



the new CoRoT planets

CoRoT Exoplanet Science Team

21.03.2013

Knowledge for Tomorrow



introduction

the Team

France IAS P. Bordé, A. Léger, M. Ollivier, O. Demangeon

LAM M. Deleuil, C. Moutou, J.M. Almenara, S. Barros, A. Bonomo, C. Damiani,
A. Santerne

OHP F. Bouchy, G. Hébrard, R. Díaz, G. Montagnier

O. Paris A. Baglin, M. Auvergne, S. Chaintreuil, D. Rouan, J. Schneider, B. Samuel

U. Nice T. Guillot, M. Havel

Germany A. Hatzes, M. Pätzold, H. Rauer, A. Erikson, G. Wuchterl, E. Günther,
M. Ammler von Eiff, J. Cabrera, Sz. Csizmadia, S. Grziwa, A. Ofir

Austria R. Dvorak, H. Lammer

Spain H. Deeg, R. Alonso, B. Tingley, H. Parviainen

UK S. Aigrain, A. McQuillan

ESA M. Fridlund, D. Gandolfi

USA M. Endl, D. Ciardi, W. Cochran, A. Shporer, P. McQueen

Israel T. Mazeh, L. Tal-Or

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 → see talk by **D. Gandolfi**



CoRoT-24

what you already know

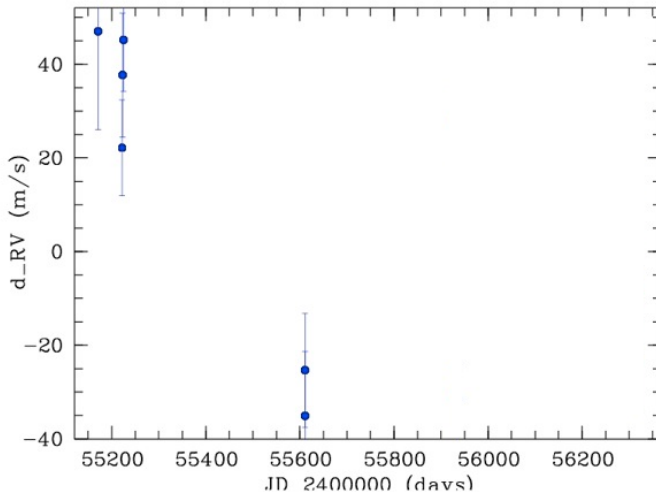
Alonso et al. in preparation

- ▶ 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



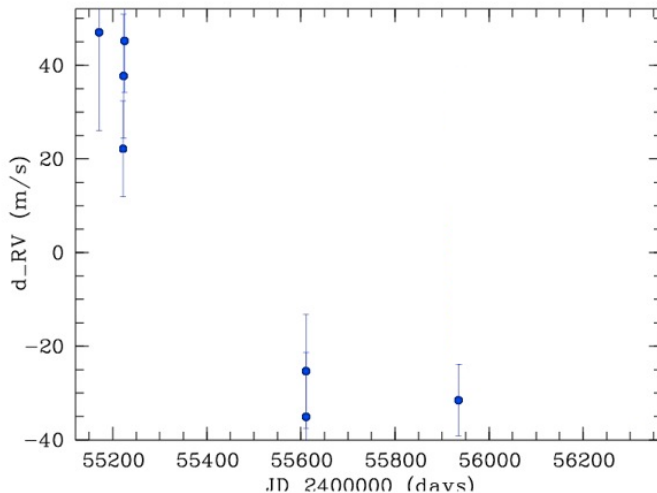
CoRoT-24

update on the drift



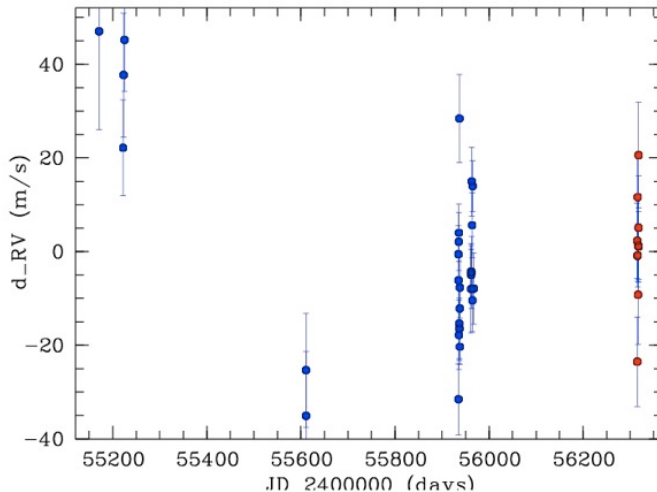
CoRoT-24

update on the drift



CoRoT-24

update on the drift



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

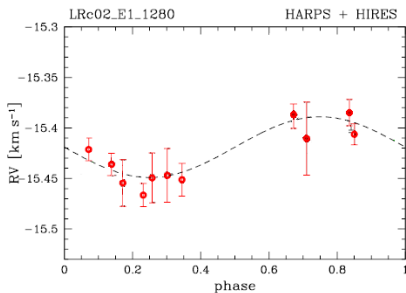
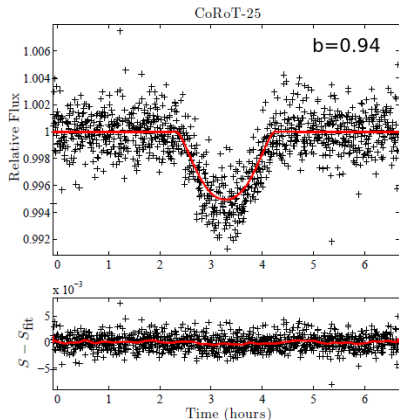


Fig. 3. Phase folded radial velocities of CoRoT-25. The black circle and green square correspond respectively to HARPS and HIRES measurements. The red open circle correspond to the averaged of the double measurements.

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, 9.1 Gyr, solar metallicity, $\log g = 4.0$, $A_V = 0.85$, 1.7 kpc, $V=15.8$ 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 57 m/s, circular orbit

CoRoT-26b

low mass hot Jupiter

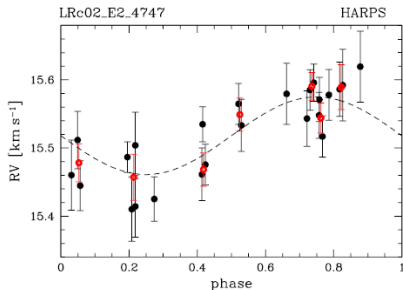
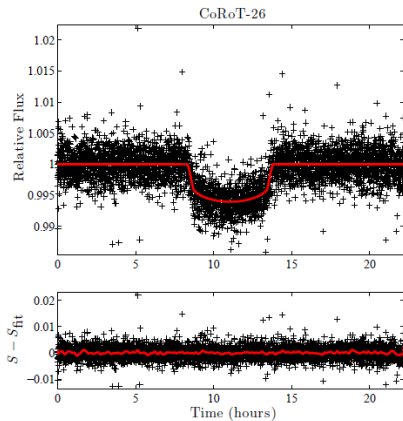


Fig. 5. Phase folded radial velocities of CoRoT-26. The black circle correspond respectively to HARPS. The red open circle correspond to the averaged of the double measurements.

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

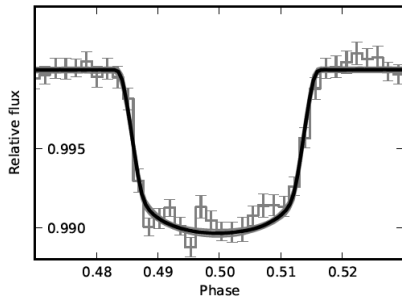


Fig. 7. Phase-folded and binned light curve with a transit model fit.

Parviainen et al. 2013, in preparation

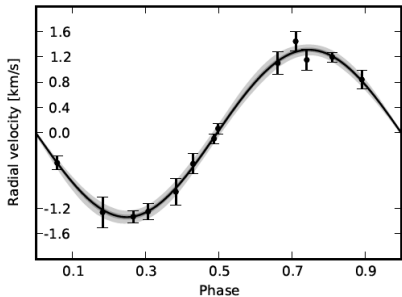


Fig. 6. Phase-folded radial velocity points with a radial velocity fit.

CoRoT-27b

the massive and dense super Jupiter

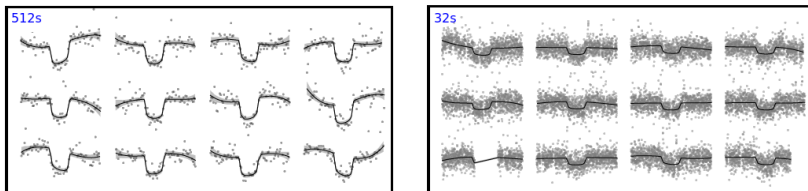


Fig. 8. Individual transits with the median transit models and 95% confidence limits.

Parviainen et al. 2013, in preparation

- ▶ see how to hunt for secondary eclipses
Parviainen et al. 2013 A&A, 550, A67

CoRoT-28b

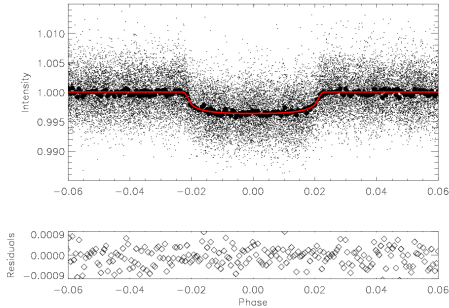
the old, low mass hot Jupiter

Cabrera et al. in preparation

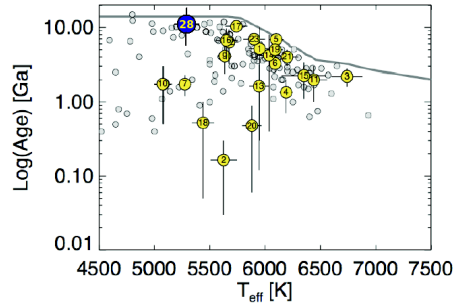
- ▶ old, low mass hot Jupiter
- ▶ 5.2d period, 0.5 Jupiter masses, 0.97 Jupiter radii (0.7 g cm^{-3}), $V=13.8$
- ▶ solar-like host star, **12Gyr**, $\log g = 3.9$
 - ▶ see talk by **G. Wuchterl**
- ▶ discovered in LRc08 (summer 2011) 84 days of observation
- ▶ 25 SOPHIE, 6 HARPS measurements
- ▶ circular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

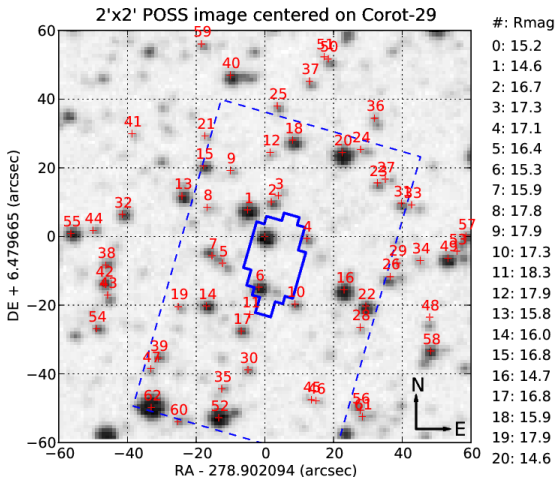
Cabrera et al. in preparation

- ▶ 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



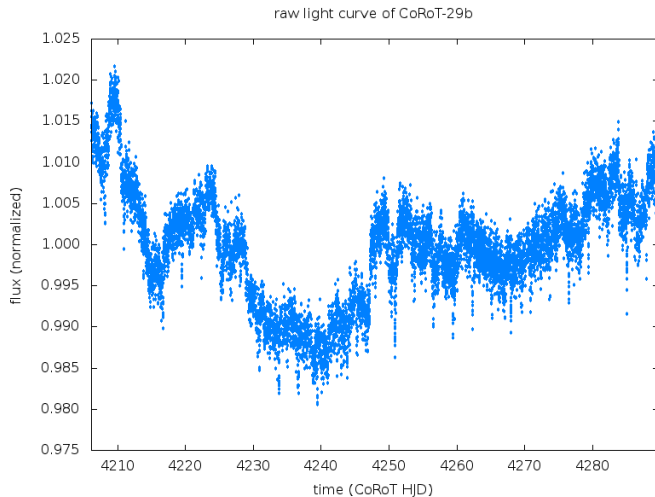
CoRoT-29b

the challenging hot Jupiter



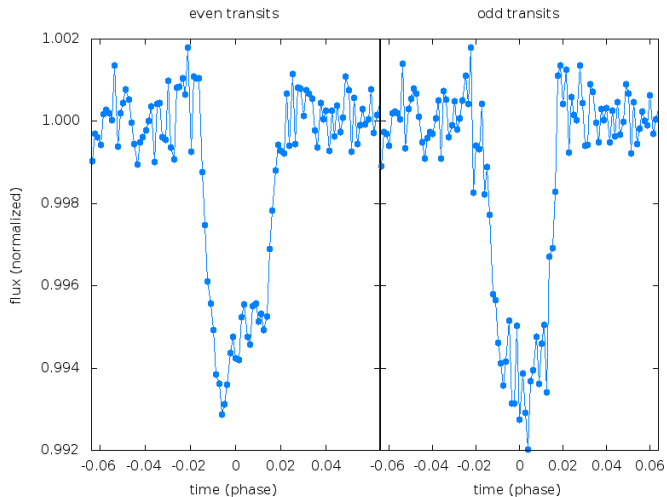
CoRoT-29b

the challenging hot Jupiter



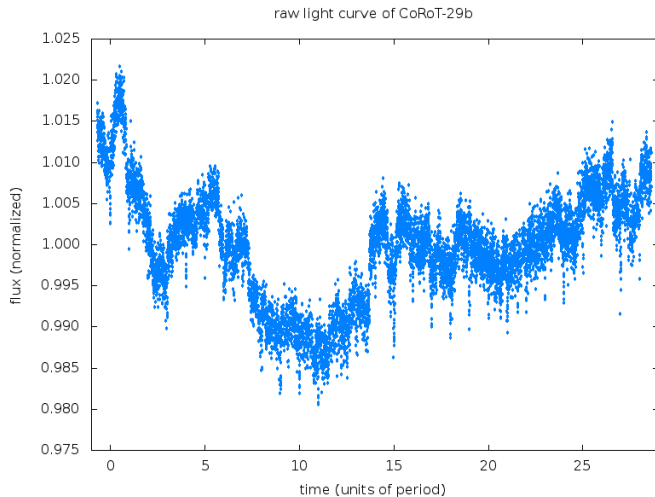
CoRoT-29b

the challenging hot Jupiter



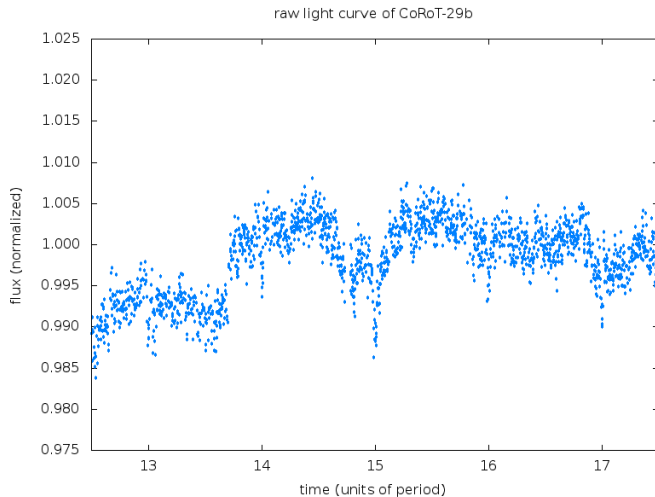
CoRoT-29b

the challenging hot Jupiter



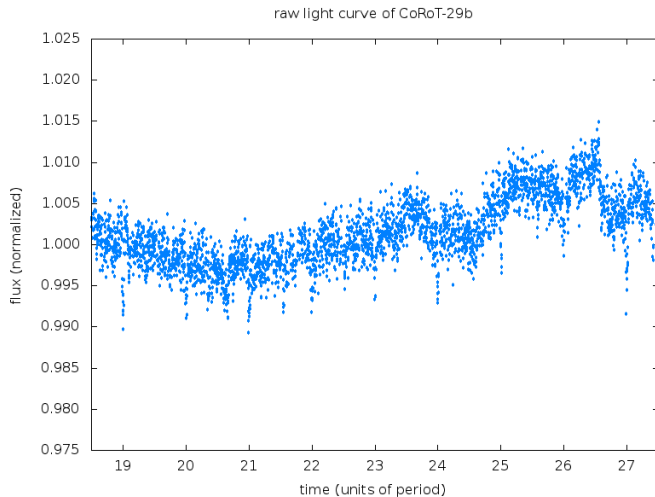
CoRoT-29b

the challenging hot Jupiter



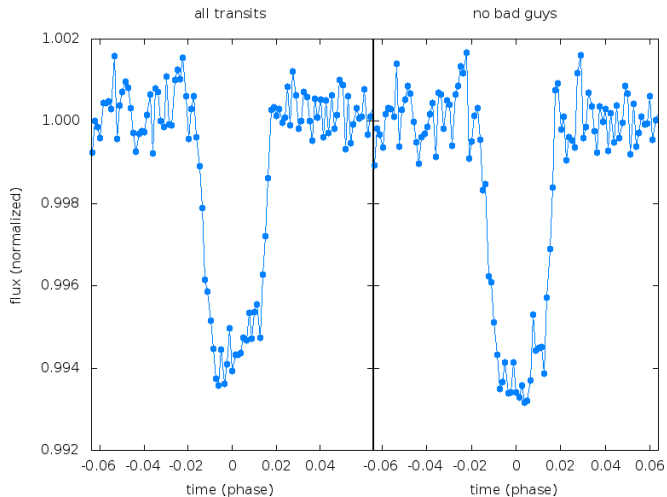
CoRoT-29b

the challenging hot Jupiter



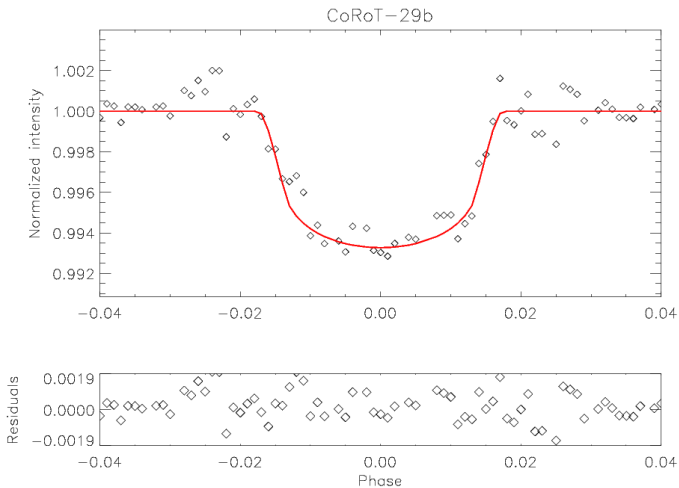
CoRoT-29b

the challenging hot Jupiter



CoRoT-29b

the challenging hot Jupiter



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

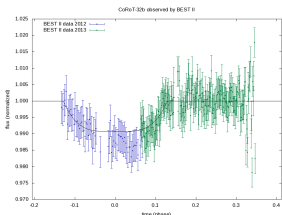


CoRoT-32b

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

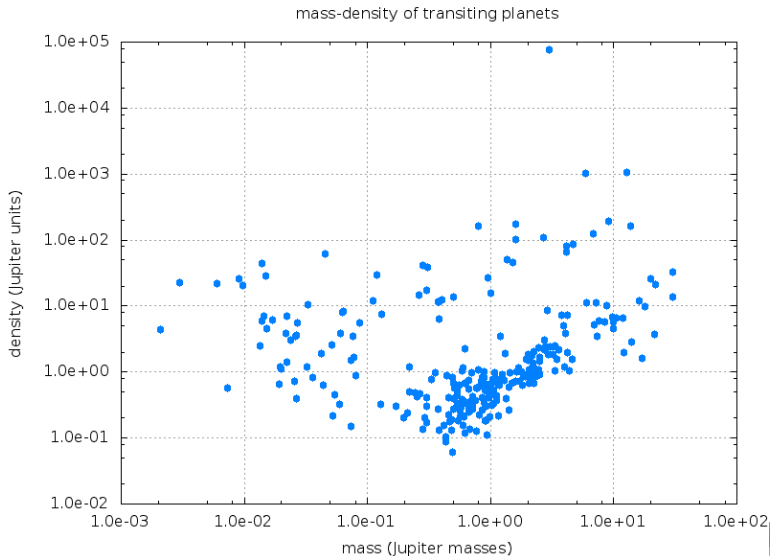
- ▶ in the program for the CoRoT extension we wrote
we have now entered the period of data interpretation

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.



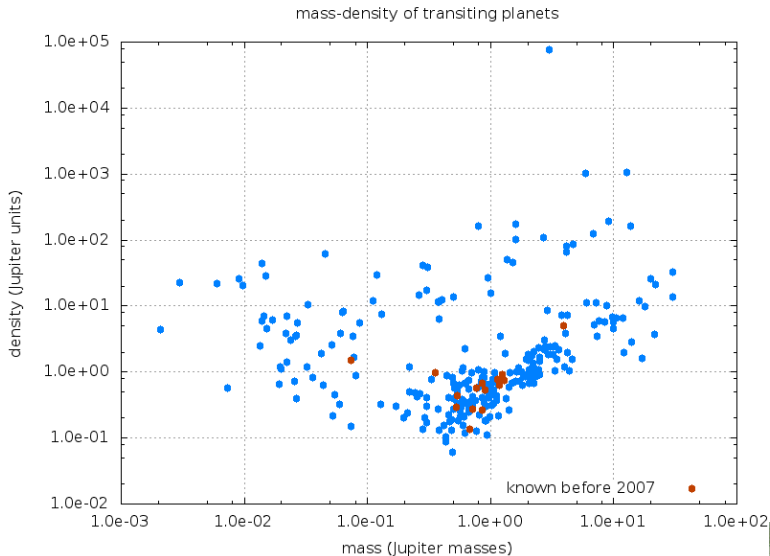
the characterization of planetary systems

mass and density of transiting planets



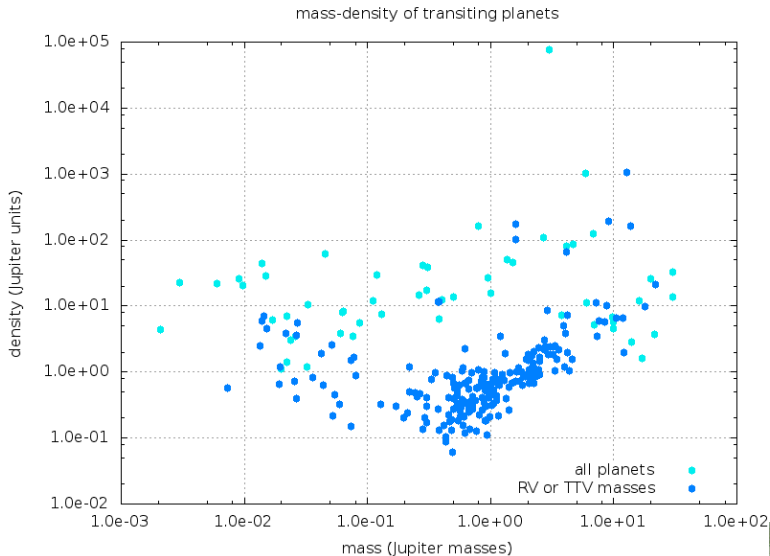
the characterization of planetary systems

mass and density of transiting planets



the characterization of planetary systems

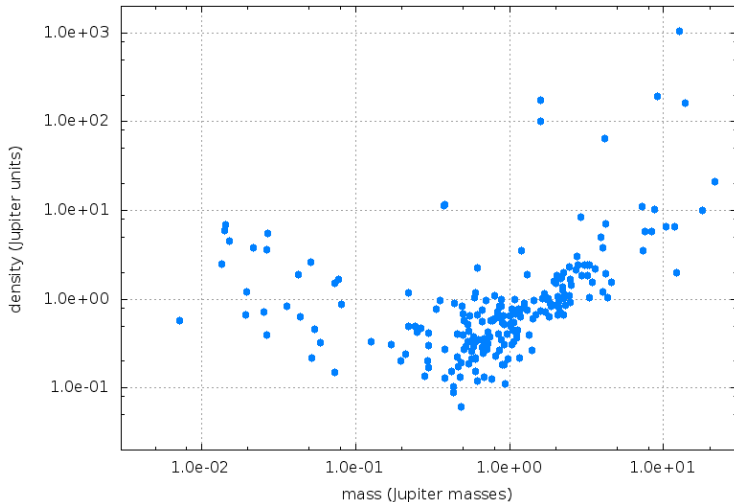
mass and density of transiting planets



the characterization of planetary systems

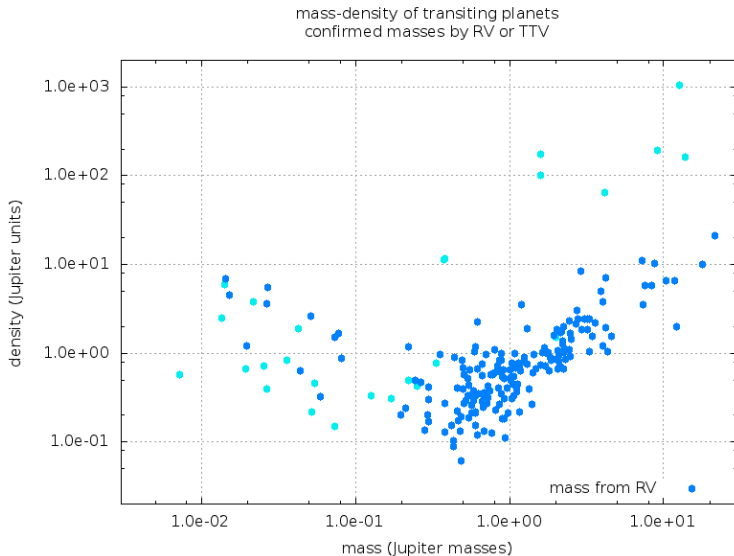
mass and density of transiting planets with known mass

mass-density of transiting planets
confirmed masses by RV or TTV



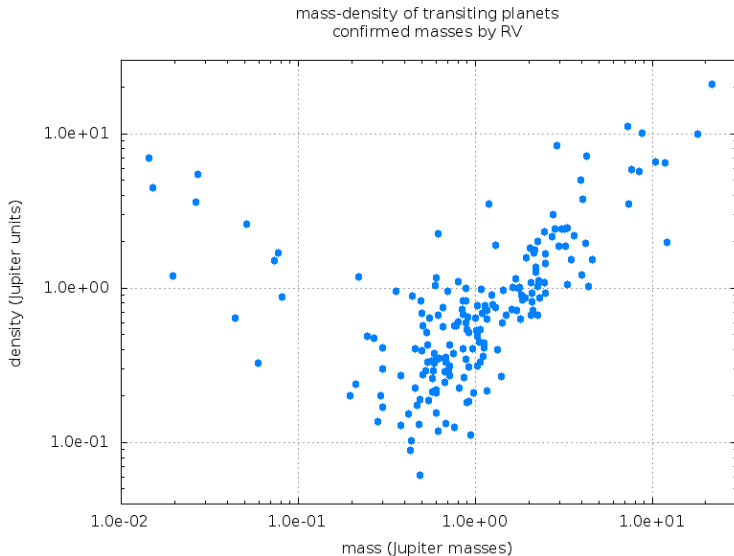
the characterization of planetary systems

mass and density of transiting planets with known mass



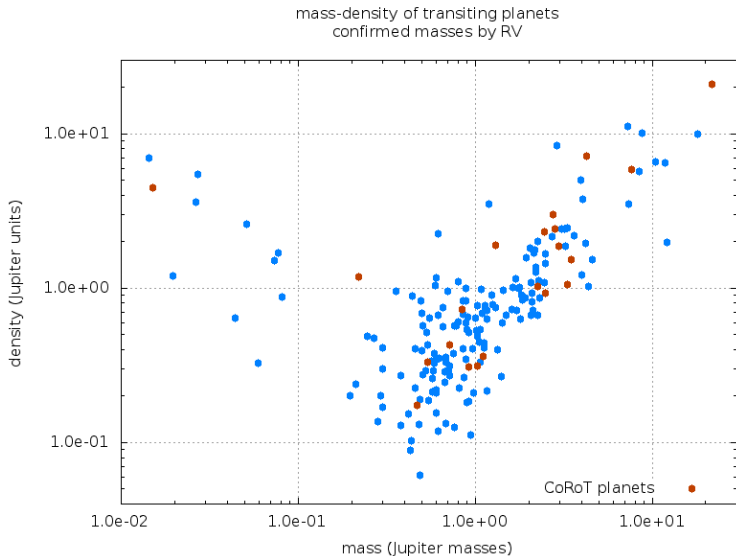
the characterization of planetary systems

mass and density of transiting planets with measured mass from RV



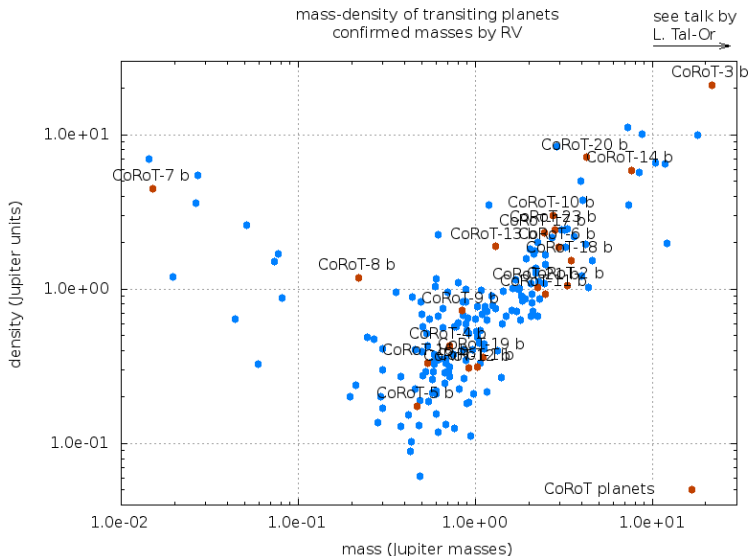
the characterization of planetary systems

mass and density of transiting planets with measured mass from RV



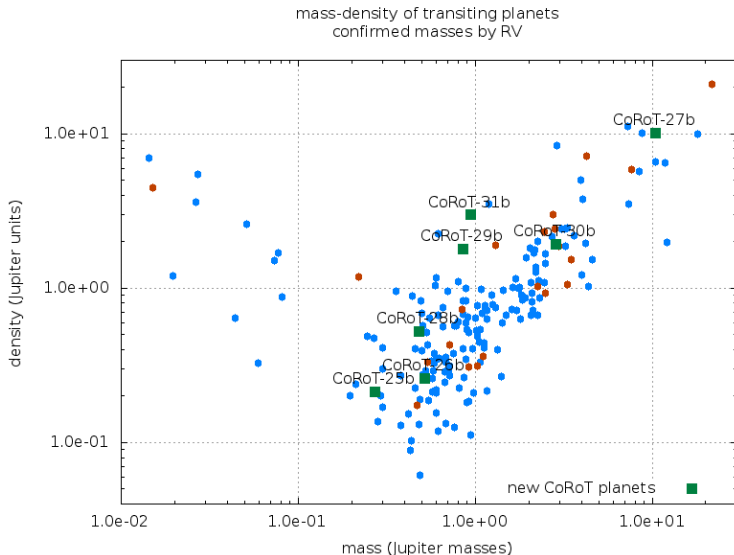
the characterization of planetary systems

mass and density of transiting planets with measured mass from RV



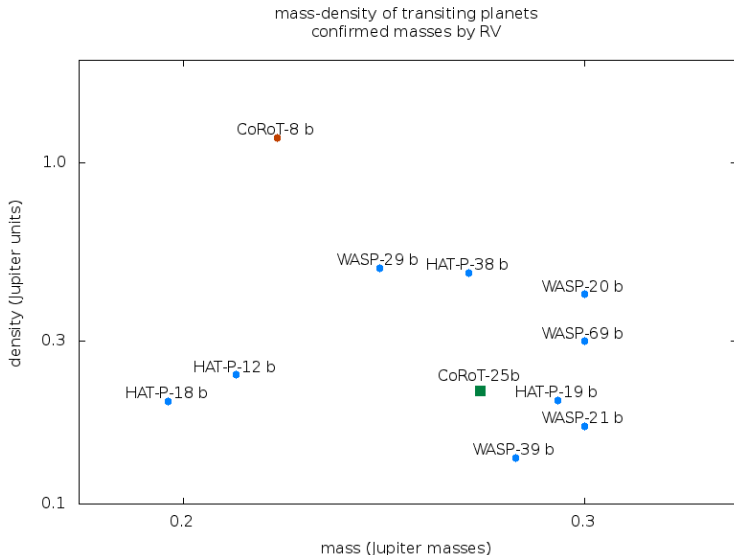
the characterization of planetary systems

mass and density of transiting planets with measured mass from RV



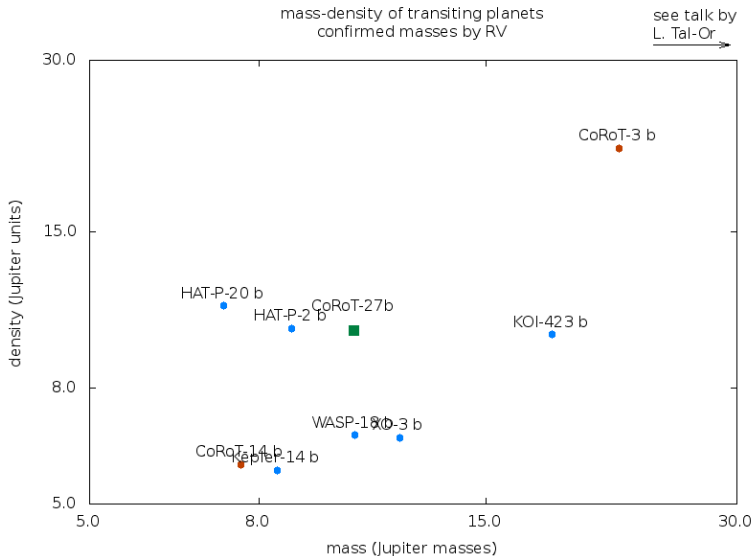
the characterization of planetary systems

mass and density of CoRoT-25b



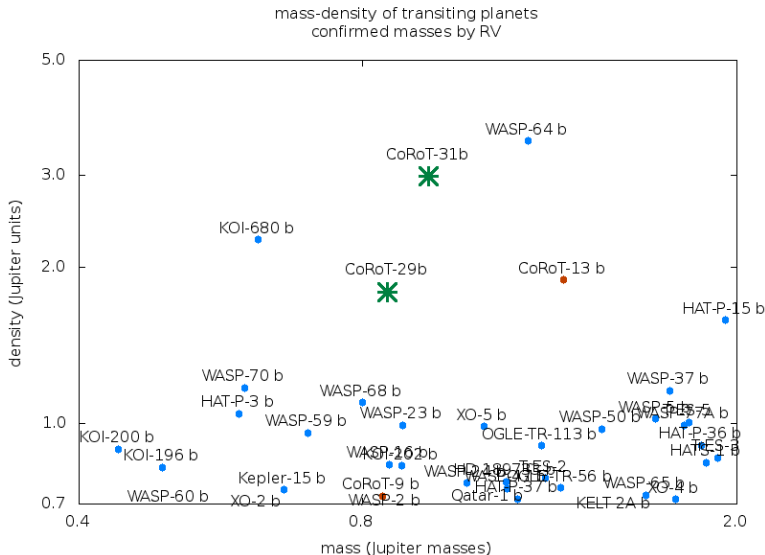
the characterization of planetary systems

mass and density of CoRoT-27b



the characterization of planetary systems

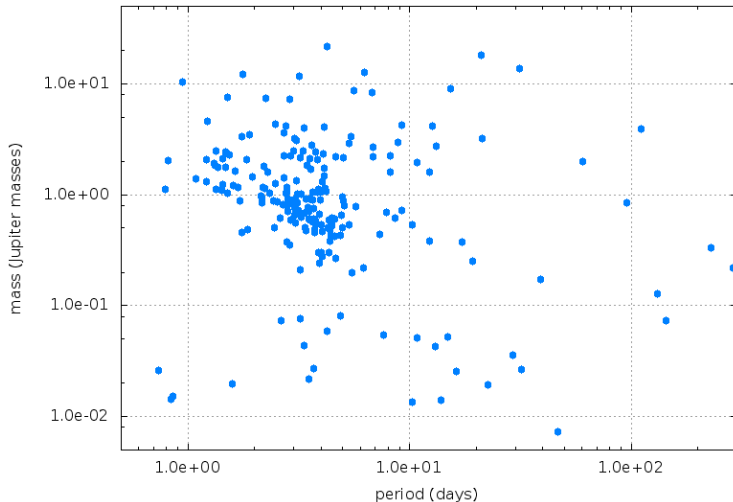
mass and density of CoRoT-29b and CoRoT-31b



the characterization of planetary systems

period and mass of transiting planets with known mass

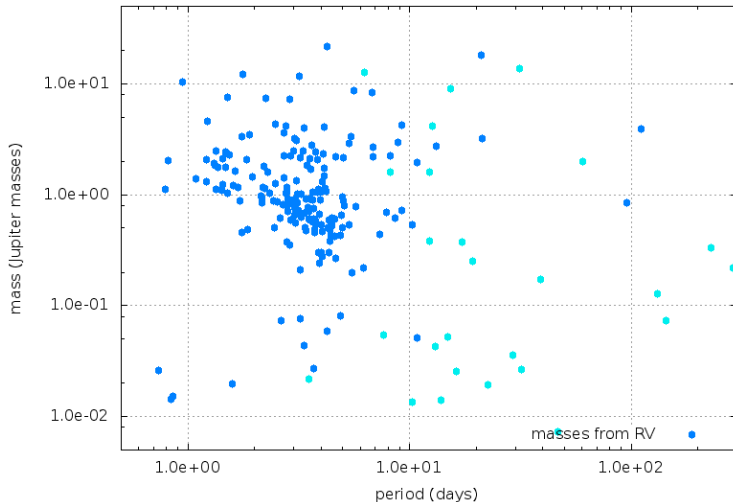
period-mass of transiting planets
confirmed masses by RV or TTV



the characterization of planetary systems

period and mass of transiting planets with known mass

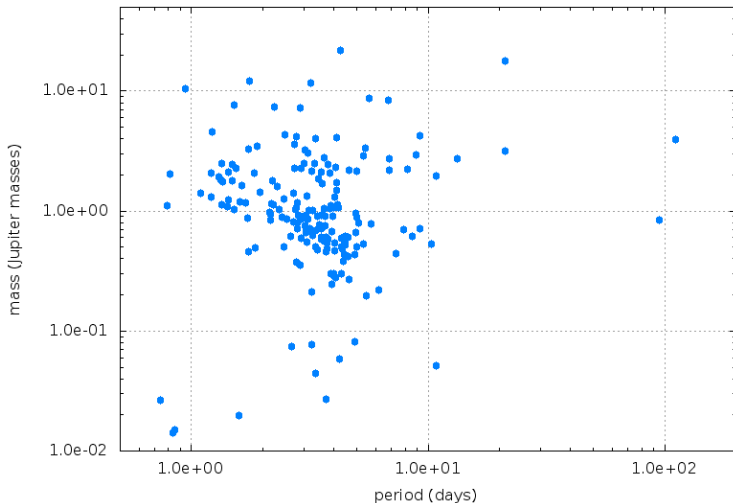
period-mass of transiting planets
confirmed masses by RV or TTV



the characterization of planetary systems

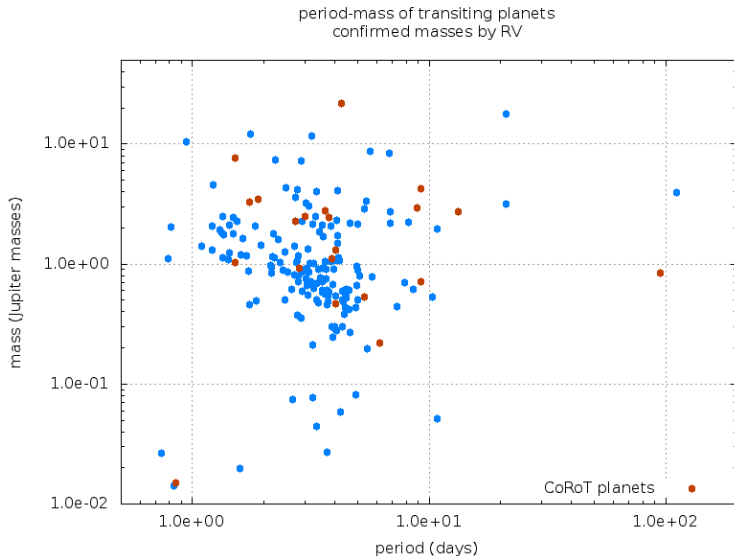
period and mass of transiting planets with measured mass from RV

period-mass of transiting planets
confirmed masses by RV



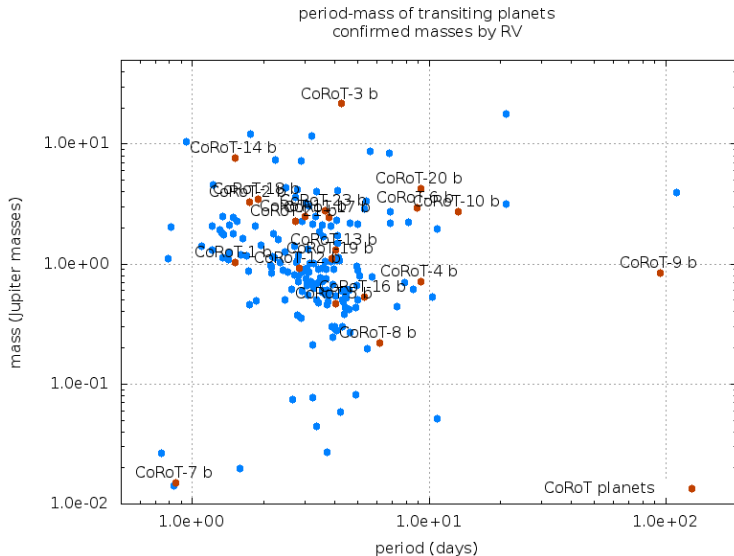
the characterization of planetary systems

period and mass of transiting planets with measured mass from RV



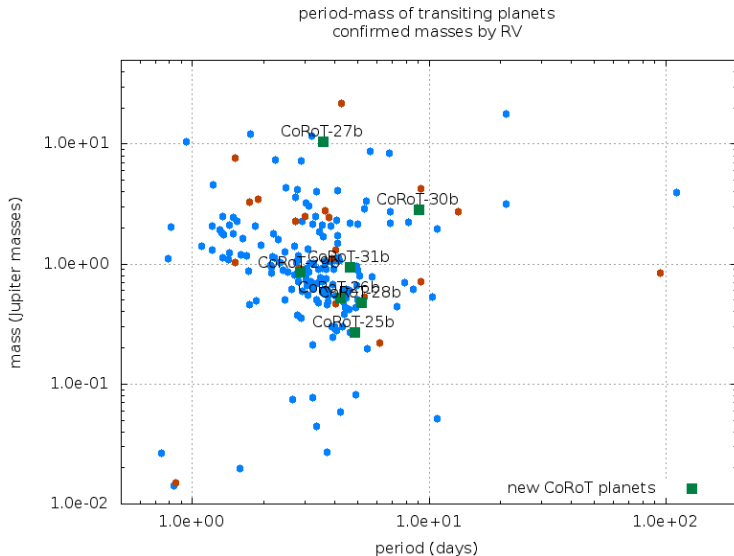
the characterization of planetary systems

period and mass of transiting planets with measured mass from RV



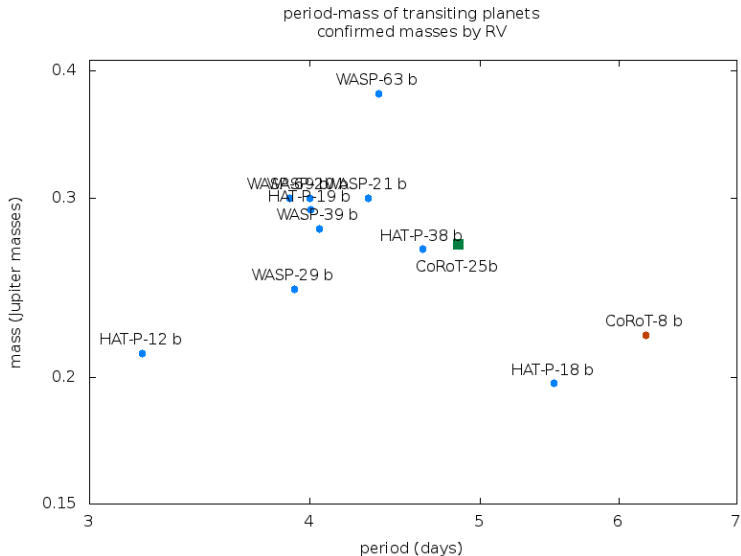
the characterization of planetary systems

period and mass of transiting planets with measured mass from RV



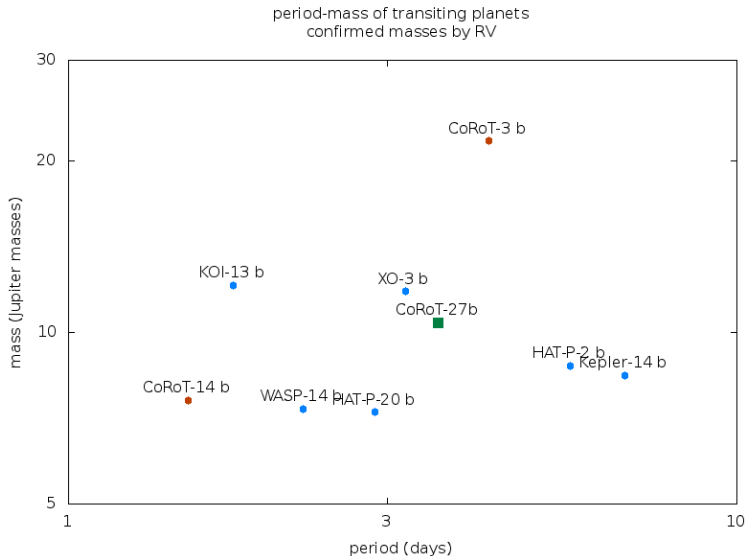
the characterization of planetary systems

period and mass of CoRoT-25b



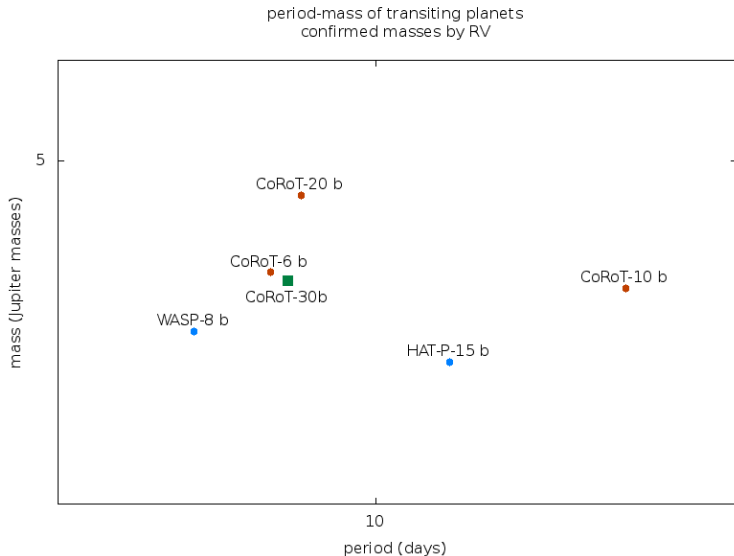
the characterization of planetary systems

period and mass of CoRoT-27b



the characterization of planetary systems

period and mass of CoRoT-30b

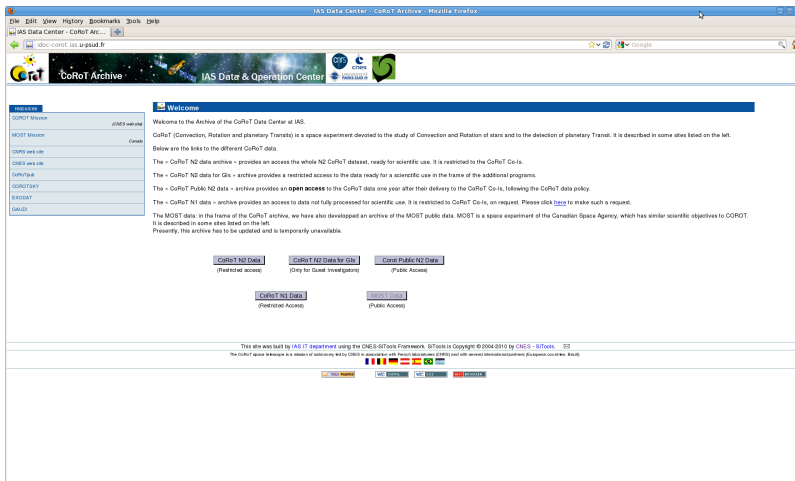


Appendix



databases

CoRoT public data



IAS Data Center - CoRoT Archive - Mozilla Firefox

idoc-corot.ias.u-psud.fr

CoRoT Archive IAS Data & Operation Center

TRANSCAT

COROT Mission (CNES website)

MOST Mission (CNES website)

COROT web site (CNES website)

COROT N2 data (CNES website)

COROT N1 data (CNES website)

COROT N2 data for GIs (CNES website)

COROT Public N2 Data (CNES website)

COROT N1 data (CNES website)

COROT T Data (CNES website)

Welcome

Welcome to the Archive of the CoRoT Data Center at IAS.

CoRoT (Convection, Rotation and planetary Transits) is a space experiment devoted to the study of Convection and Rotation of stars and to the detection of planetary Transits. It is described in some sites listed on the left.

Below are the links to the different CoRoT data.

The CoRoT N2 data archive provides an access to the whole N2 CoRoT dataset, ready for scientific use. It is restricted to the CoRoT Co-Is.

The CoRoT N2 data for GIs archive provides a restricted access to the data ready for a scientific use in the frame of the additional programs.

The CoRoT Public N2 data archive provides an open access to the CoRoT data one year after their delivery to the CoRoT Co-Is, following the CoRoT data policy.

The CoRoT N1 data archive provides an access to data not fully processed for scientific use. It is restricted to CoRoT Co-Is, on request. Please click [here](#) to make such a request.

The MOST data, in the frame of the CoRoT archive, we have also developed an archive of the MOST public data. MOST is a space experiment of the Canadian Space Agency, which has similar scientific objectives to CoRoT. It is described in some sites listed on the left. Presently, this archive has to be updated and is temporarily unavailable.

[CoRoT N2 Data](#) (Restricted access)

[CoRoT N2 Data for GIs](#) (Only for Guest Investigators)

[CoRoT Public N2 Data](#) (Public Access)

[CoRoT N1 Data](#) (Restricted Access)

[COROT T Data](#) (Public Access)

This site was built by IAS IT department using the CNES-SiTools Framework. SiTools is Copyright © 2004-2010 by CNES - SiTools.

The CoRoT space telescope is a result of collaboration led by CNES in association with French laboratories (CEA) and with several international partners (European countries, BRAC).

DLR CNES ESA

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



databases

CoRoT planets

CoRoT) with contribution from french laboratories (see the [LFSIA CoRoT site](#)), Austria, Belgium, Brazil, ESA (see the [ESA CoRoT site](#)), Germany (see the [german CoRoT site](#)) and Spain (see the [spanish CoRoT site](#)). CoRoT aims at the discovery of extrasolar planets by the method of transits and the characterization of stellar interiors via asteroseismology. Use the links on the header to check the latest news or to learn about the planets and brown dwarfs discovered by CoRoT. You can also find some useful information on the mission and download the CoRoT data to do your own analysis. All the information contained in this site comes from this XML file: [corotplanets.xml](#)'." data-bbox="82 192 904 854"/>

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

CoRoT Discoveries

About News Planets Brown Dwarfs Links and useful information Public Data

About this site

This site provides information about the CoRoT discoveries.

CoRoT is a mission lead by CNES (see the CNES site on [CoRoT](#)) with contribution from french laboratories (see the [LFSIA CoRoT site](#)), Austria, Belgium, Brazil, ESA (see the [ESA CoRoT site](#)), Germany (see the [german CoRoT site](#)) and Spain (see the [spanish CoRoT site](#)). CoRoT aims at the discovery of extrasolar planets by the method of transits and the characterization of stellar interiors via asteroseismology.

Use the links on the header to check the latest news or to learn about the planets and brown dwarfs discovered by CoRoT. You can also find some useful information on the mission and download the CoRoT data to do your own analysis.

All the information contained in this site comes from this XML file: [corotplanets.xml](#)

W3C XHTML 2.0 Juan Cabrera. Last update: 16.01.2013

<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

Kepler

	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

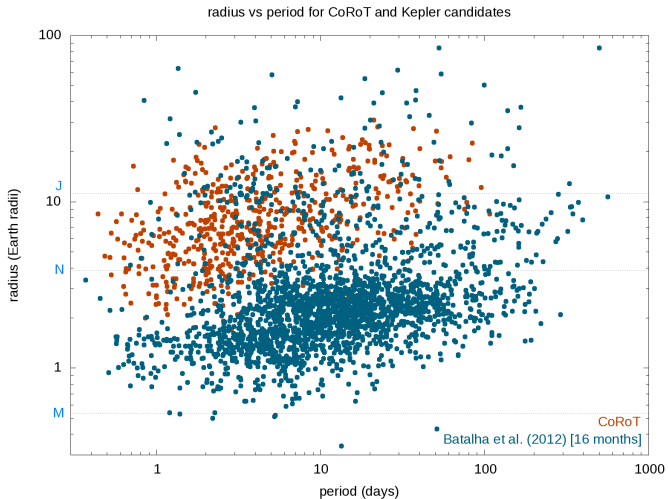
other surveys

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 (Christiansen et al. 2013)
- ▶ WASP: ~18M stars, ~50% dwarfs (WASP archive)

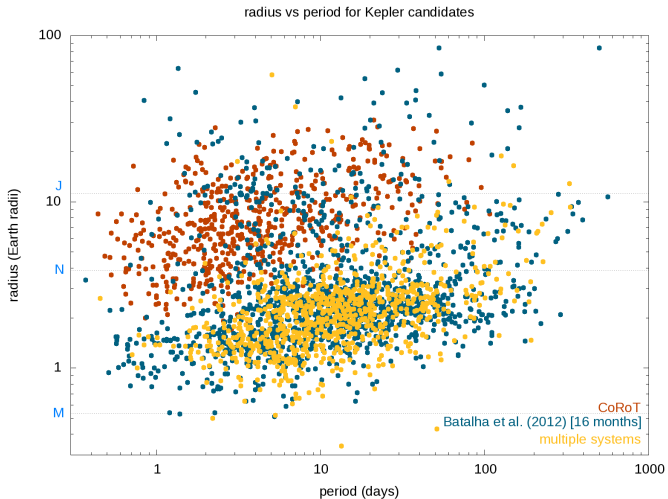
3D plots

period vs radius



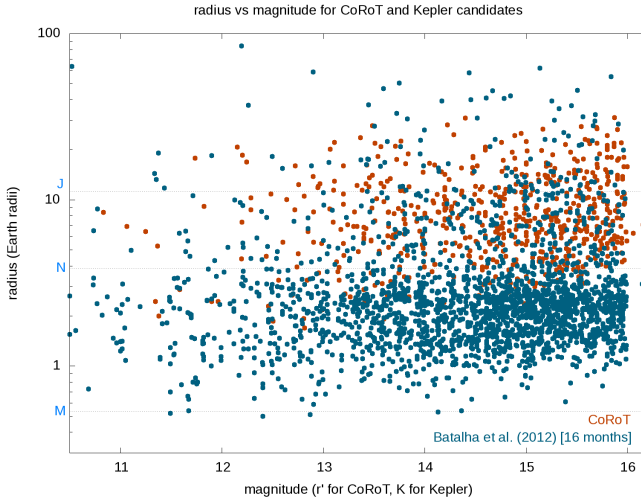
3D plots

period vs radius



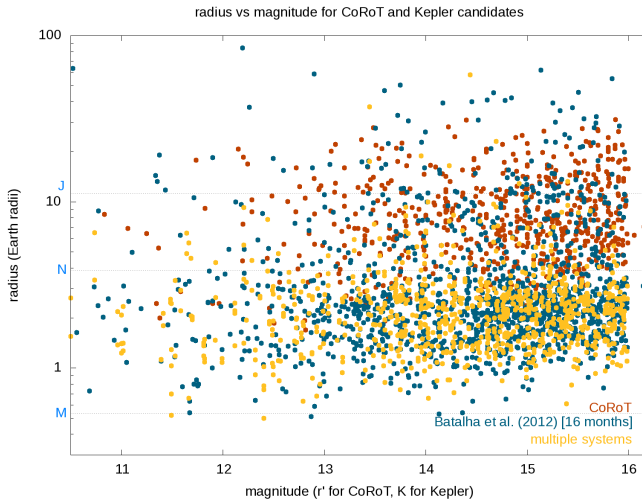
3D plots

magnitude vs radius



3D plots

magnitude vs radius



CoRoT yield of hot Jupiters

- ▶ CoRoT, anticenter direction ($6^{\text{h}}50^{\text{m}}$): $0.4 \pm 0.2\%$
- ▶ on study for center direction (metallicity gradient?)

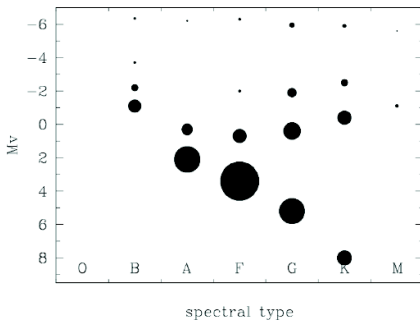


Fig. 4. HRD of the stars observed by CoRoT. The size of the circles is proportional to the number of stars of that category.

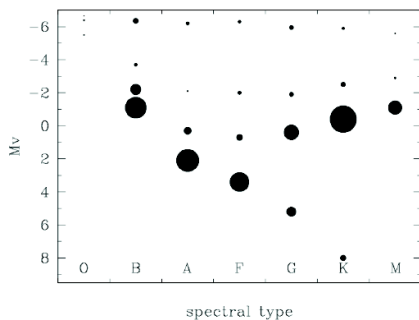
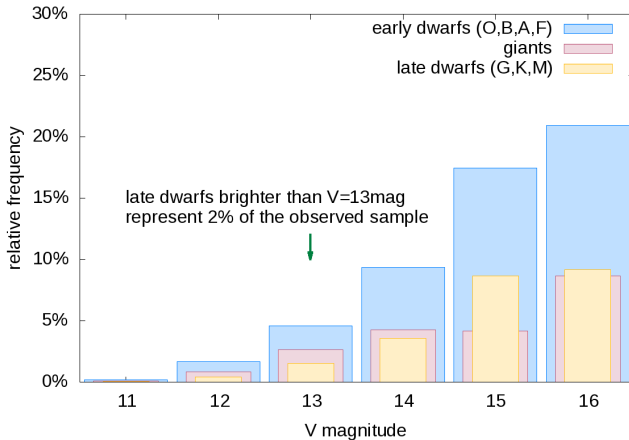


Fig. 6. Same as Fig. 4 but for stars brighter than 6.5 mag.

CoRoT yield of hot Jupiters

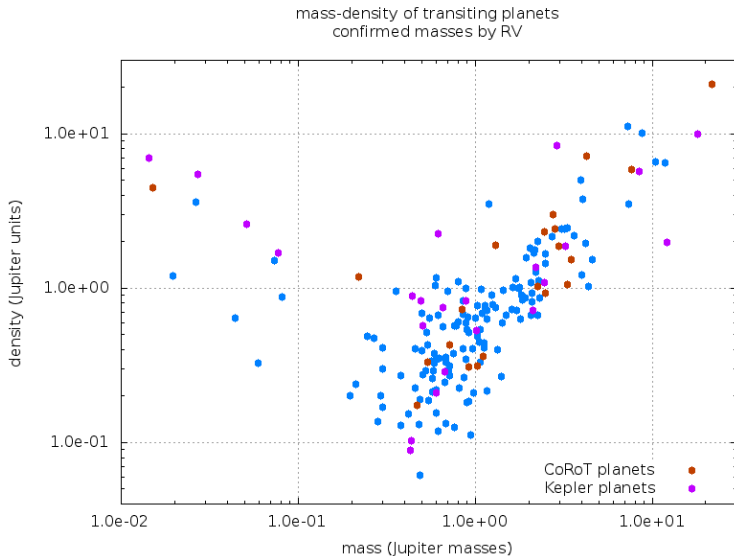
CoRoT magnitude range

histogram of stars observed by CoRoT
(based on Guenther et al. 2012)



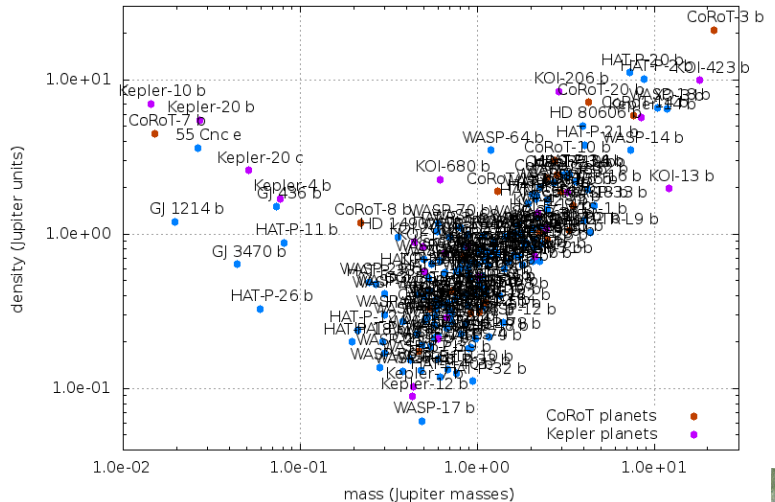
mass-density

CoRoT and Kepler



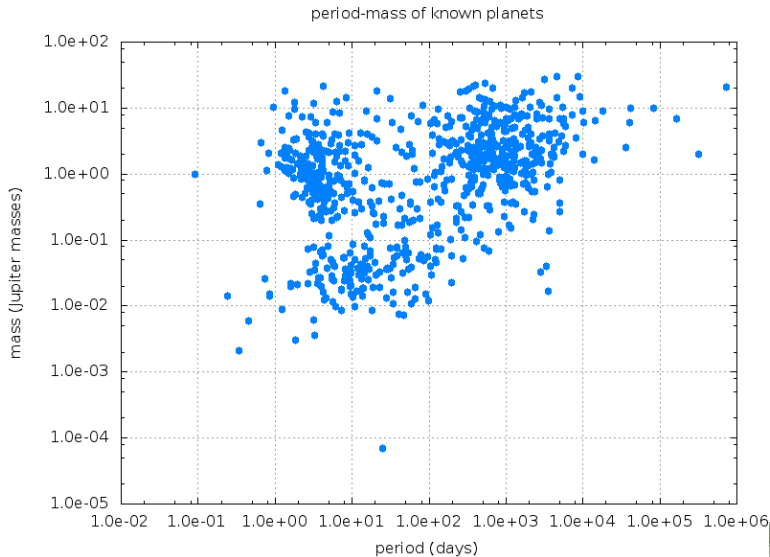
mass-density planet names

mass-density of transiting planets
confirmed masses by RV



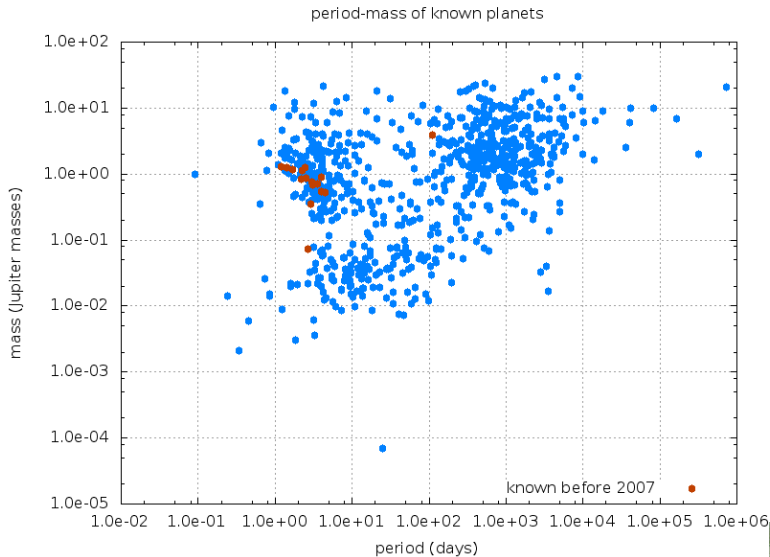
period-density

known planets



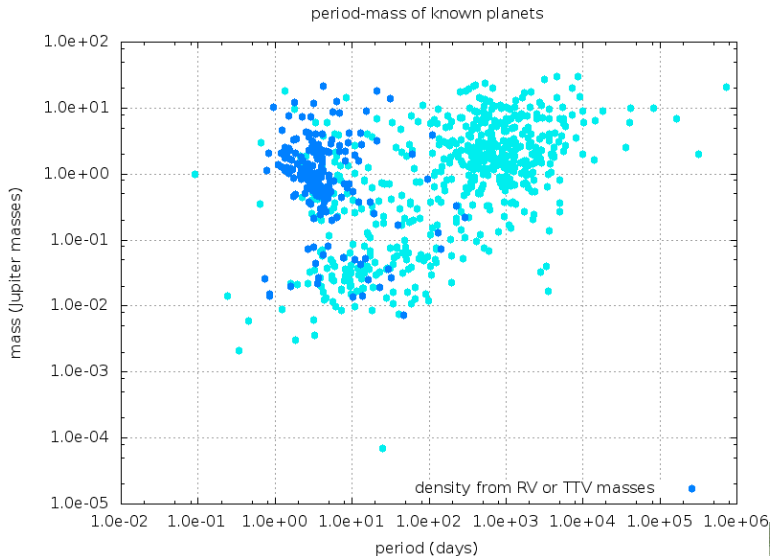
period-density

known planets 2007



period-density

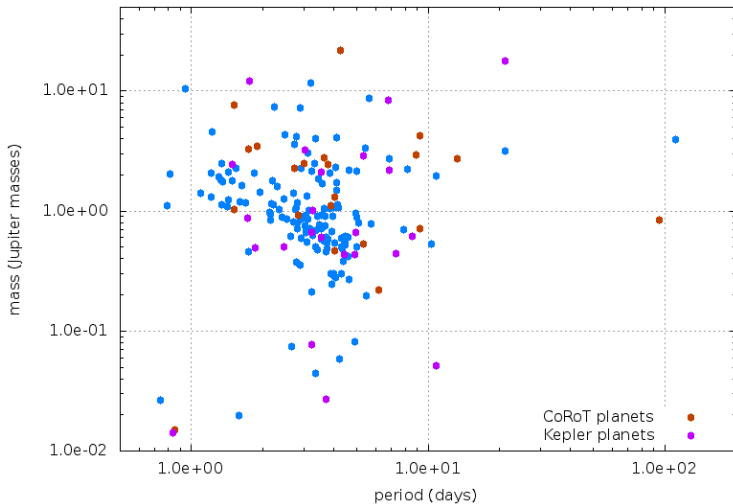
known planets and transiting planets



period-density

CoRoT and Kepler

period-mass of transiting planets
confirmed masses by RV



period-density

planet names



period-mass of transiting planets
confirmed masses by RV

