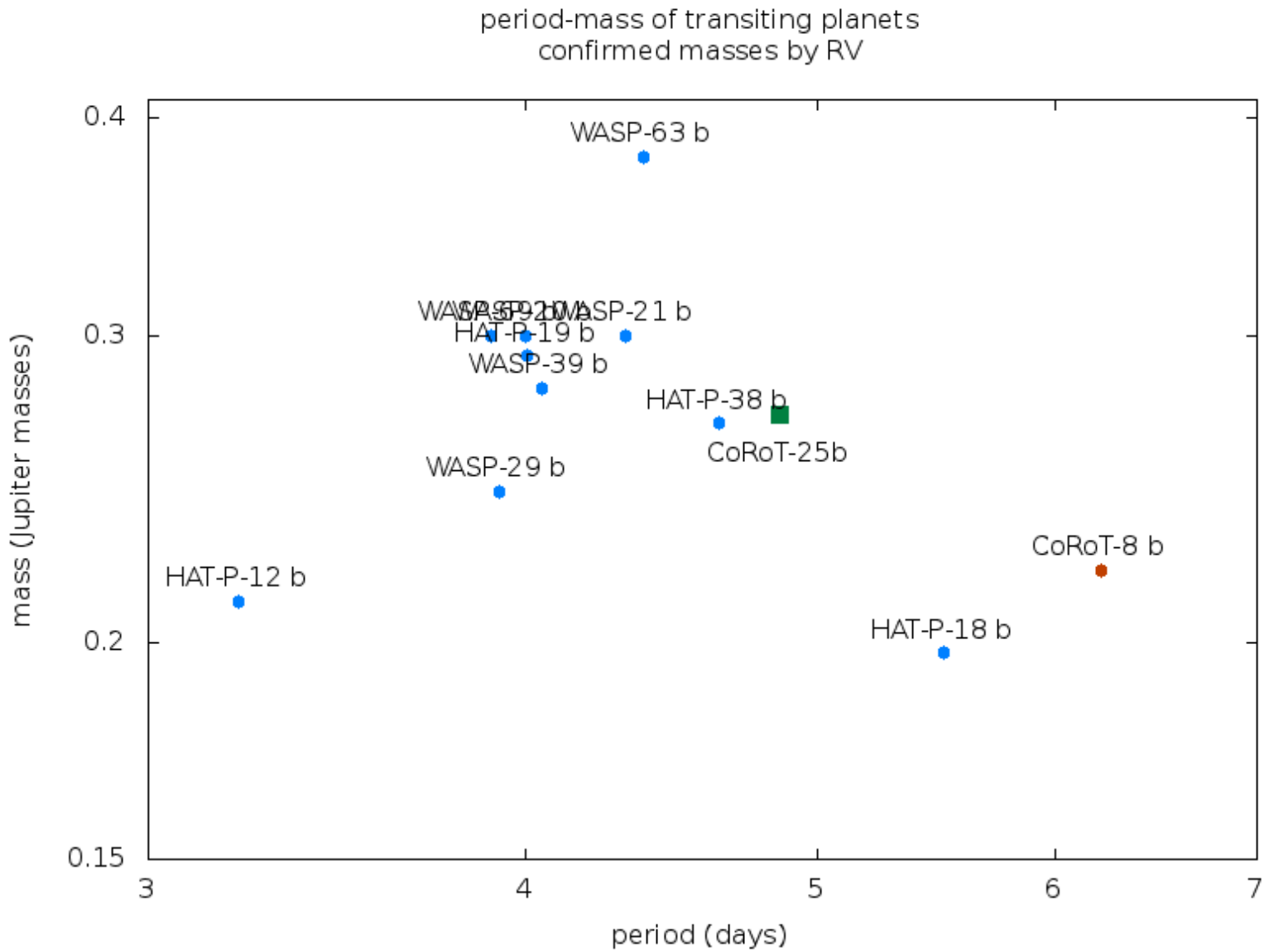
the characterization of planetary systems

period and mass of transiting planets with measured mass from RV



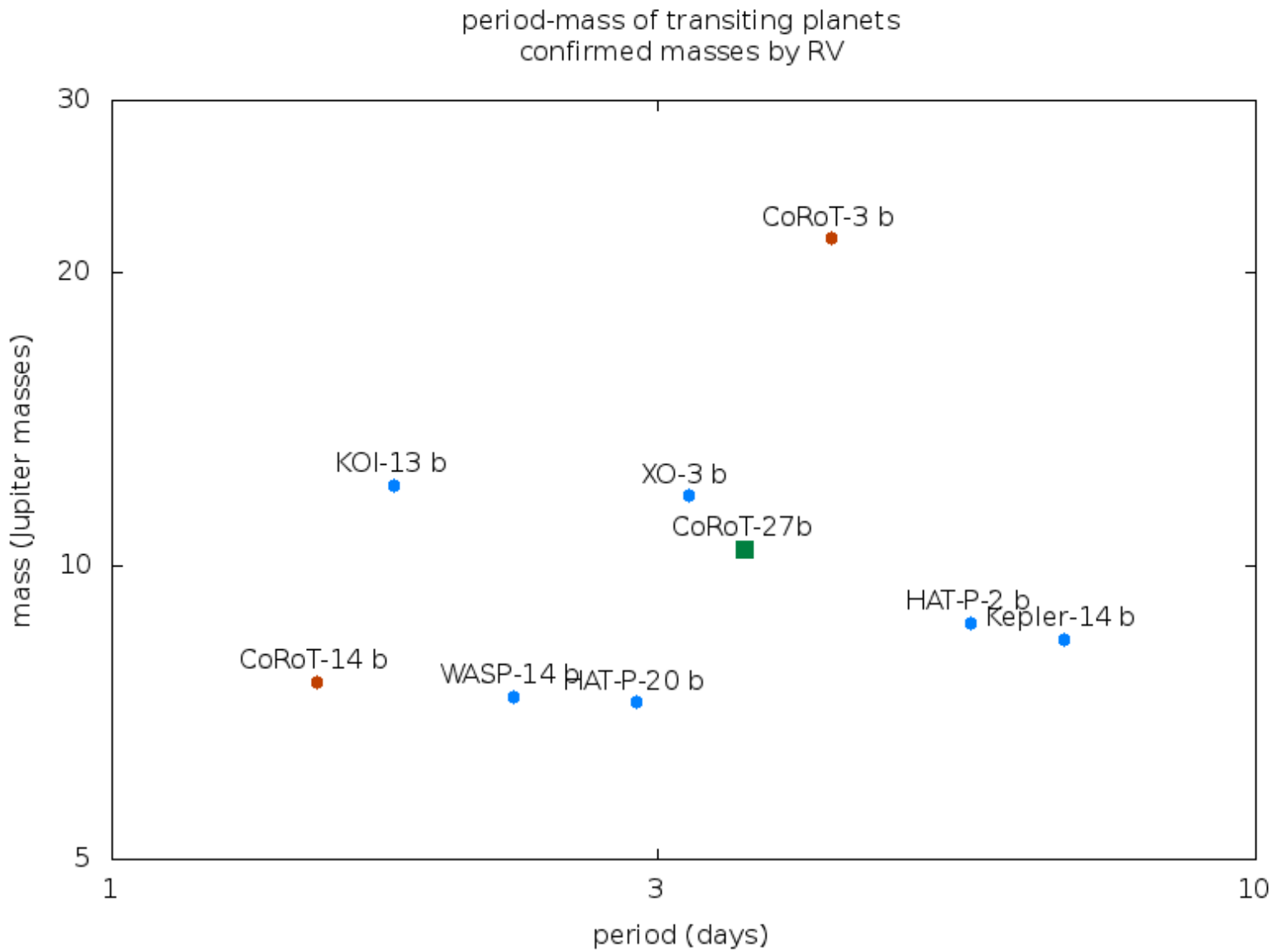
the characterization of planetary systems

period and mass of CoRoT-25b



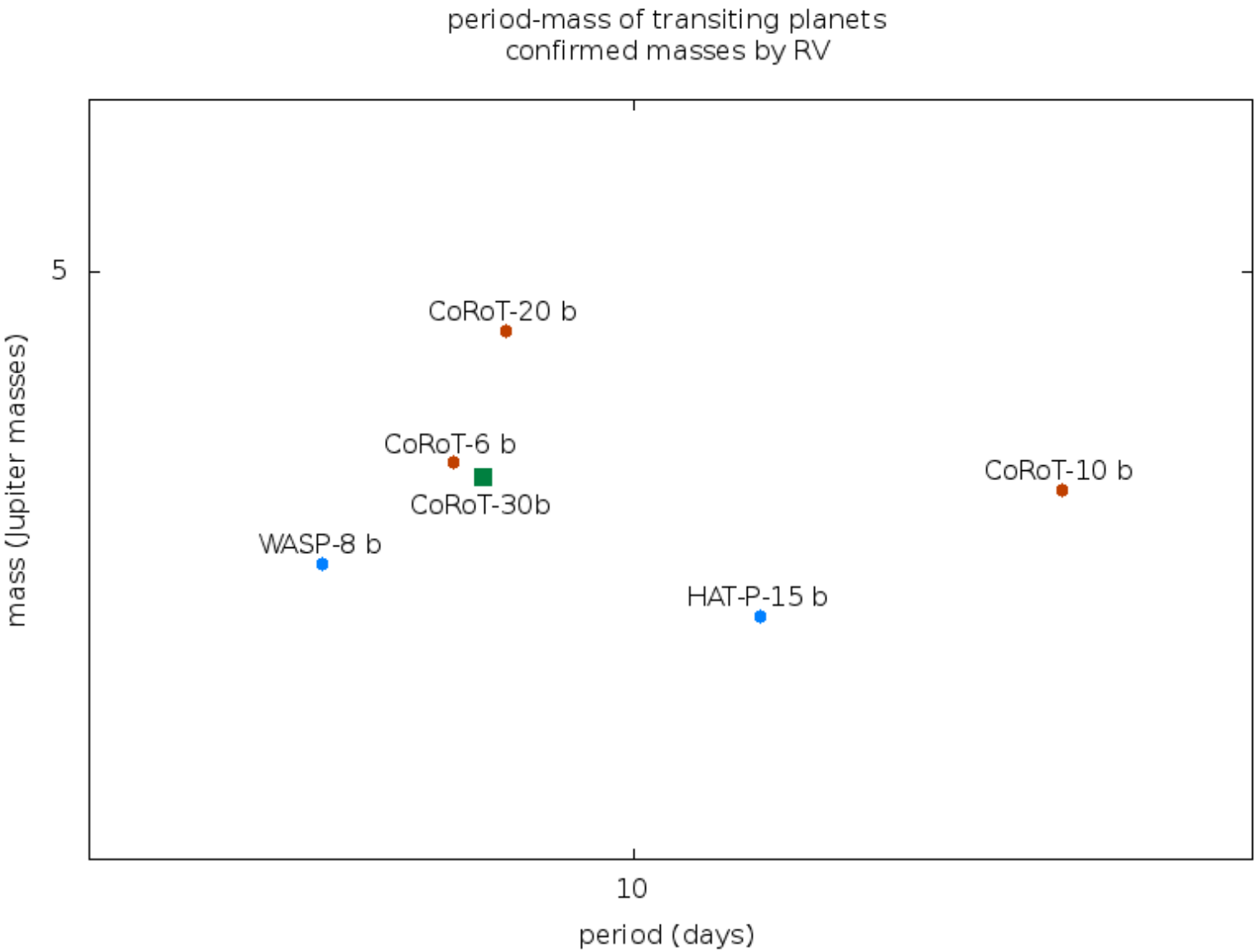
the characterization of planetary systems

period and mass of CoRoT-27b



the characterization of planetary systems

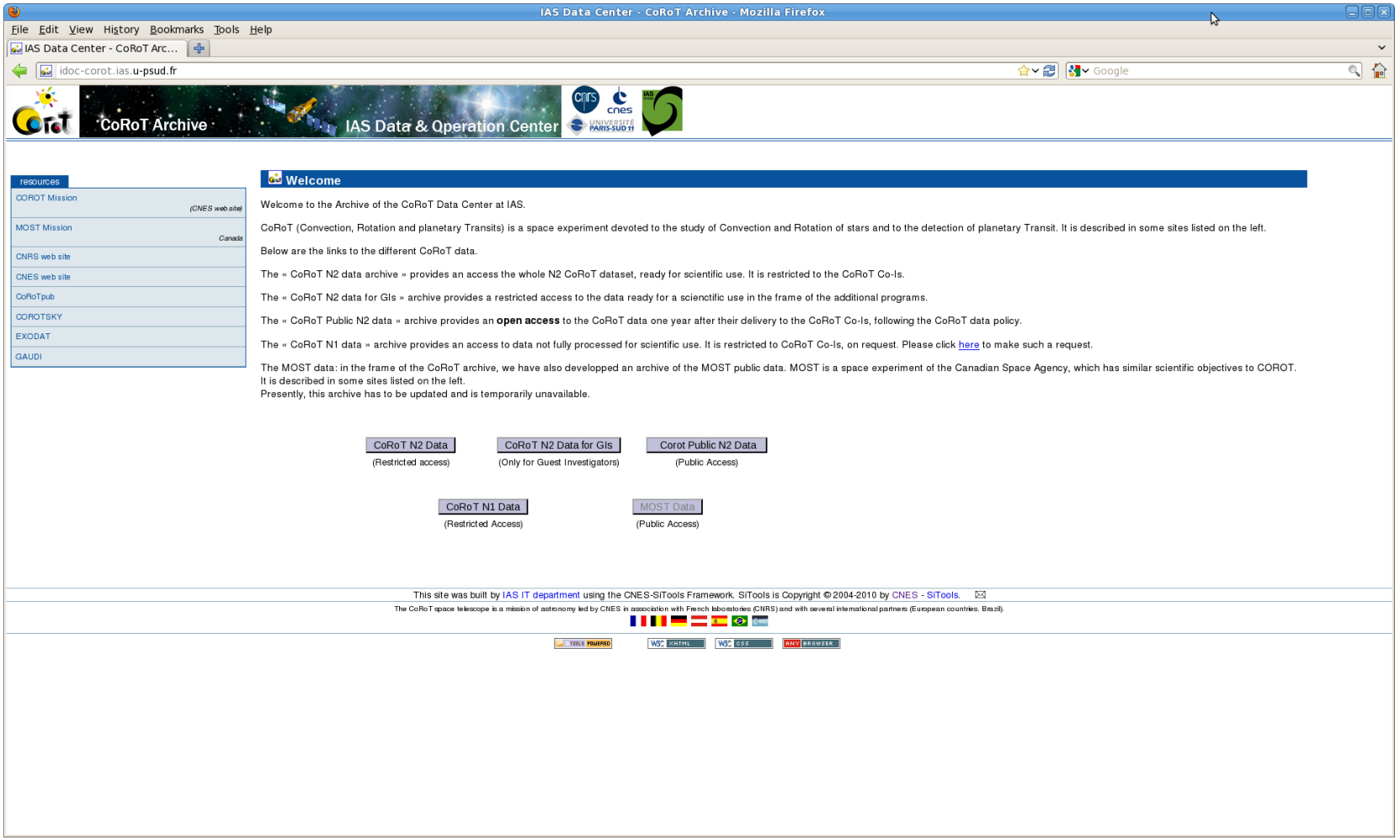
period and mass of CoRoT-30b



Appendix

databases

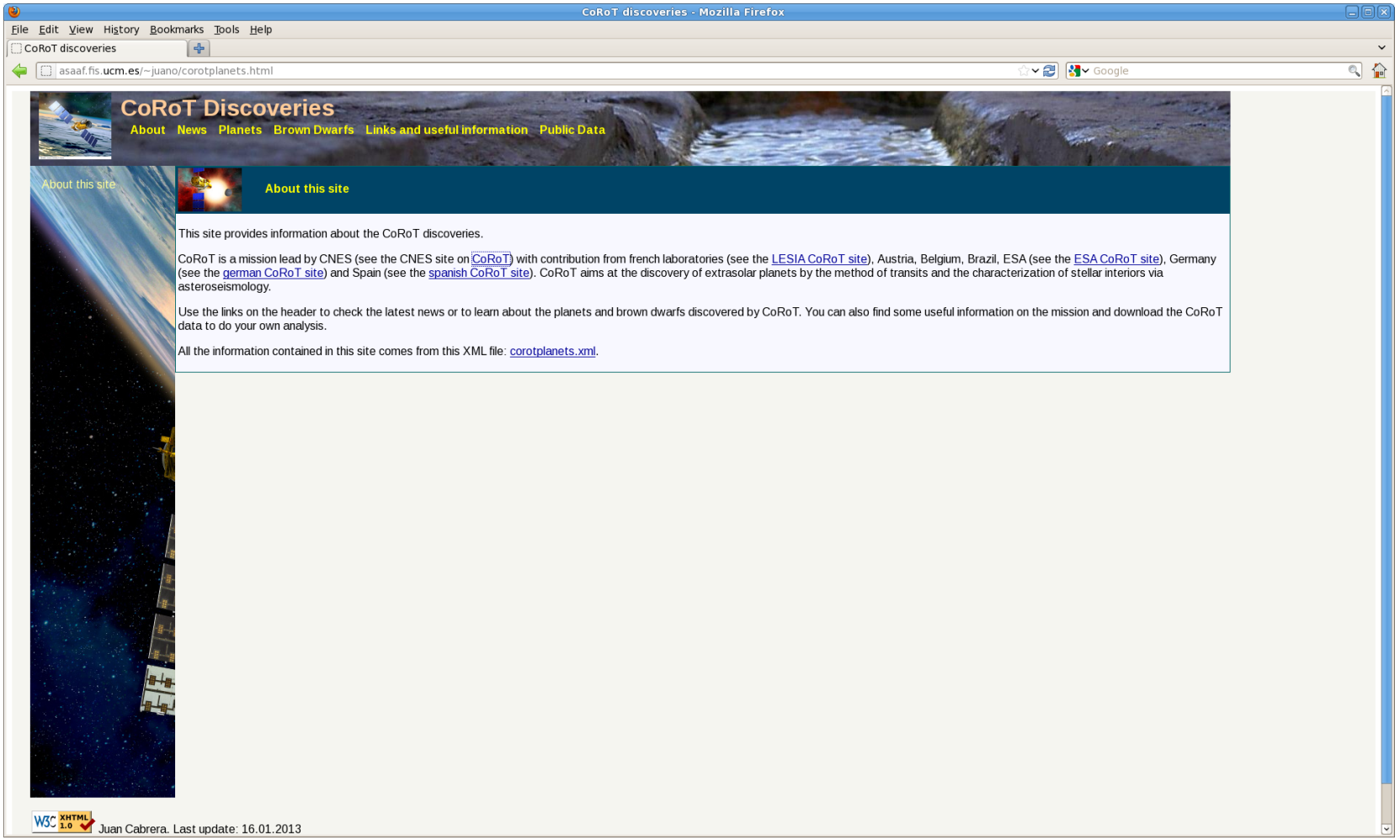
CoRoT public data



http://idoc-corot.ias.u-psud.fr/

databases

CoRoT planets



http://asaaf.fis.ucm.es/~juano/corotplanets.html

survey statistics

CoRoT and Kepler

	RV	TTV	RV/TTV upper	none	
Brown Dwarf	1	0	0	0	1
Jupiter	25	0	0	2	27
Saturn	2	0	0	0	2
Neptune	2	0	2	0	4
Super Earth	1	0	0	0	1
Earth	0	0	0	0	0
35	31	0	2	2	35

	RV	TTV	RV/TTV upper	none	
brown dwarf	1	0	0	0	1
jupiter	18	3	2	2	25
saturn	2	5	1	2	10
neptune	2	10	14	11	37
super Earth	3	9	45	30	87
Earth	0	0	7	4	11
171	26	27	69	49	171

all planets in Kepler FOV

survey statistics

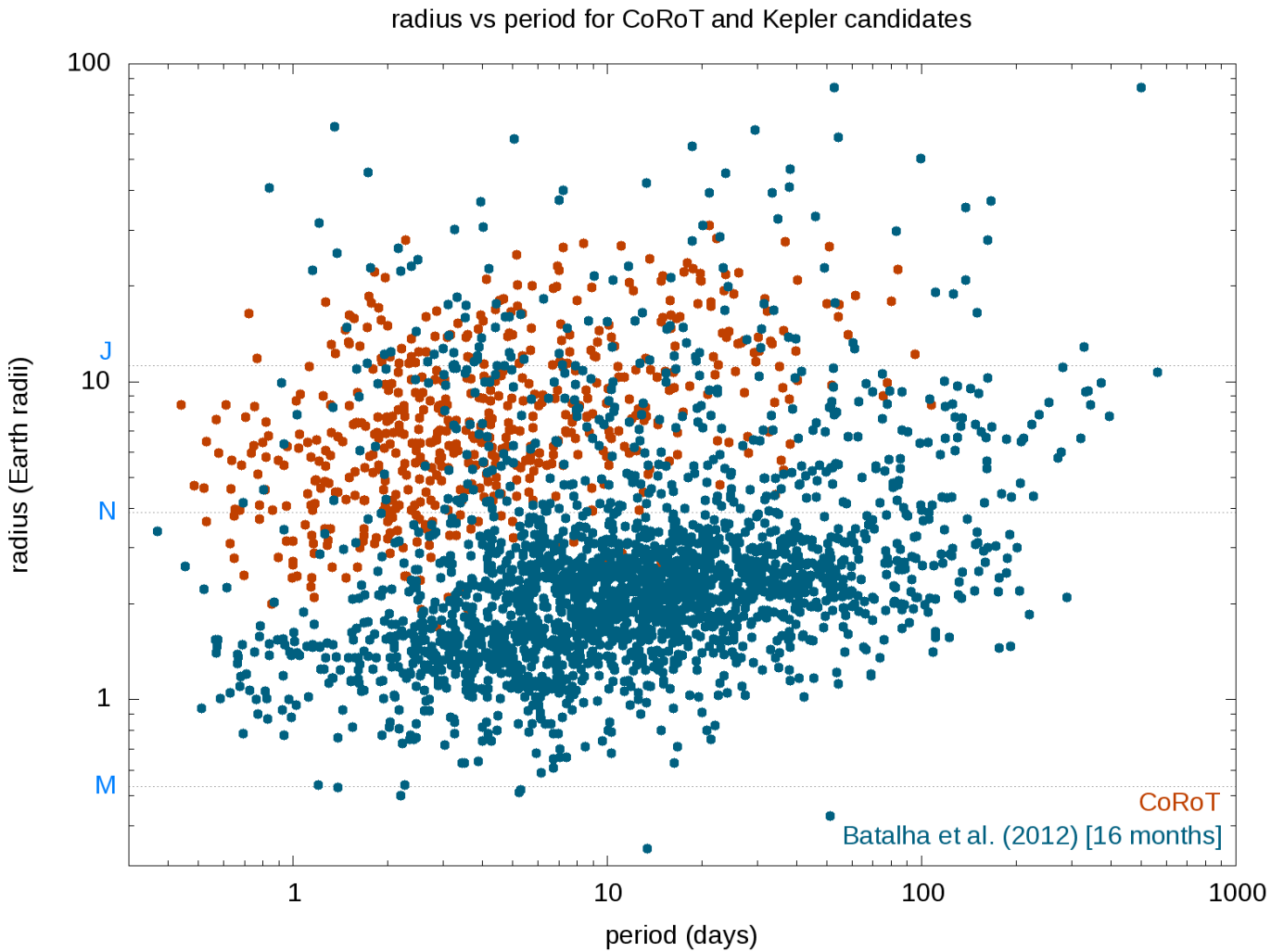
other surveys

survey	planets with confirmed mass and radius	planets (all)	systems (all)	planetary candidates	eclipsing binaries	dwarf stars
CoRoT	31	35	31	537	3029	96000
	0.03%	**0.04%**	**0.03%**	**0.56%**	**3.2%**	
Kepler	56	177	78	2321	2165	114000
	0.05%	**0.16%**	**0.07%**	**2.04%**	**1.9%**	
WASP	74	74	74	-	-	9.00E+006
	0.001%	**0.001%**	**0.001%**			

- CoRoT: ∼160k stars, ∼60% dwarfs (Aigrain et al. 2009)
- Kepler: ∼190k stars, ∼60% dwarfs (Christiensen et al. 2013)
- WASP: ∼18M stars, ∼50% dwarfs (WASP archive)

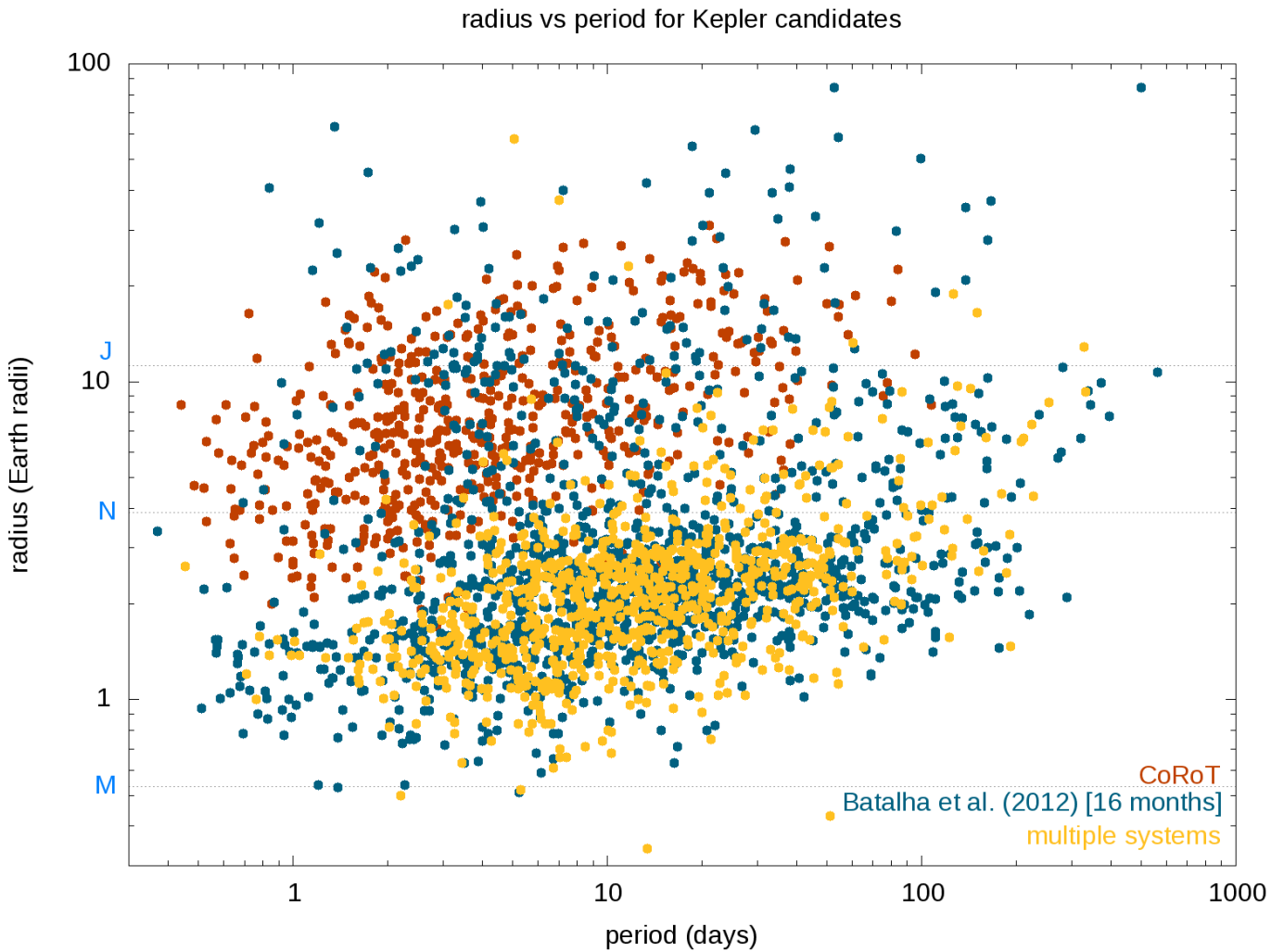
3D plots

period vs radius



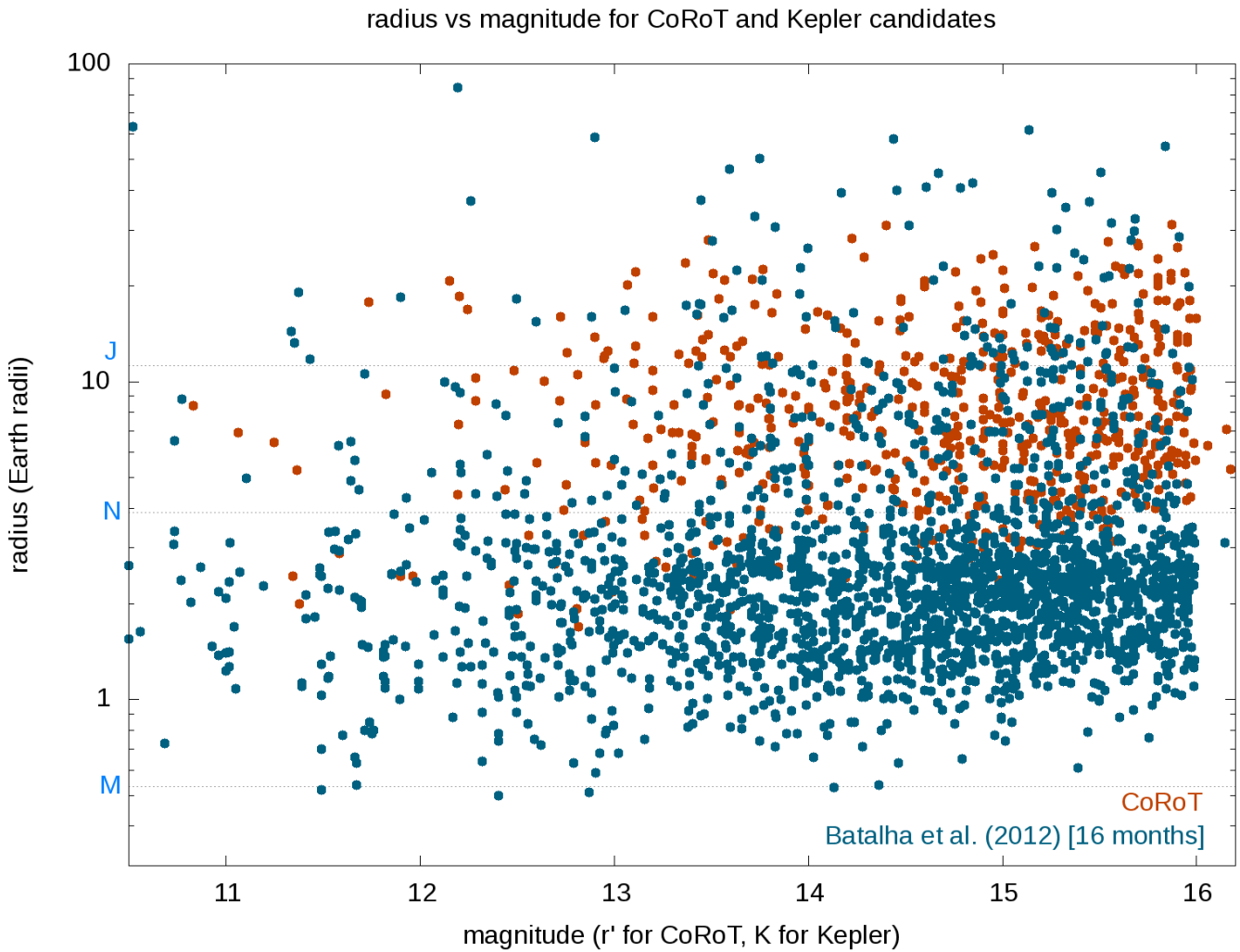
3D plots

period vs radius



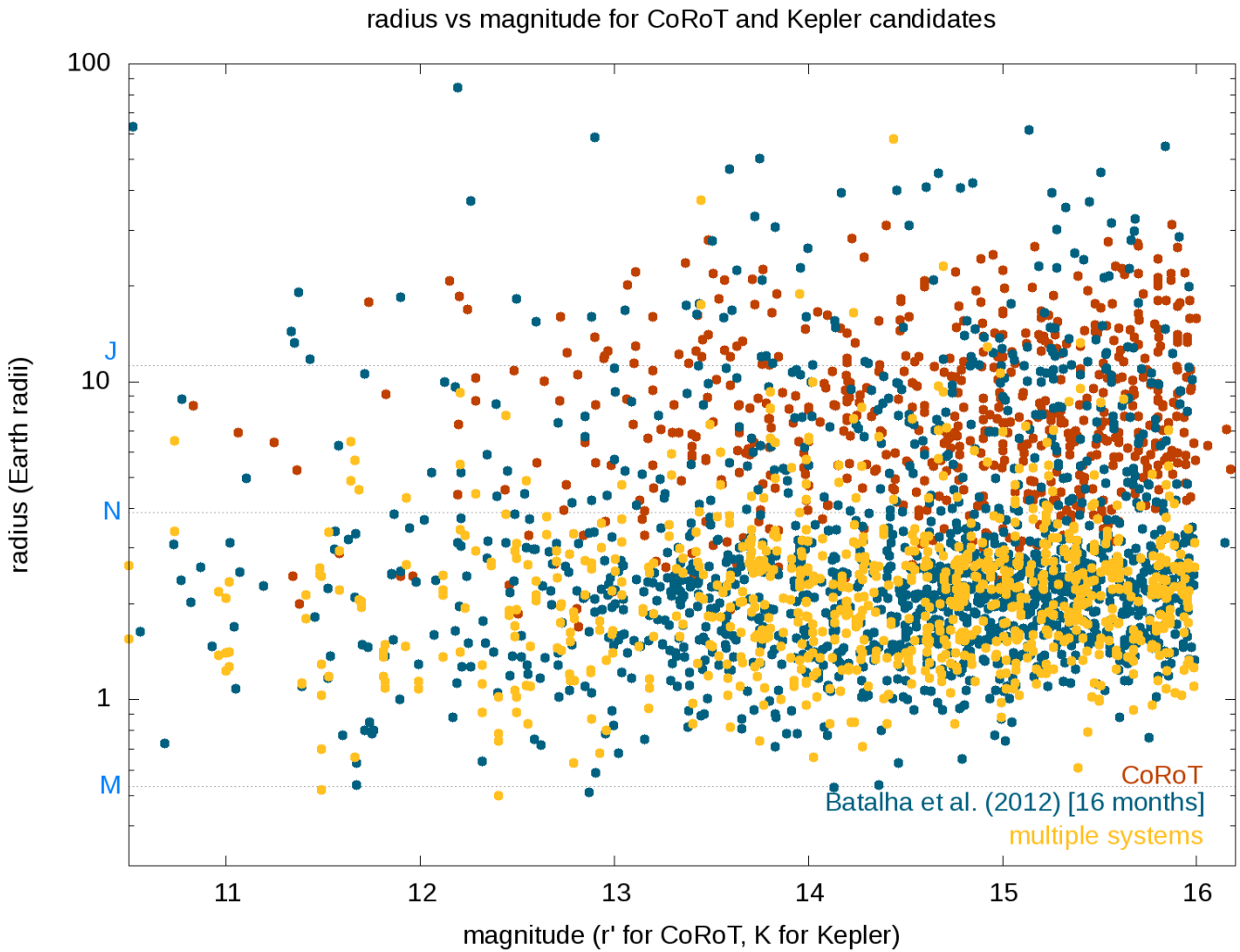
3D plots

magnitude vs radius



3D plots

magnitude vs radius



CoRoT yield of hot Jupiters

- CoRoT, anticenter direction (6^h50^m): $0.4 \pm 0.2\%$
- on study for center direction (metallicity gradient?)

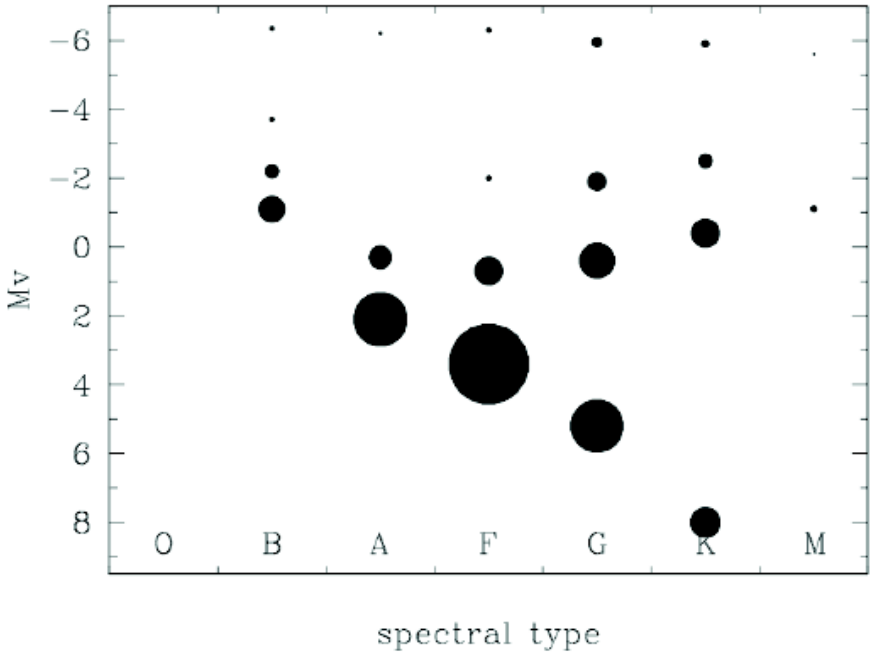


Fig. 4. HRD of the stars observed by CoRoT. The size of the circles is proportional to the number of stars of that category.

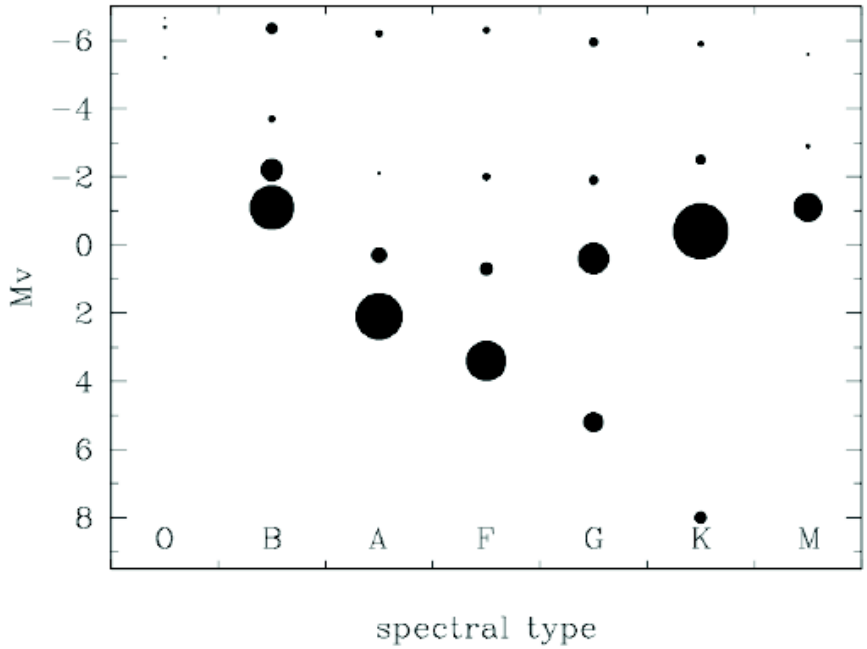
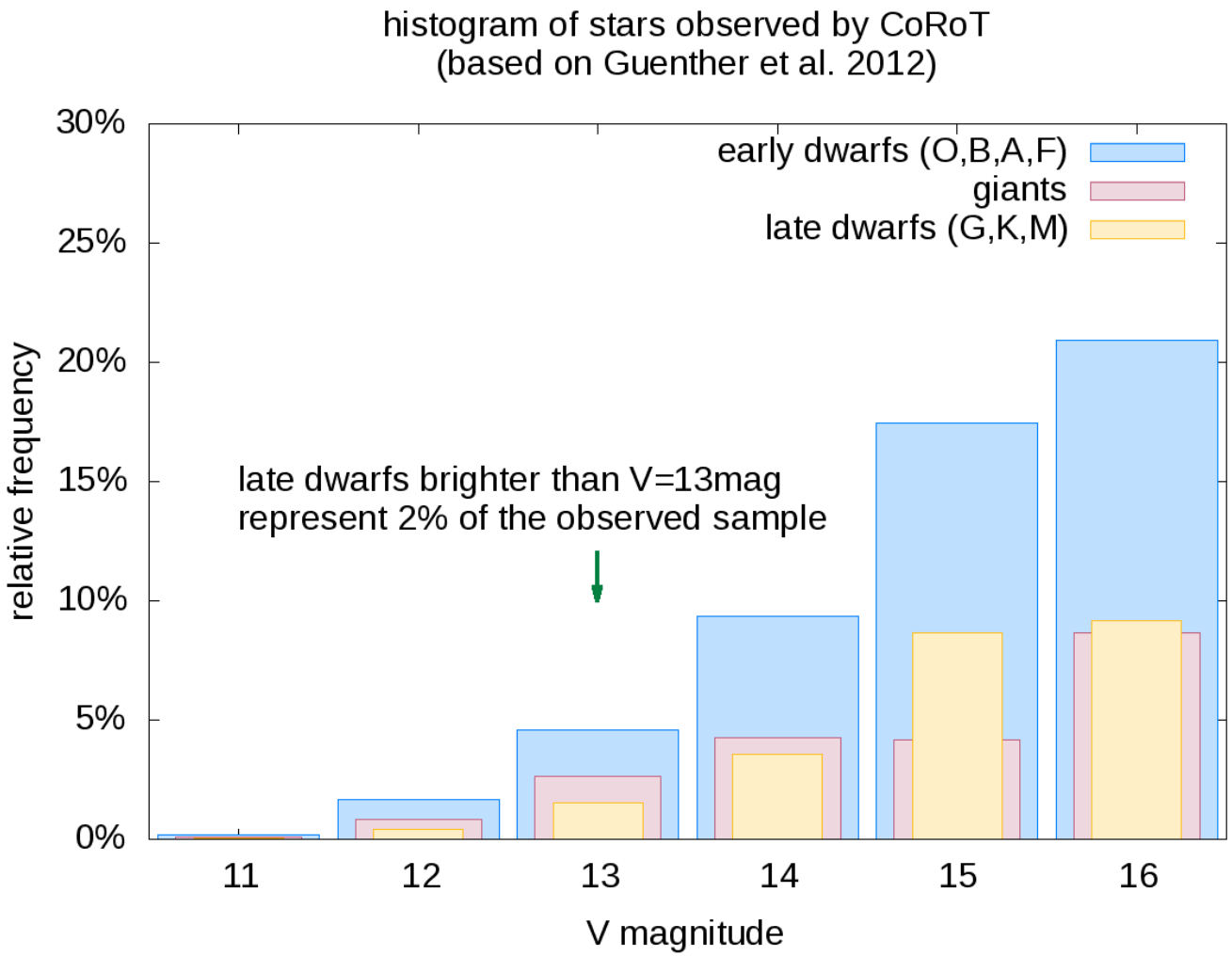


Fig. 6. Same as Fig. 4 but for stars brighter than 6.5 mag.

Günther et al. 2012

CoRoT yield of hot Jupiters

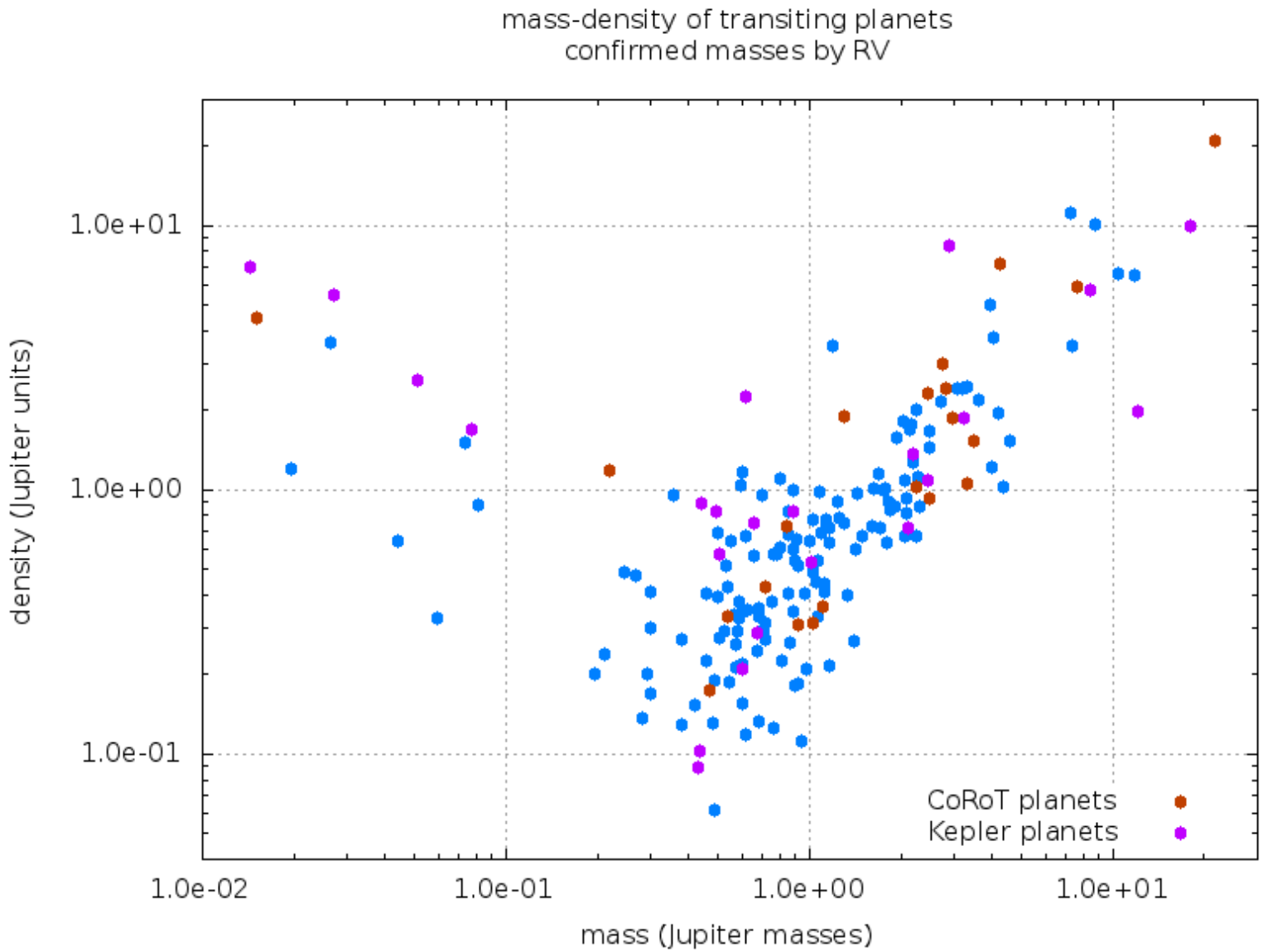
CoRoT magnitude range



data from Günther et al. 2012

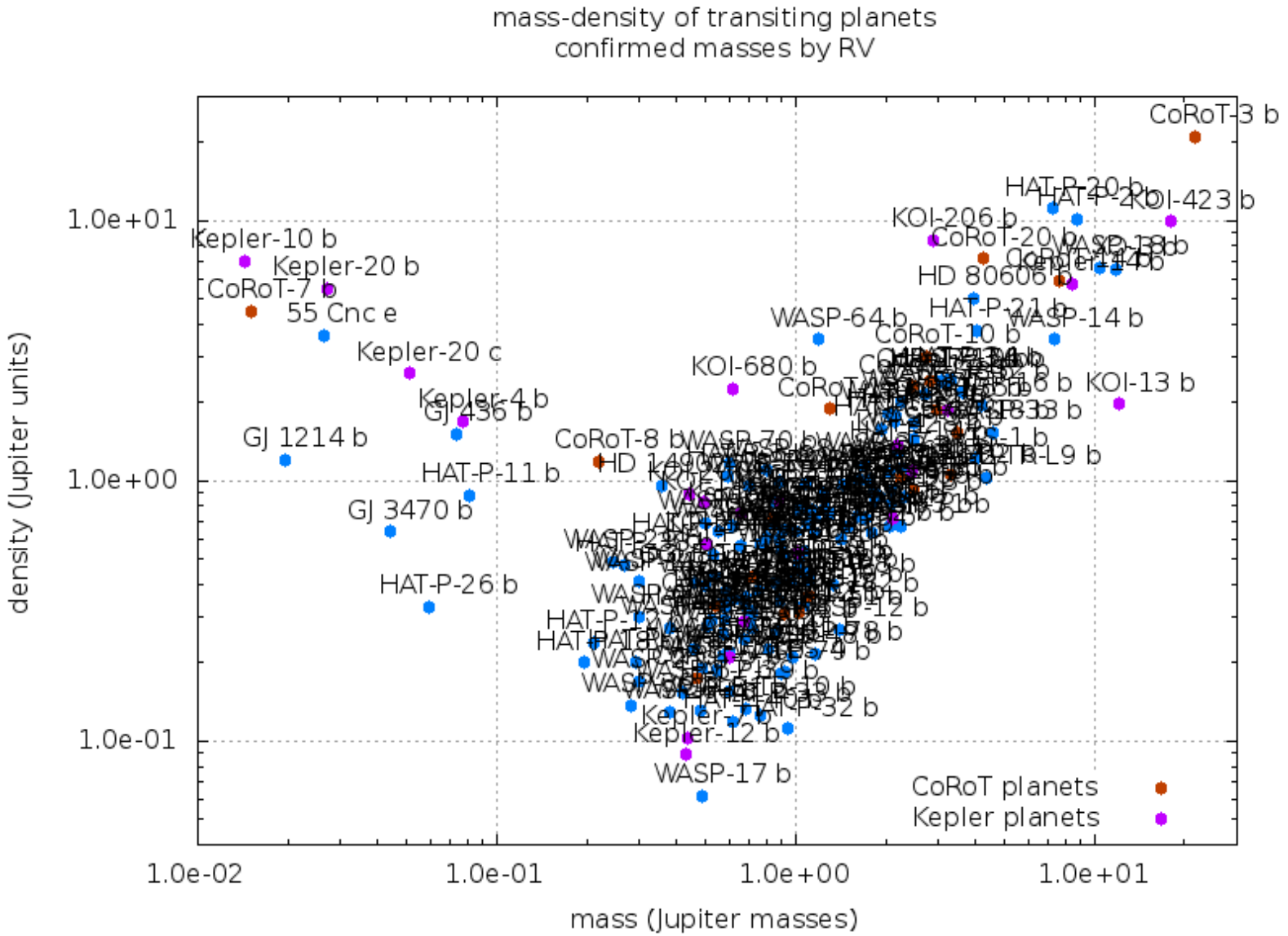
mass-density

CoRoT and Kepler



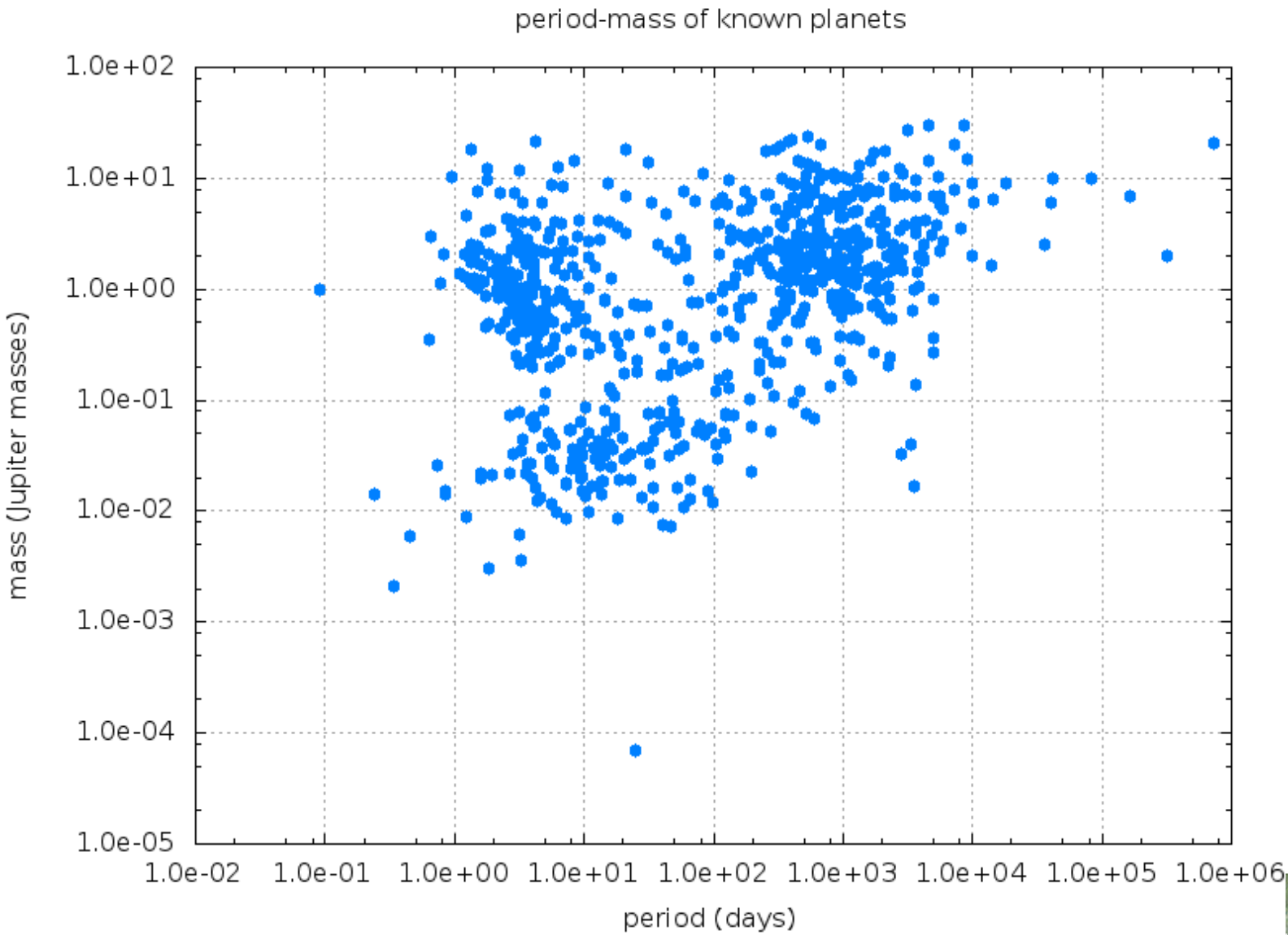
mass-density

planet names



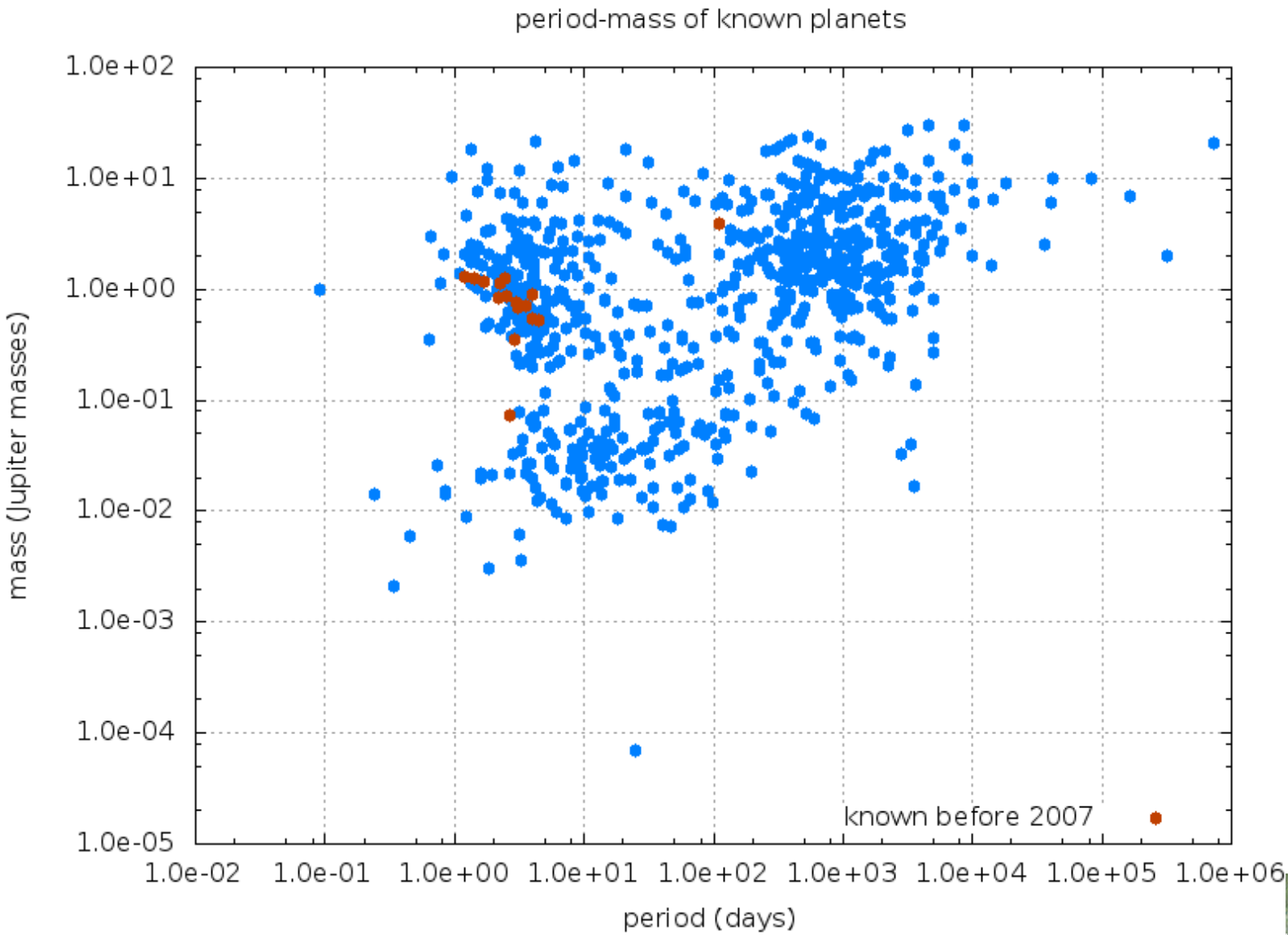
period-density

known planets



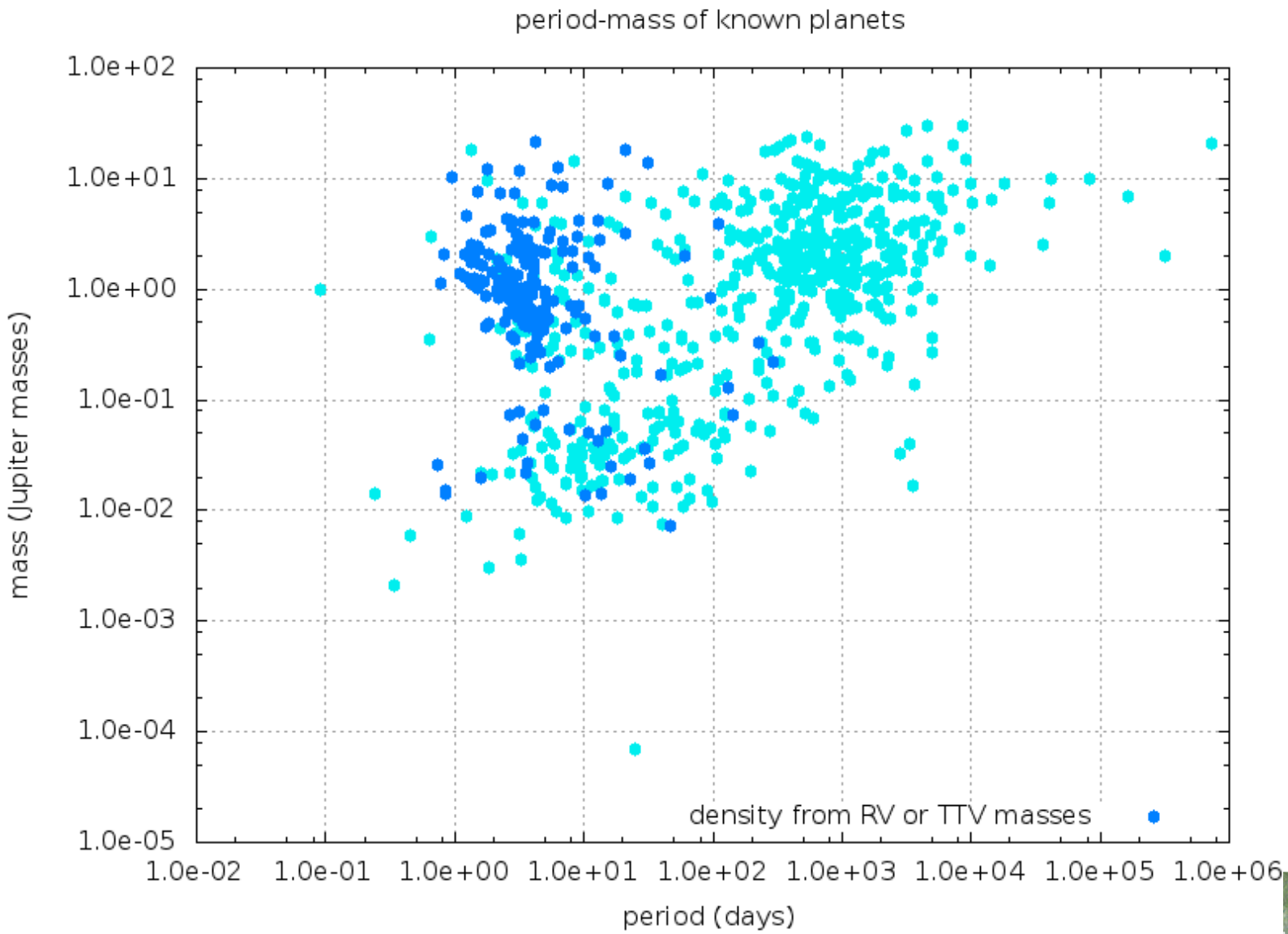
period-density

known planets 2007



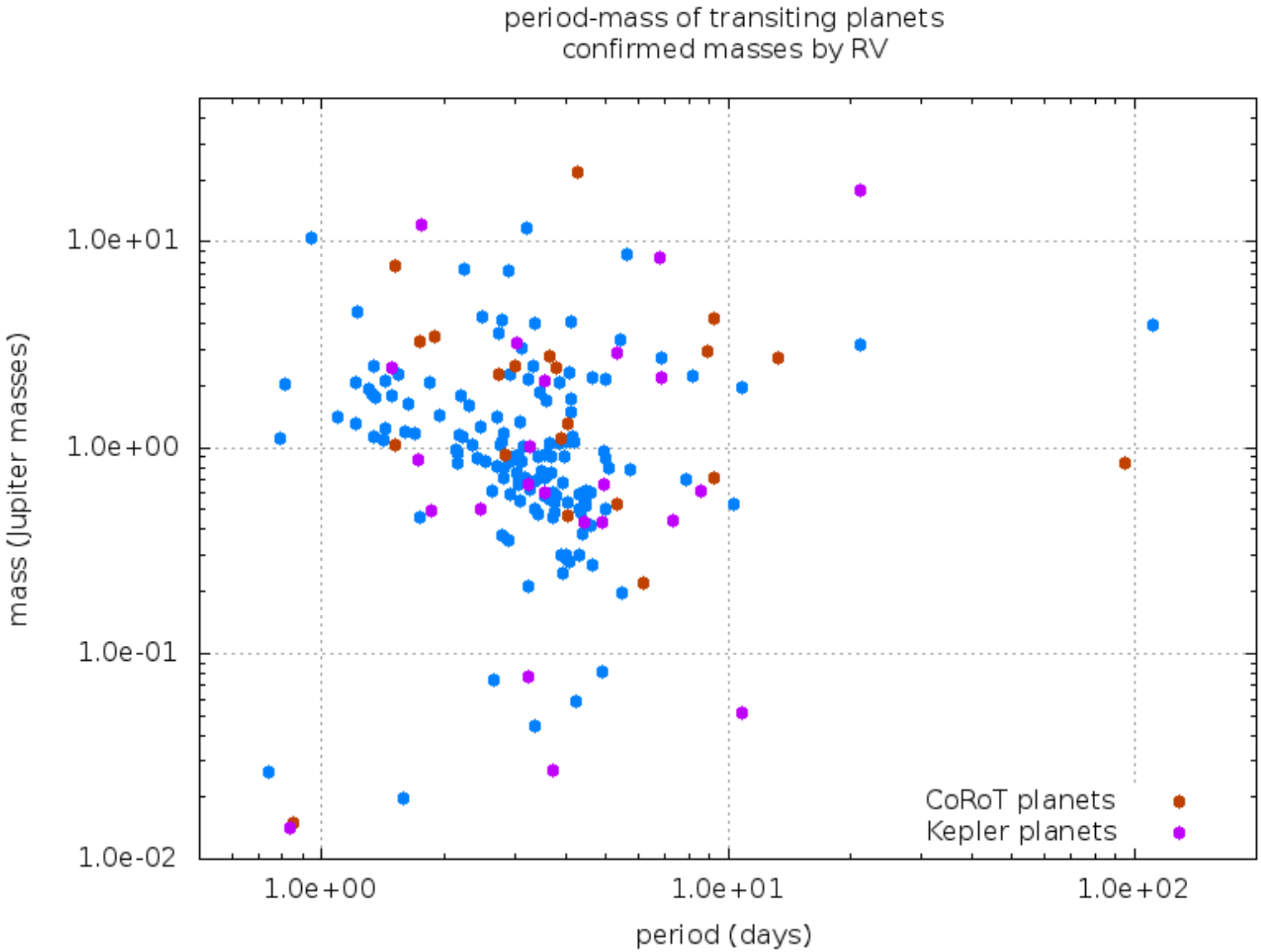
period-density

known planets and transiting planets



period-density

CoRoT and Kepler



period-density

planet names