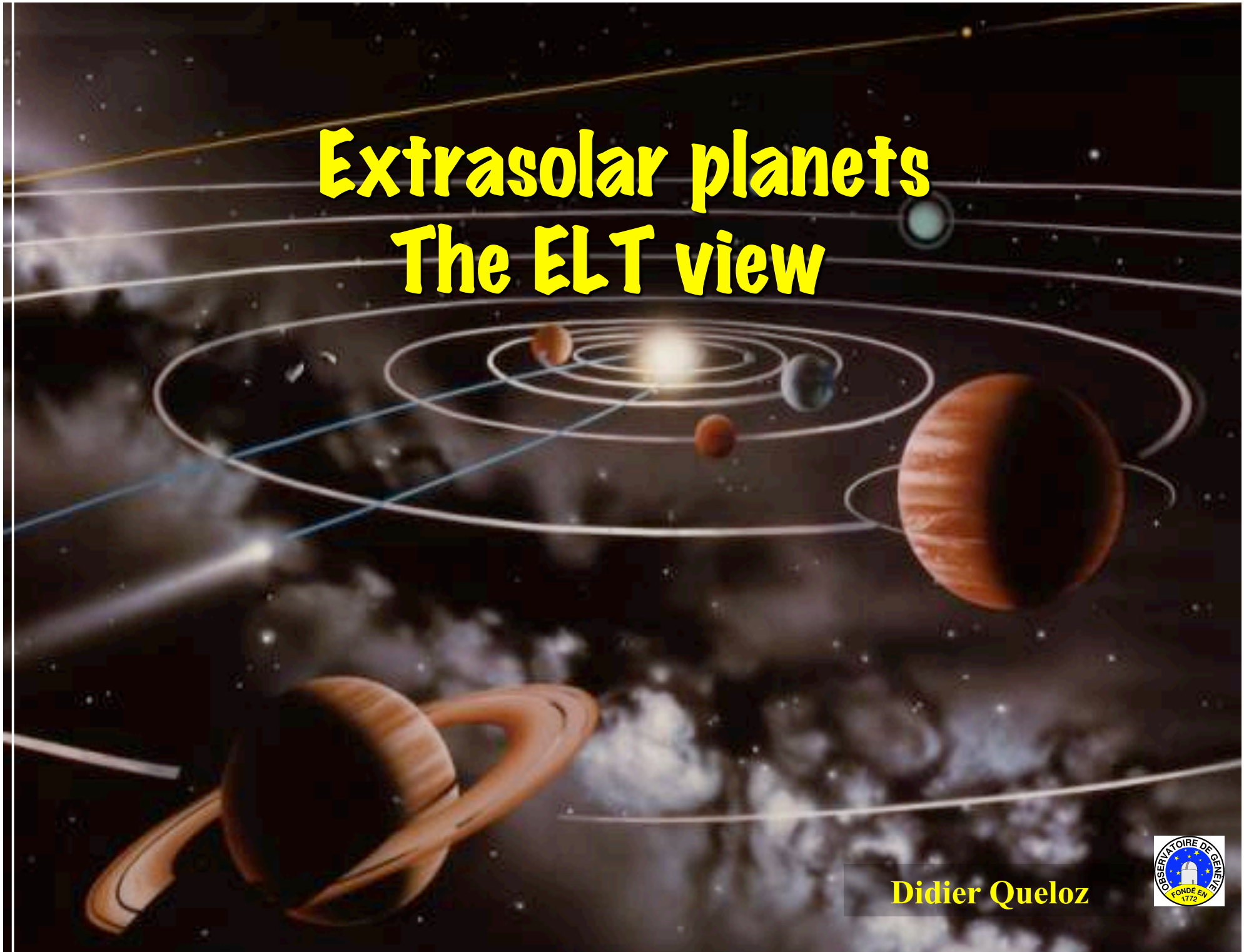
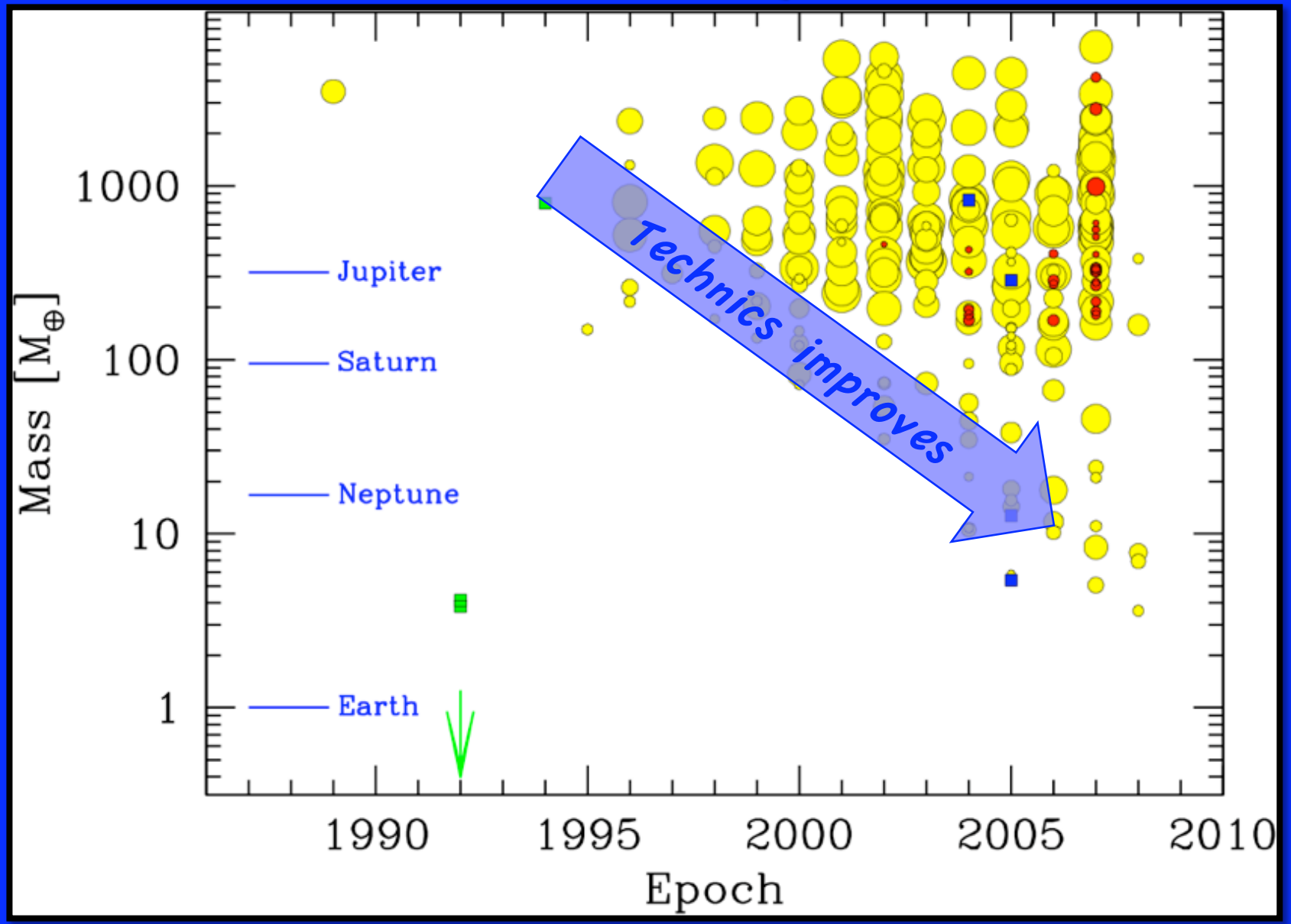
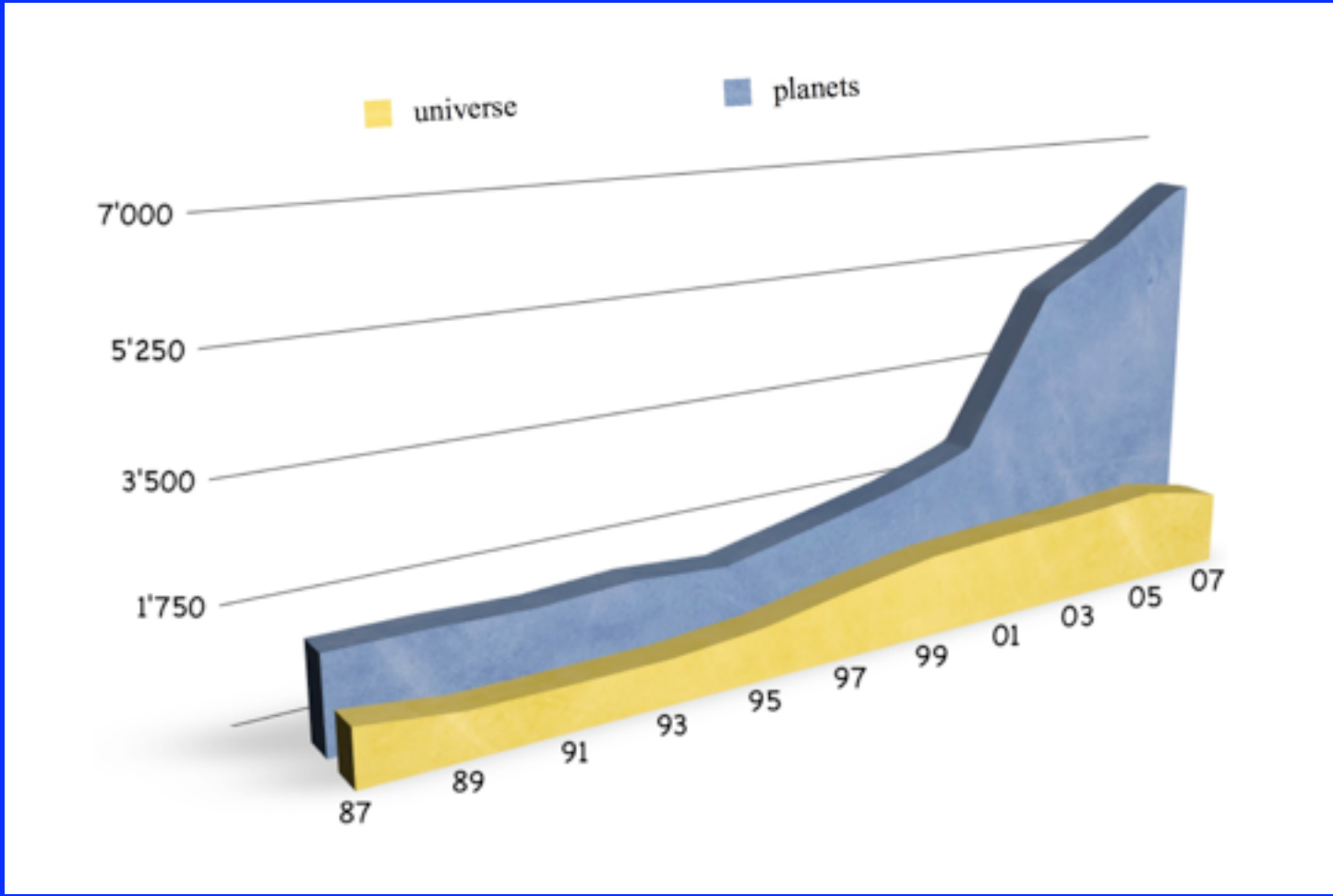

Extrasolar planets
The ELT view
Didier Queloz
OBSERVATOIRE DE GENEVE
FONDÉ EN 1772

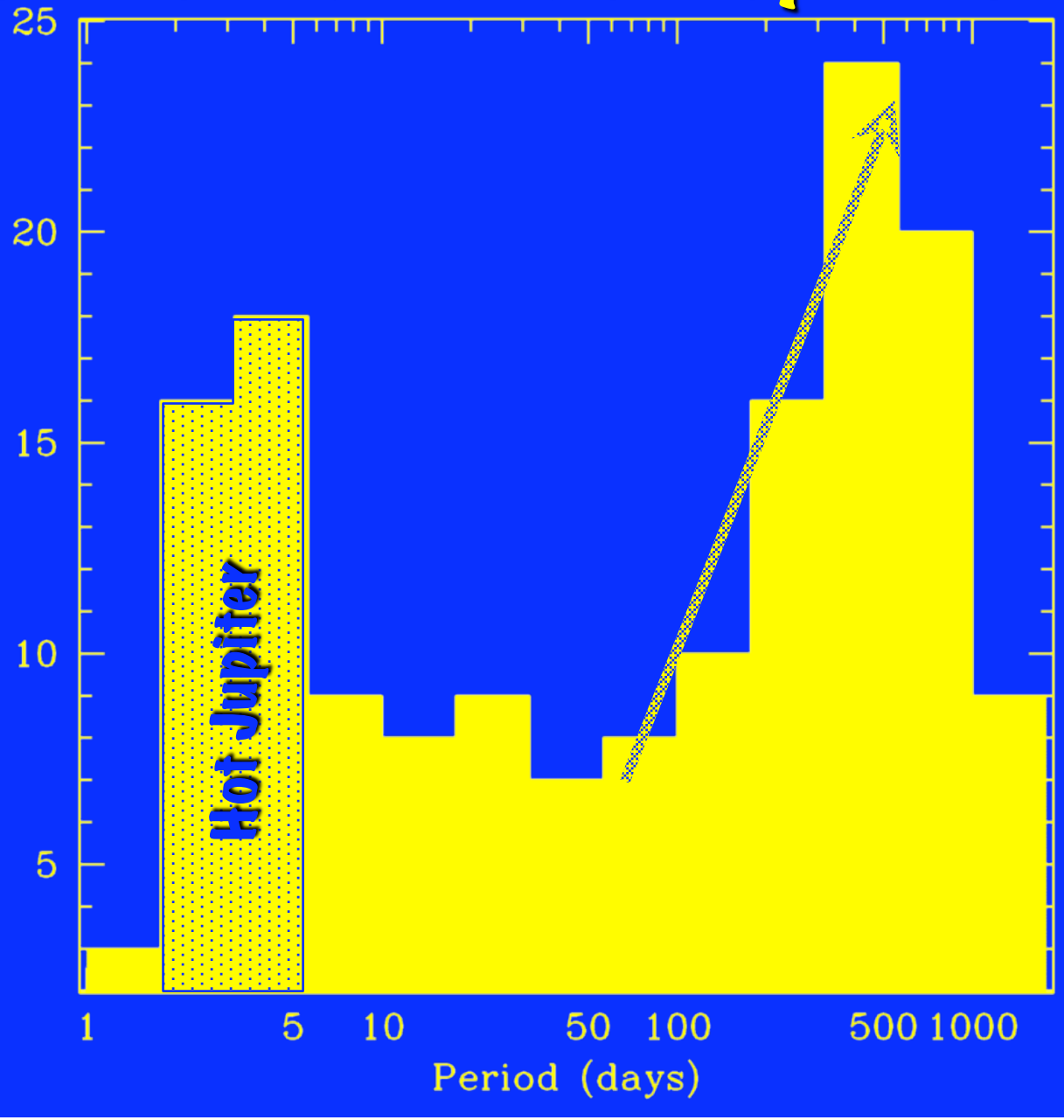
Today closing 500 planets found

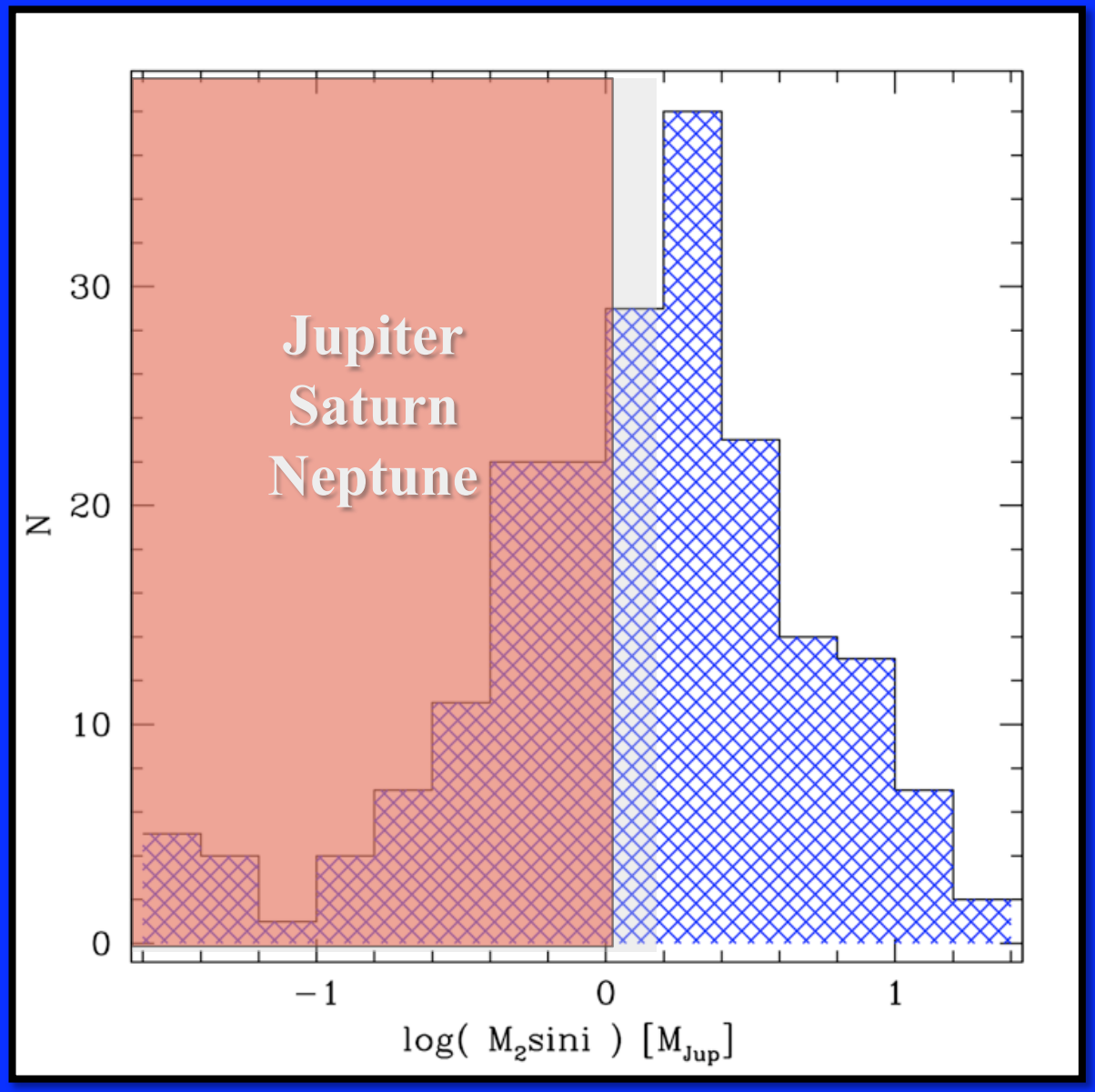


Planet against Universe

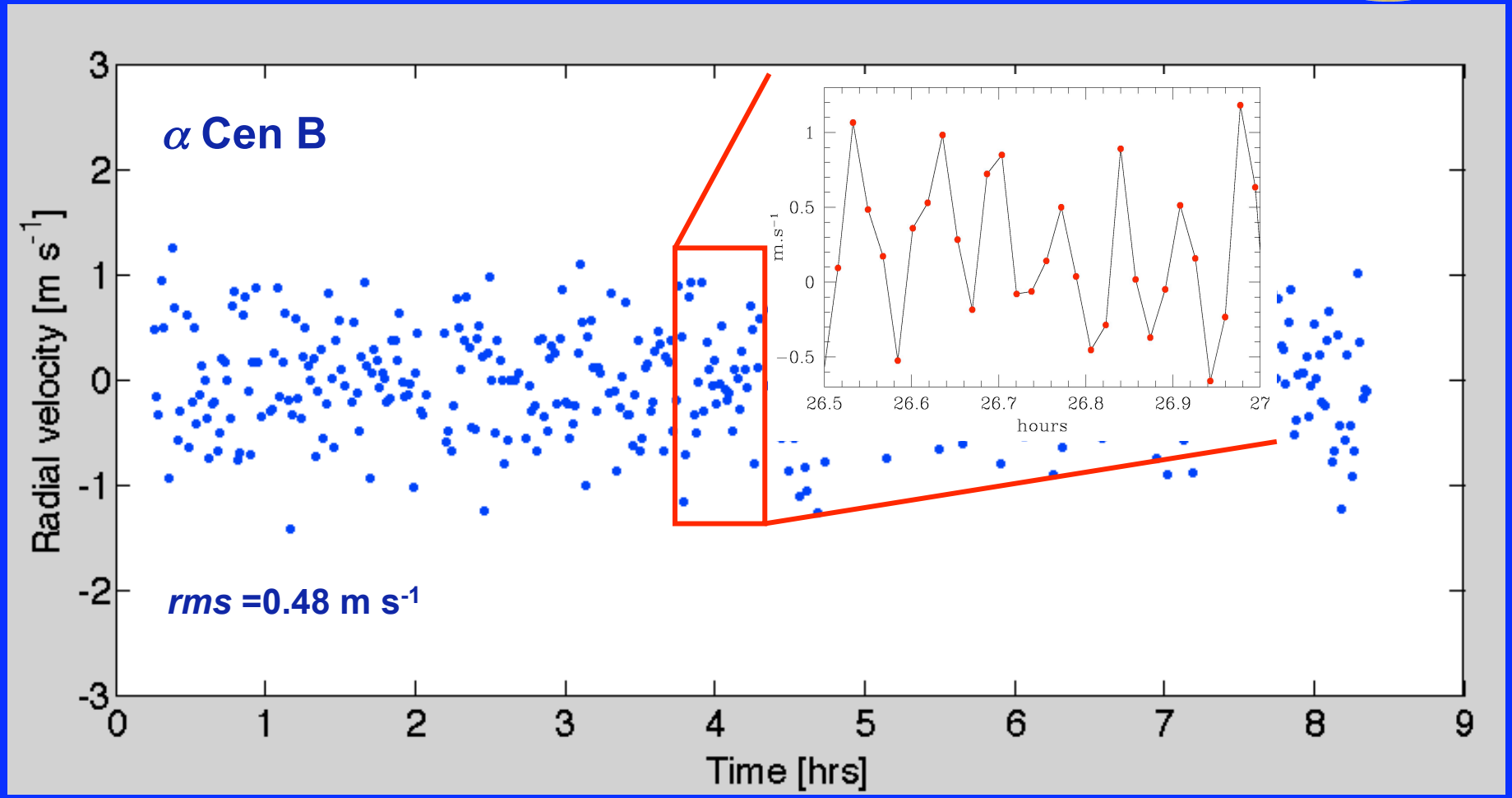


Distribution of orbital periods

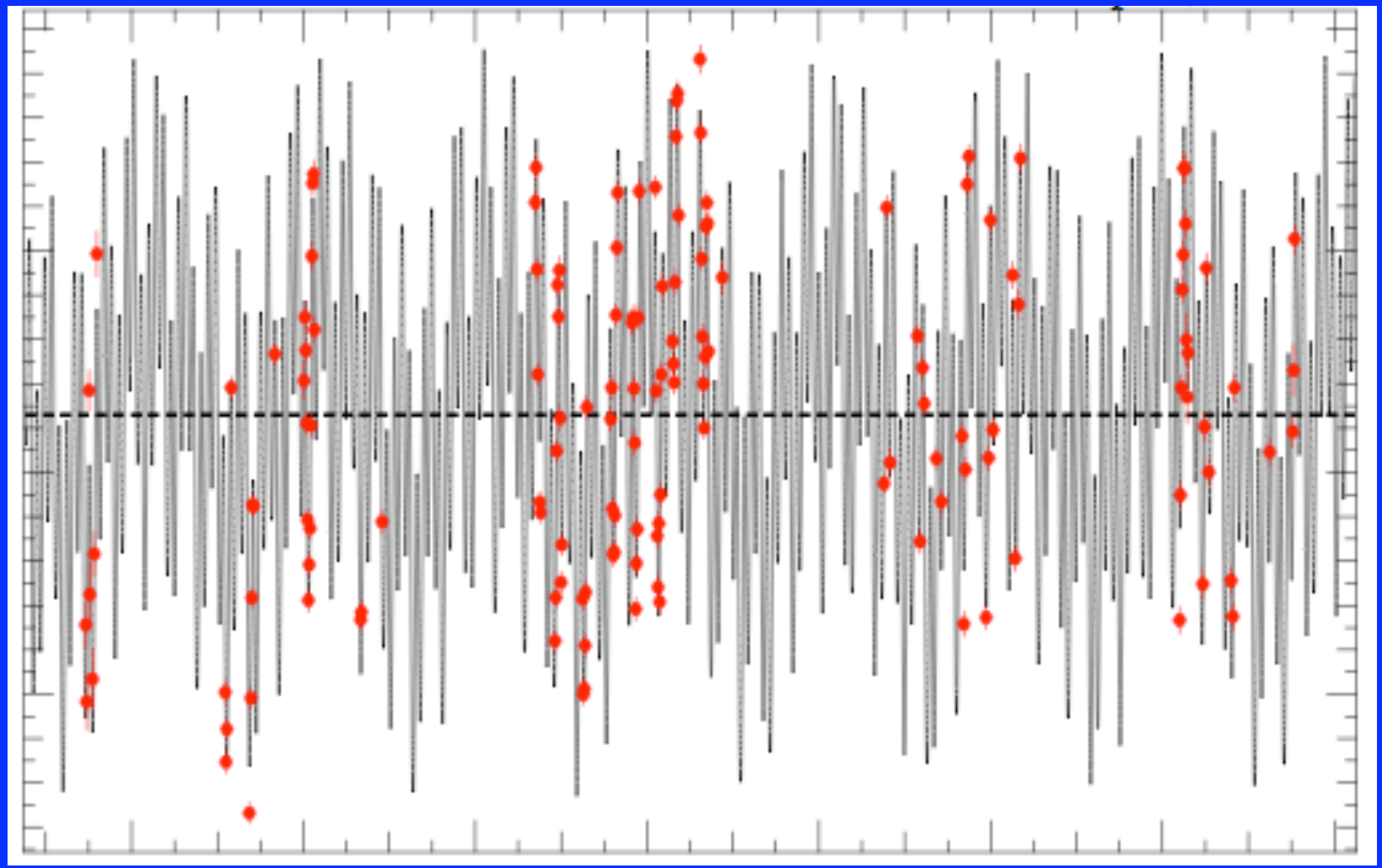



Jupiter
Saturn
Neptune
N
30
20
10
0
−1
0
1
log(M2sini) [MJup]

the RV short-term "smog"



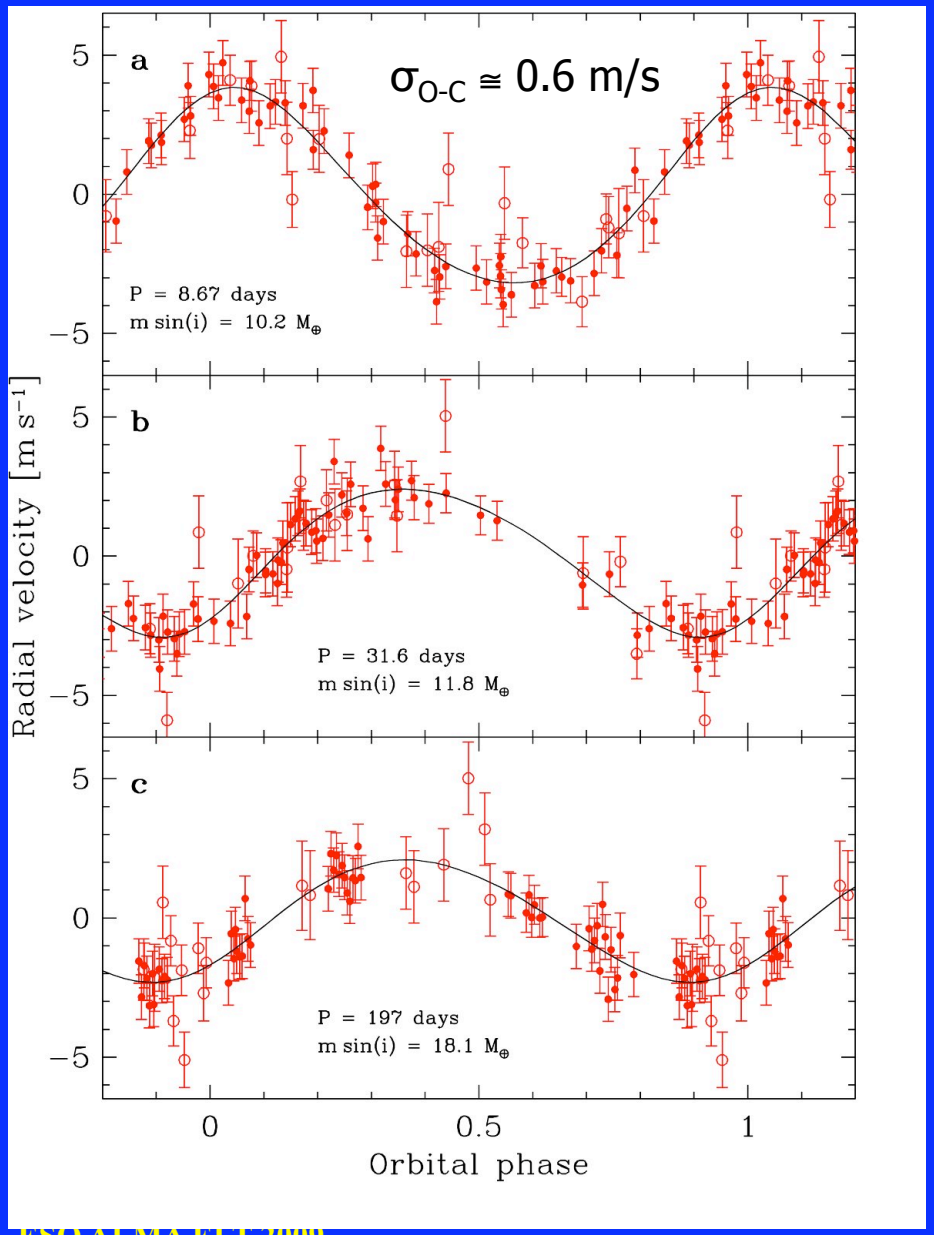
HD69830



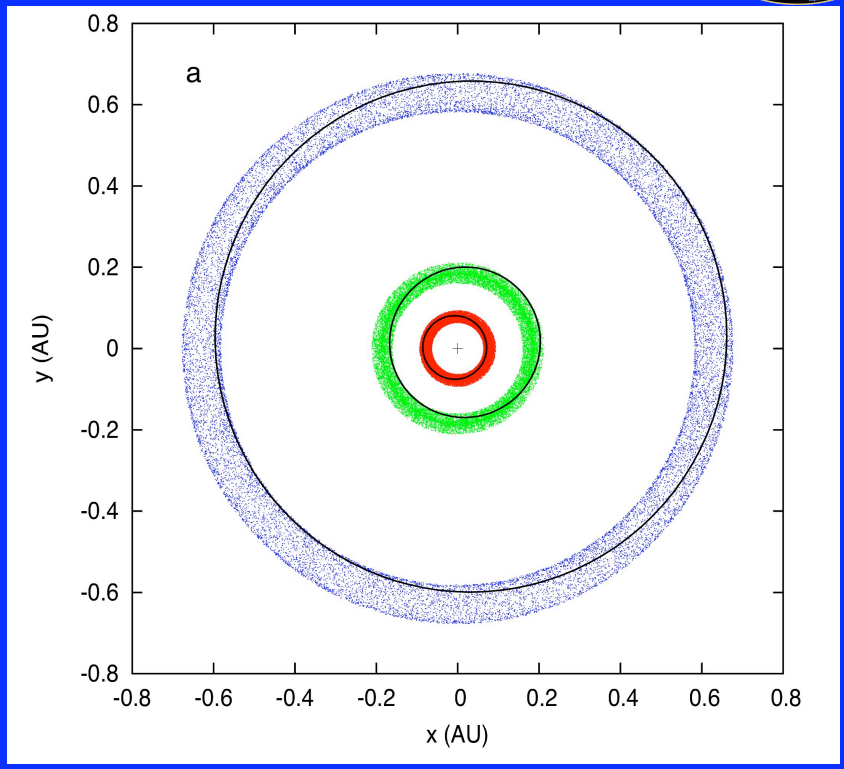
5 m/s

1400 days

HD 69830 – the triplet of Neptunes …



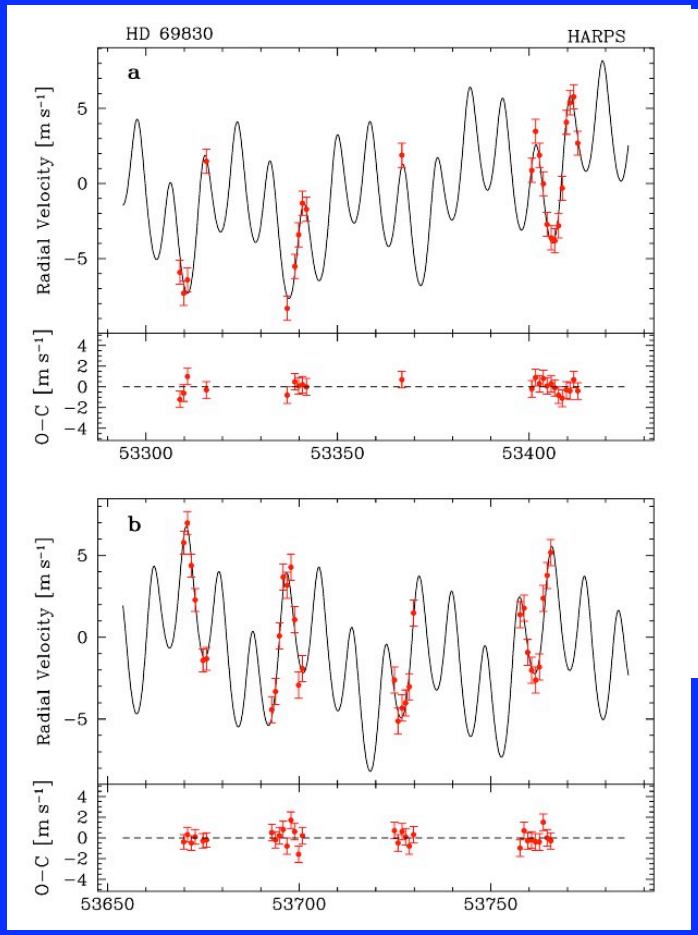
Lovis et al., Nature, 2006

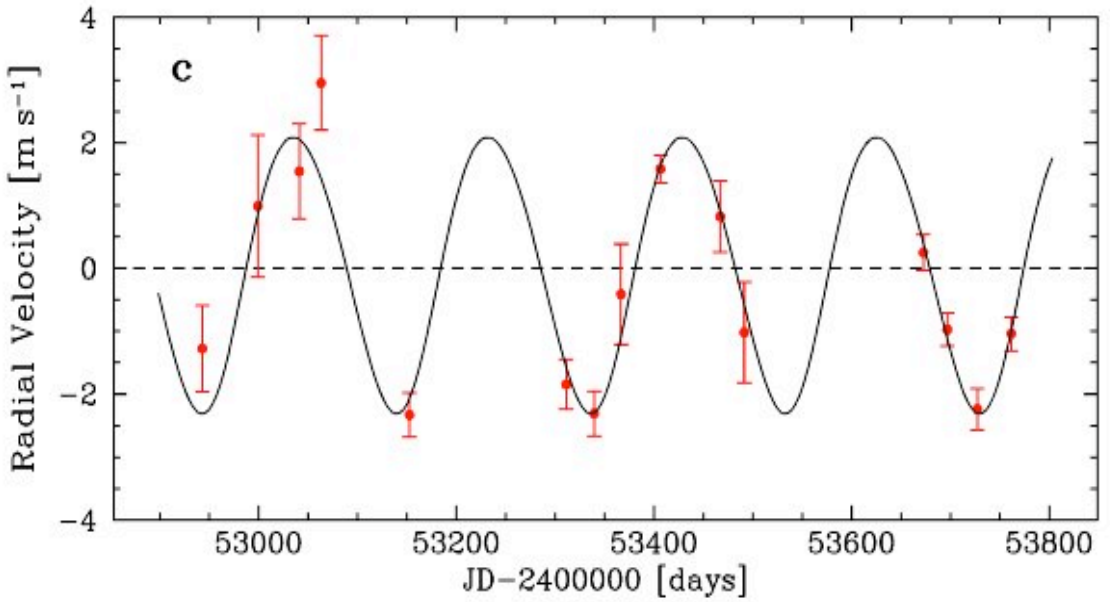


P1 = 8.67 days M sini = 10.2 M_{Earth}
P2 = 31.6 days M sini = 11.8 M_{Earth}
P3 = 197 days M sini = 18.1 M_{Earth}

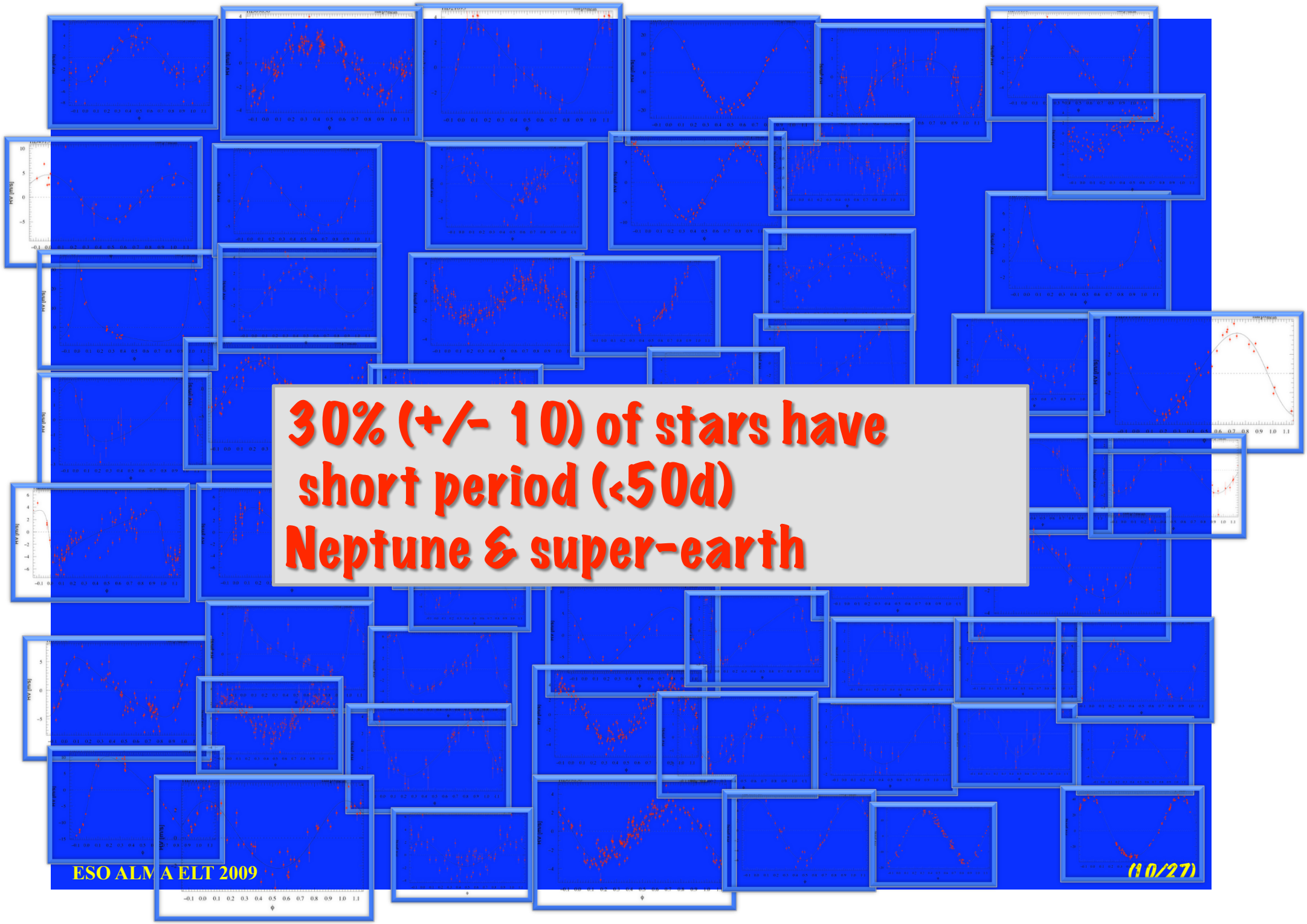
HARPS@3.6-m telescope, *ESO La Silla*

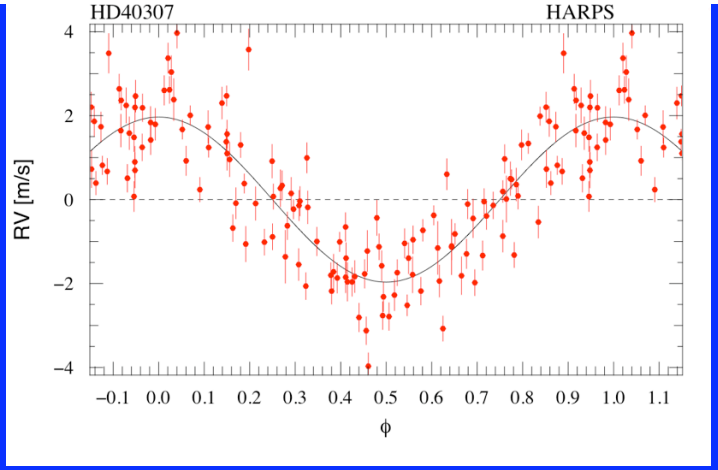
HD 69830 - exploring the limit...

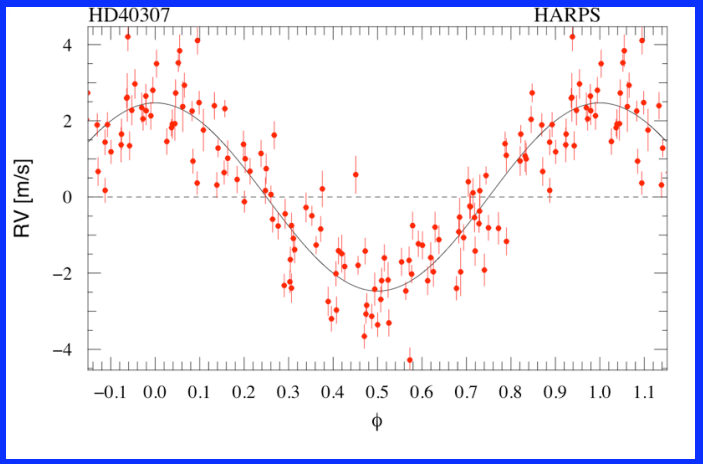


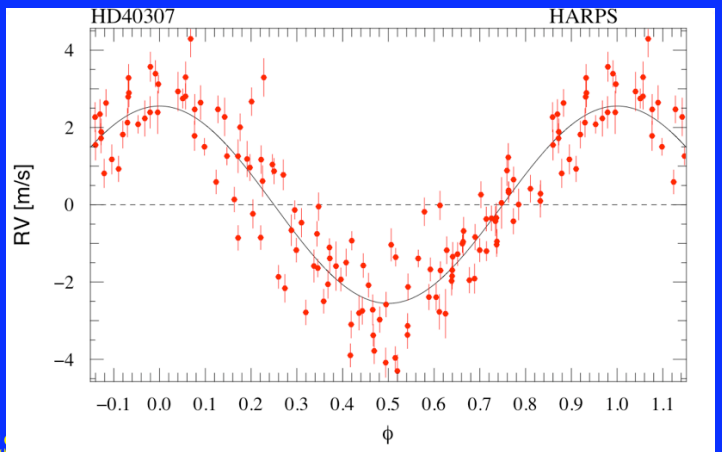


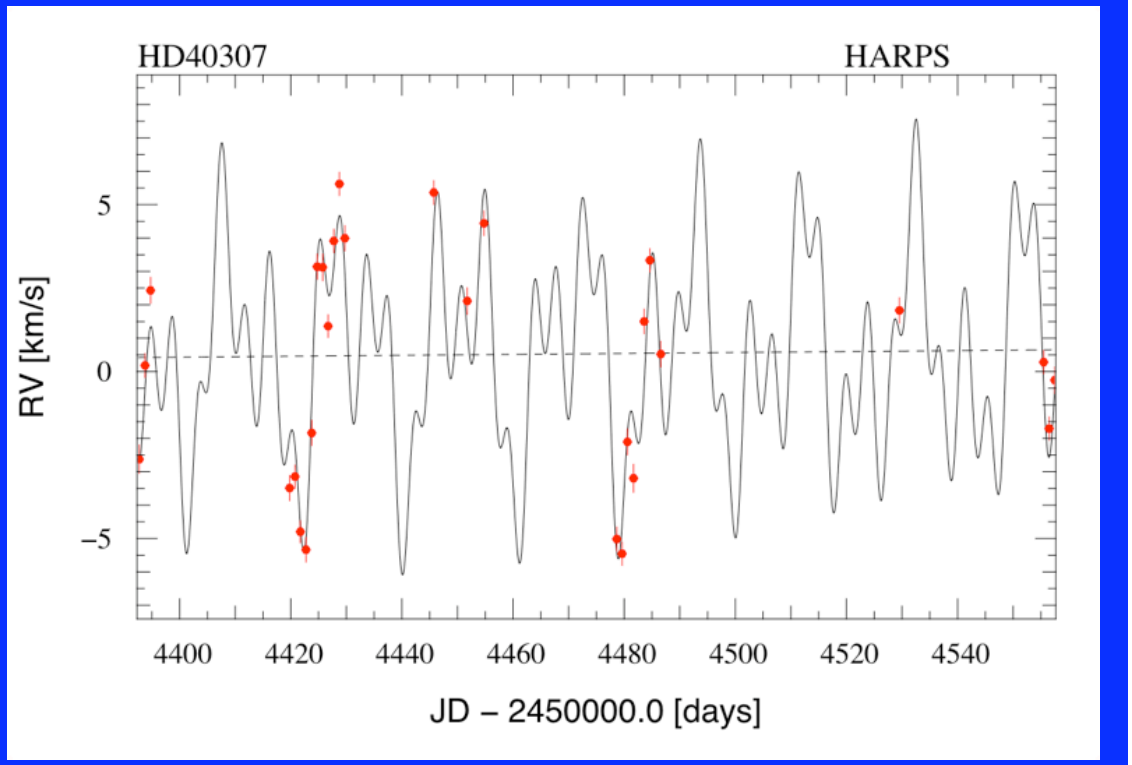
20 cm/s *rms*


30% (+/- 10) of stars have
short period (<50d)
Neptune & super-earth
ESO ALMA ELT 2009
(10/27)





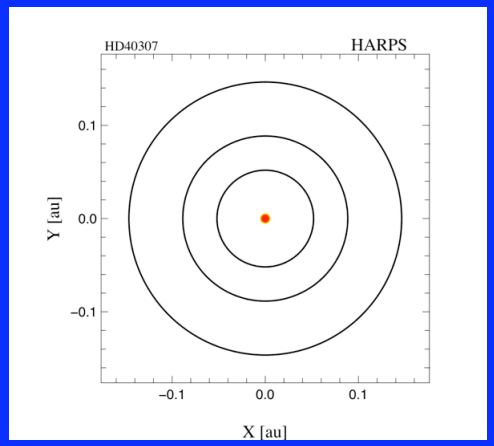




HD40307 :

4.3 d, 4.3 Me
9.6 d, 6.9 Me
20.5 d, 9.7 Me

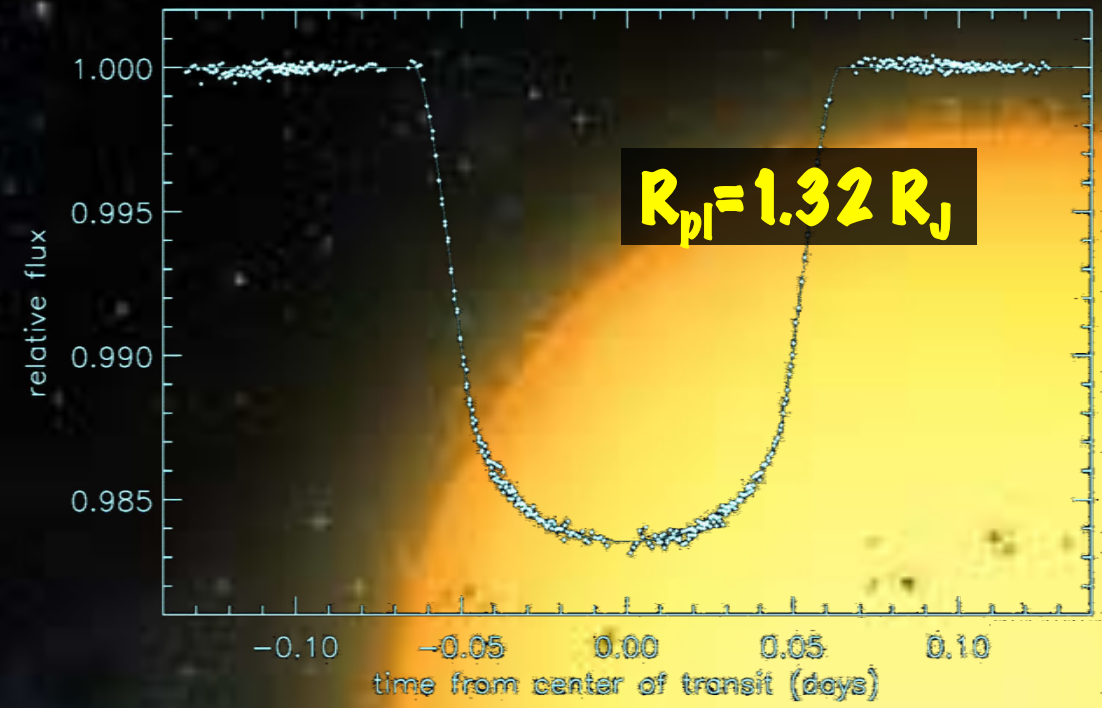
(Mayor et al. 2008)



E

(11/27)

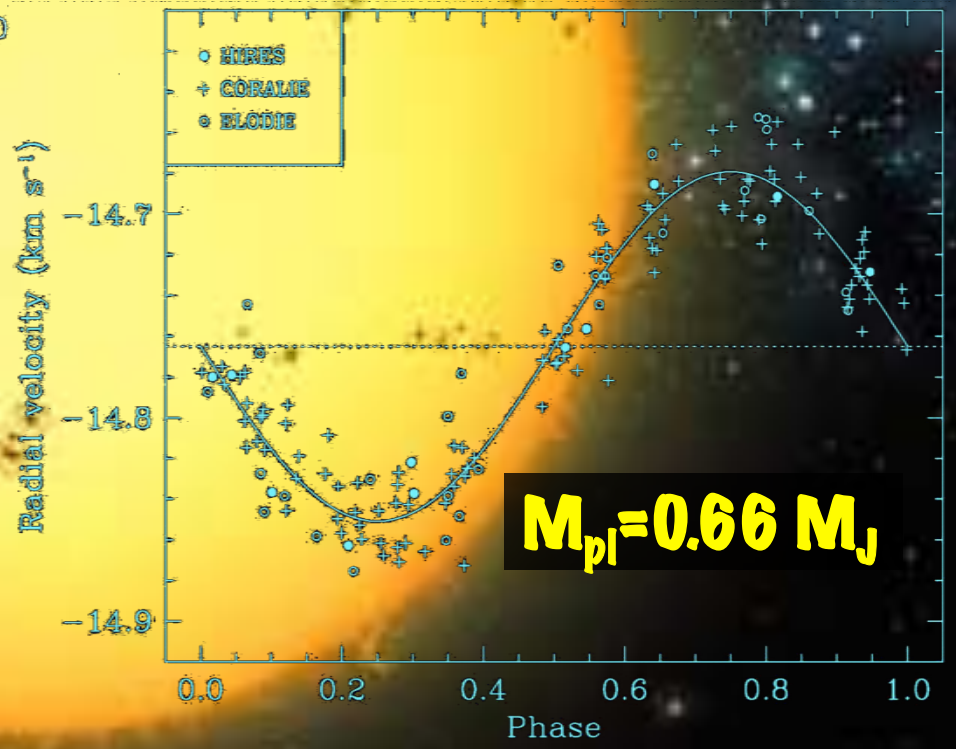
Inside planets with transits



R_{pl}=1.32 R_J

HD209458

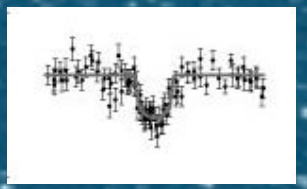
ρ_{pl}=0.3 ρ_J

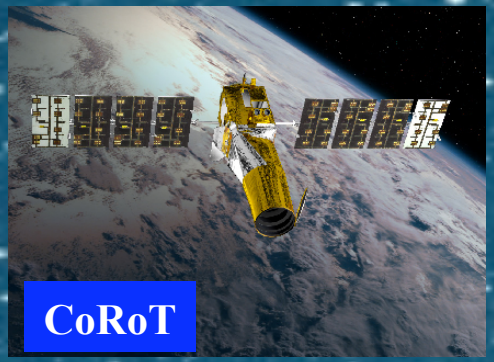


M_{pl}=0.66 M_J

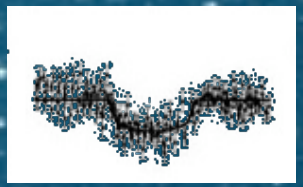

OGLE


HATNet



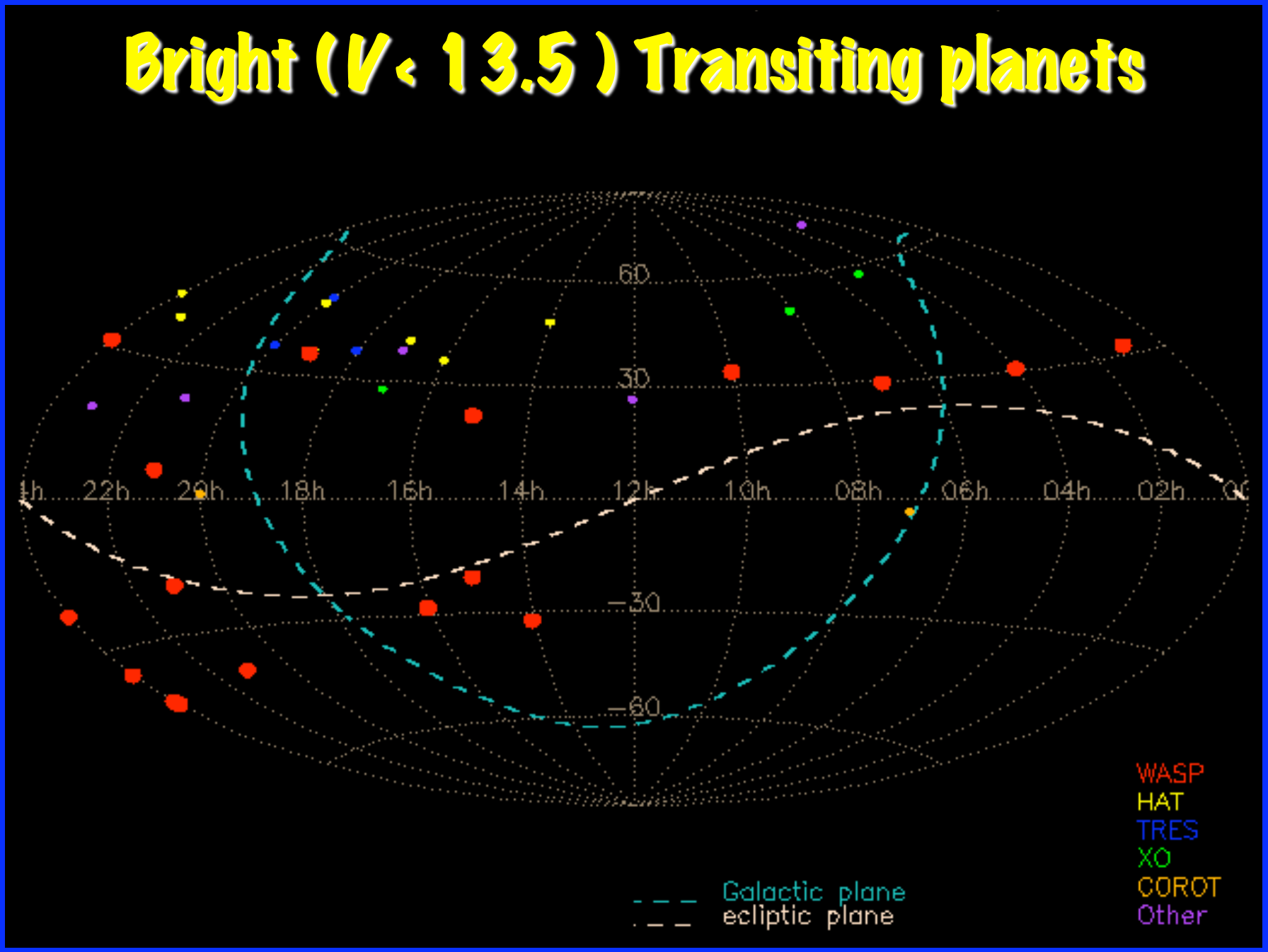

CoRoT


XO

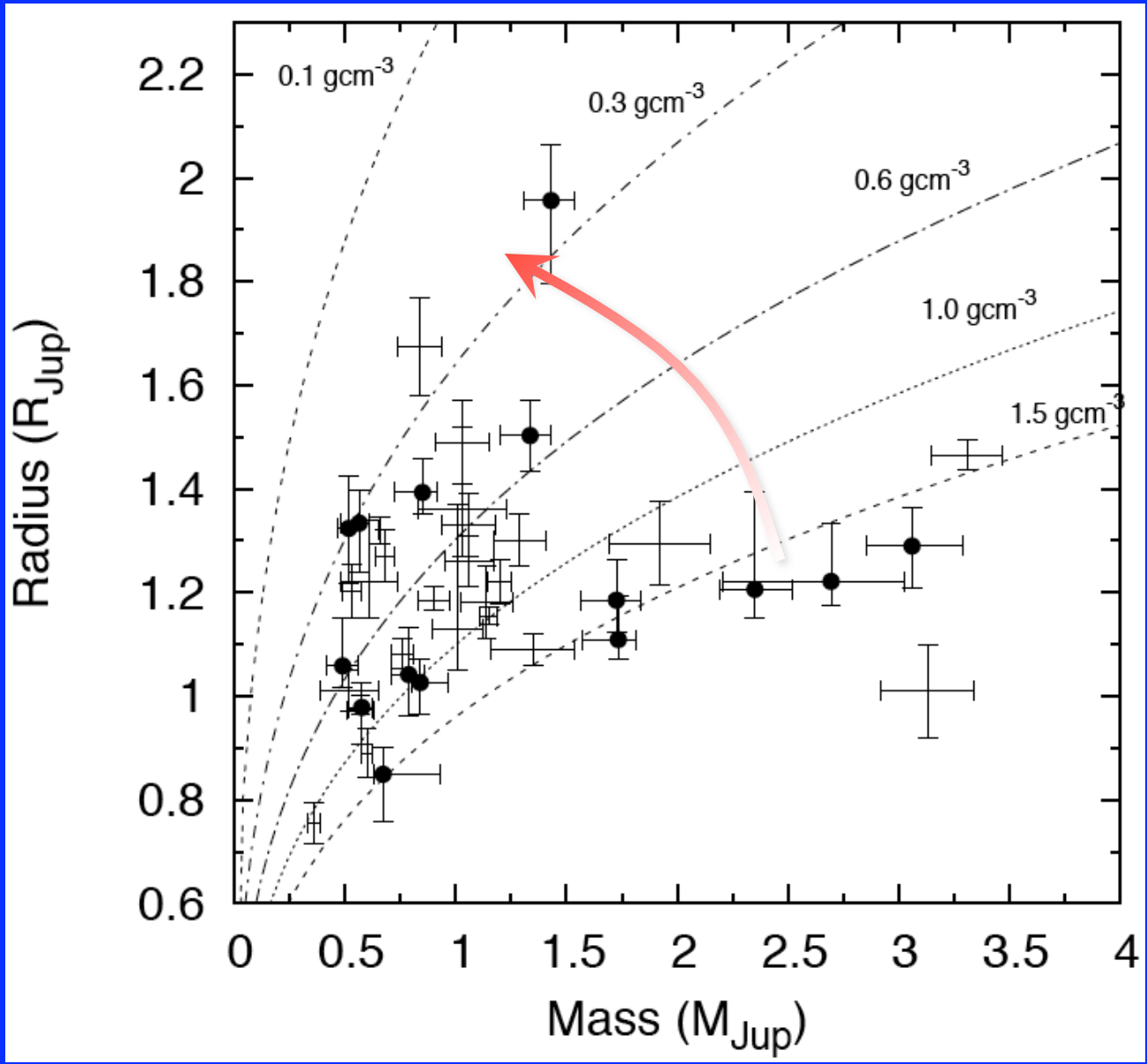


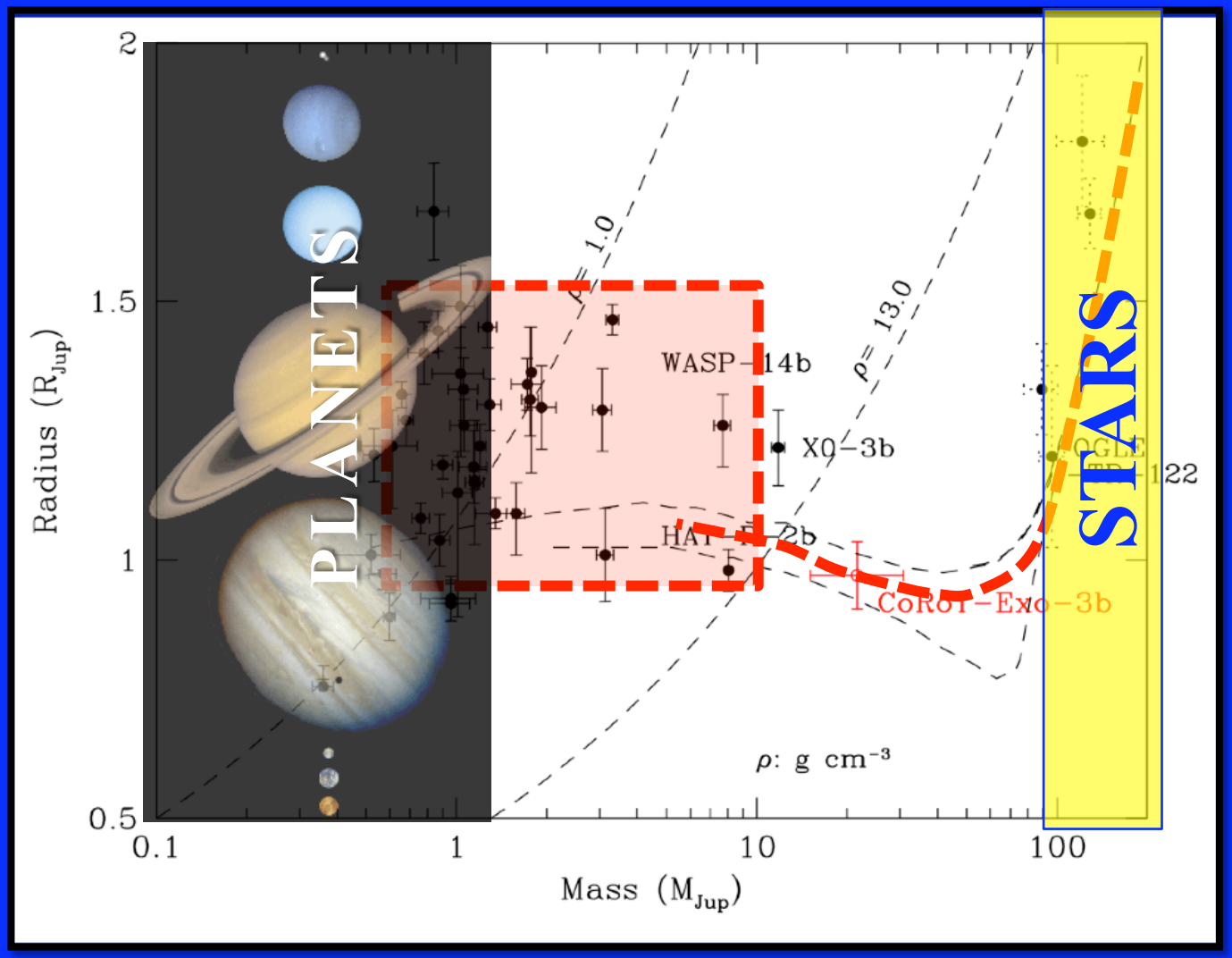

SuperWASP

Bright ($V < 13.5$) Transiting planets

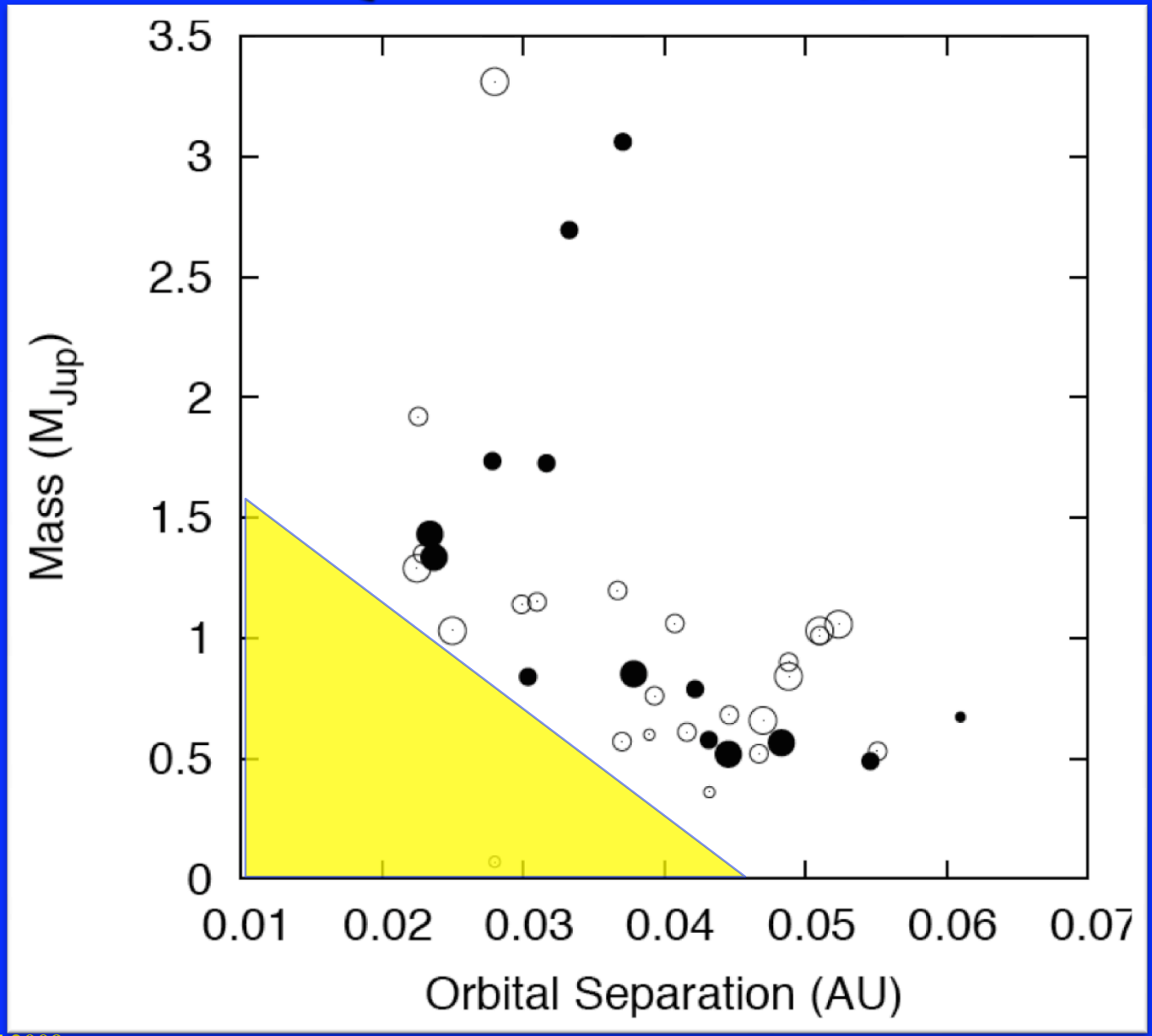


Planet density

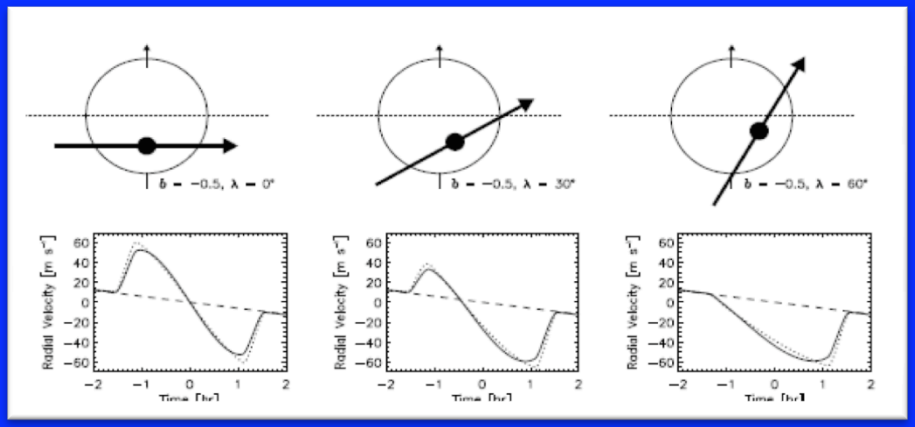


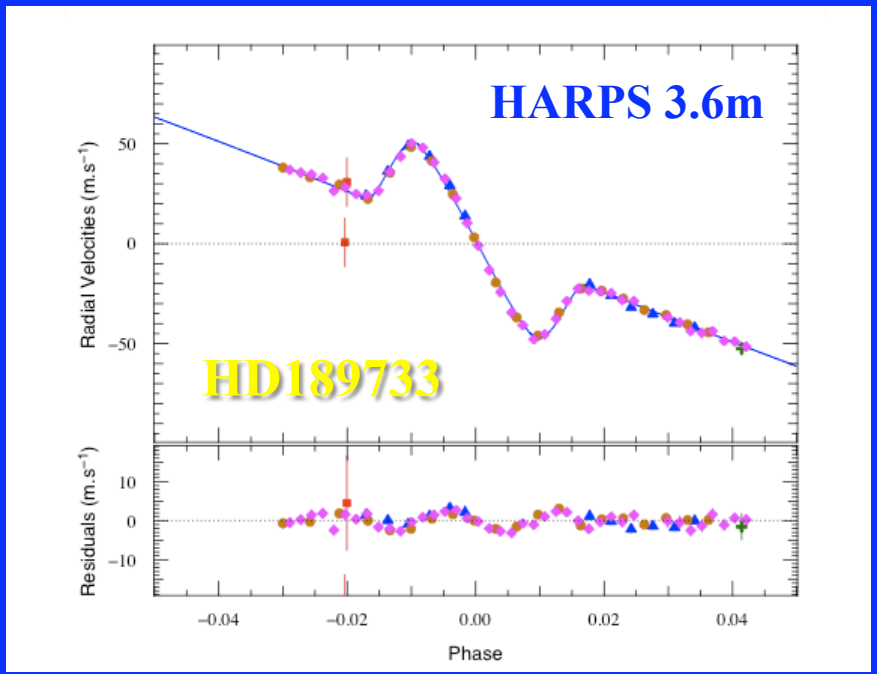

PLANETS
STARS
Radius (R_{Jup})
Mass (M_{Jup})
2
1.5
1
0.5
0.1
1
10
100
ρ= 1.0
ρ= 13.0
WASP−14b
XO−3b
HAT−P−2b
CoRoT−Exo−3b
ρ: g cm⁻³

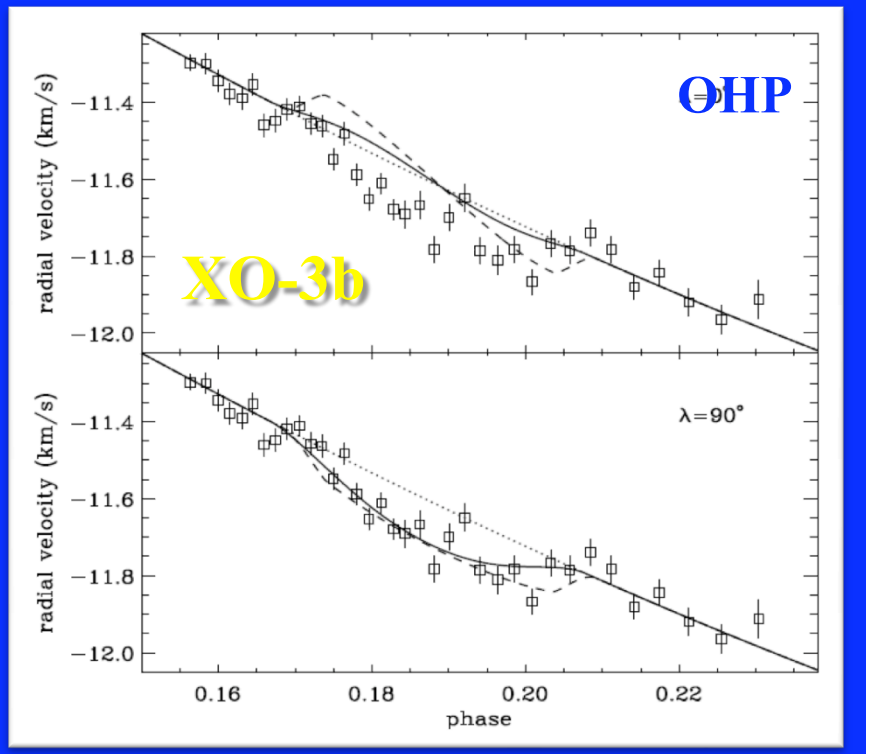
The imprint of the migration



Rossiter – Mc Laughlin effect



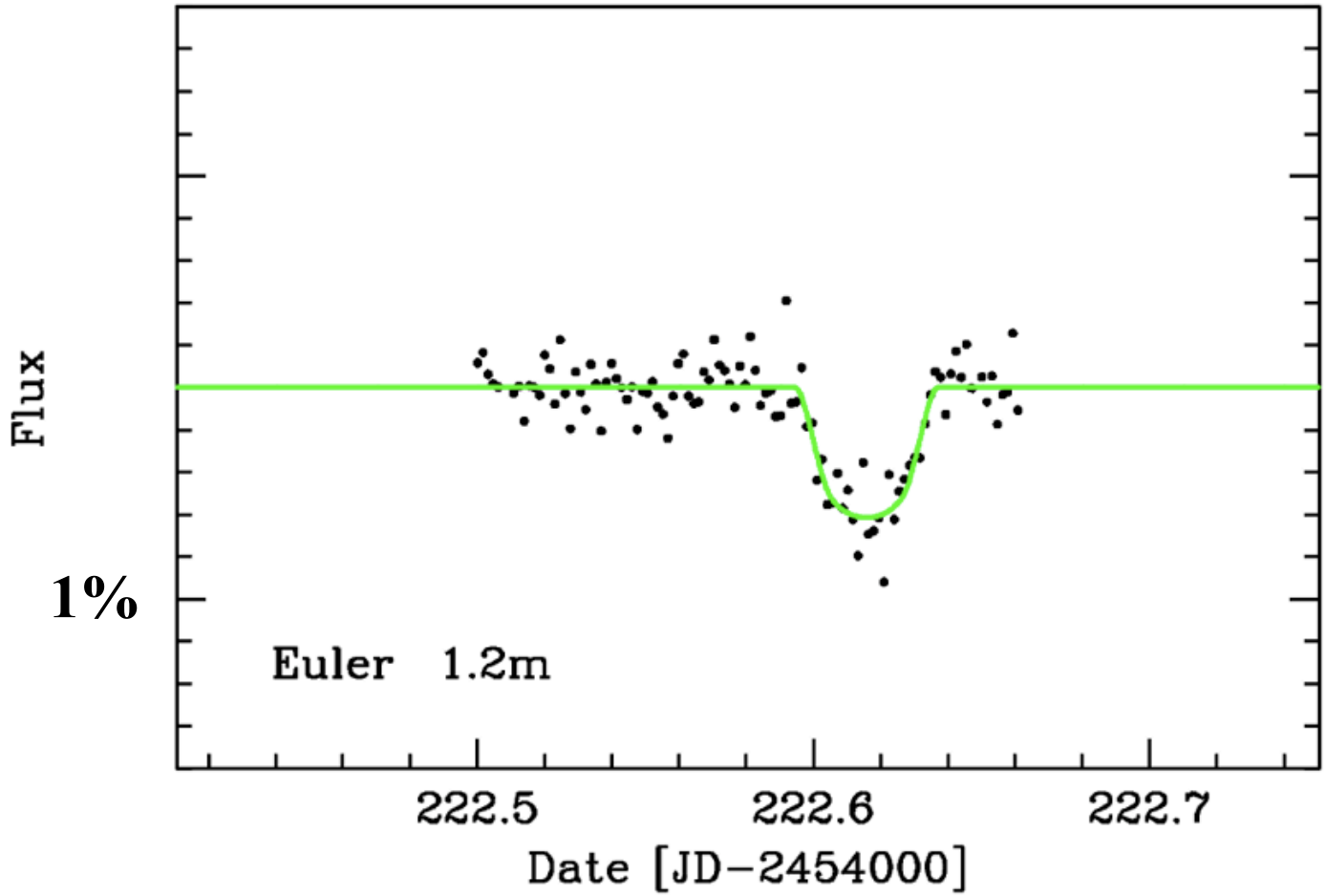




Hébrard et al. 2008

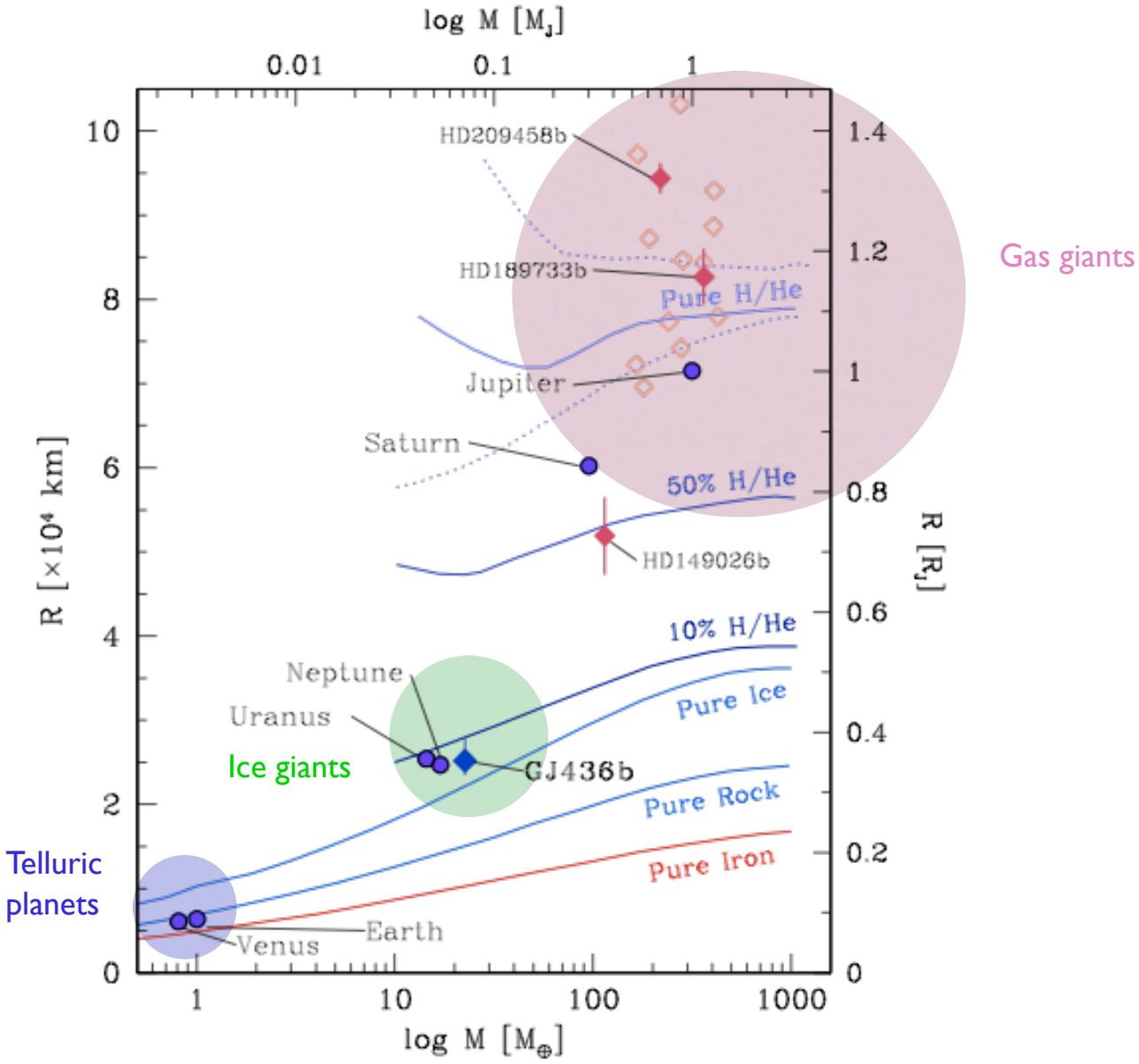
Amaury et al. submitted

A Transiting Neptune on GJ 436



(Gillon et al. 2007 A&A)

Overall mass-radius diagram for planets

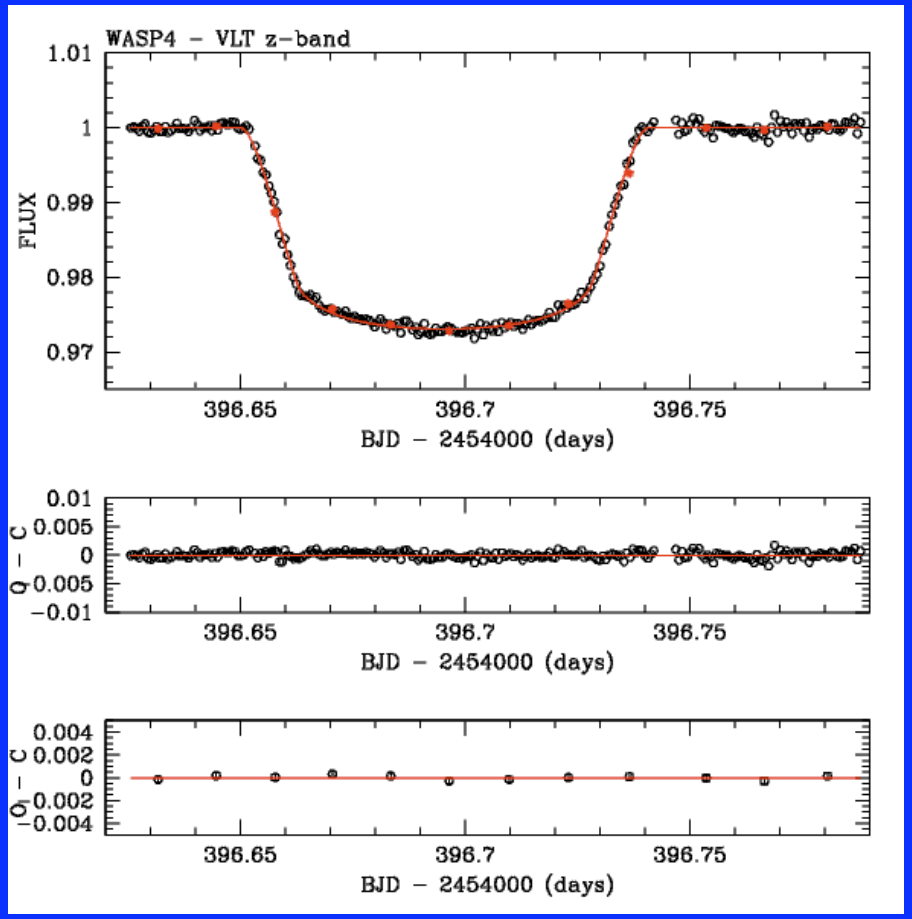


WASP-4 with FORS on VLT

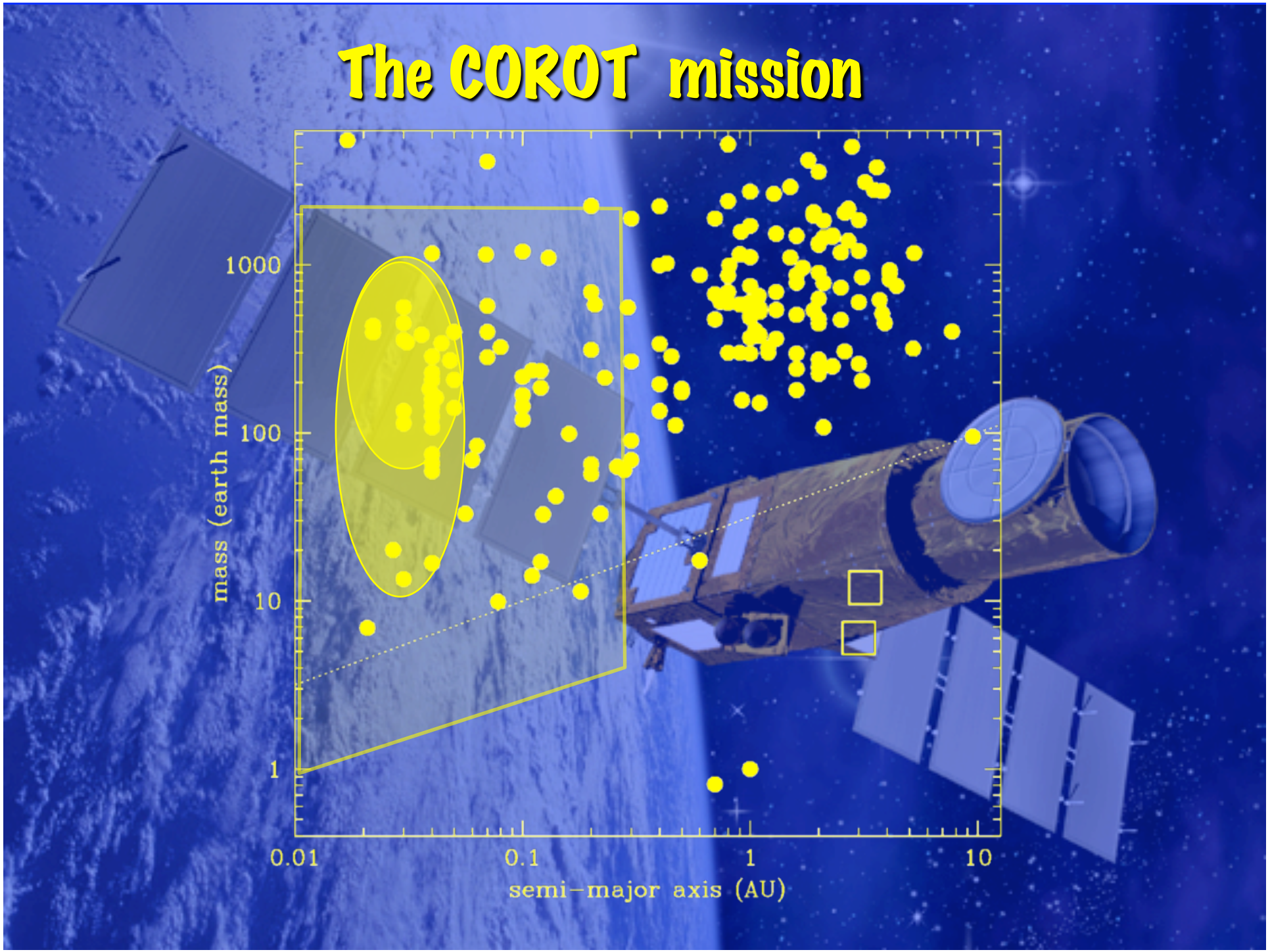
$dT = 54s$

$\sigma = 0.00055$

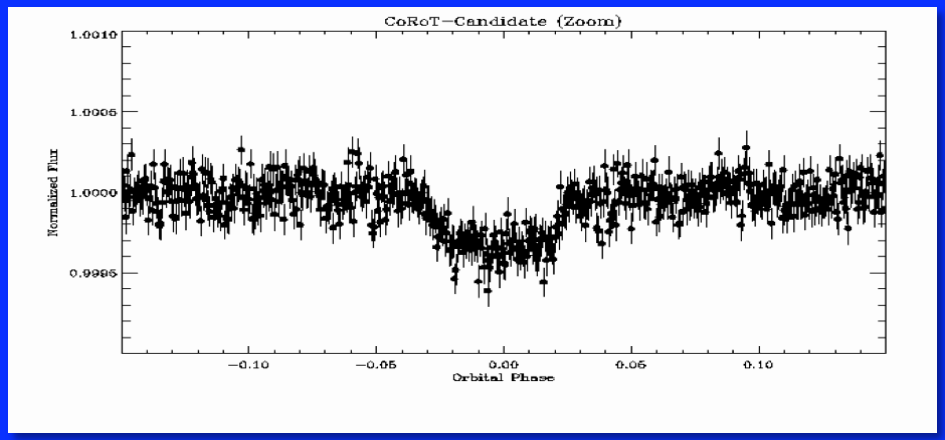
$\sigma_r = 0.00014$



The COROT mission

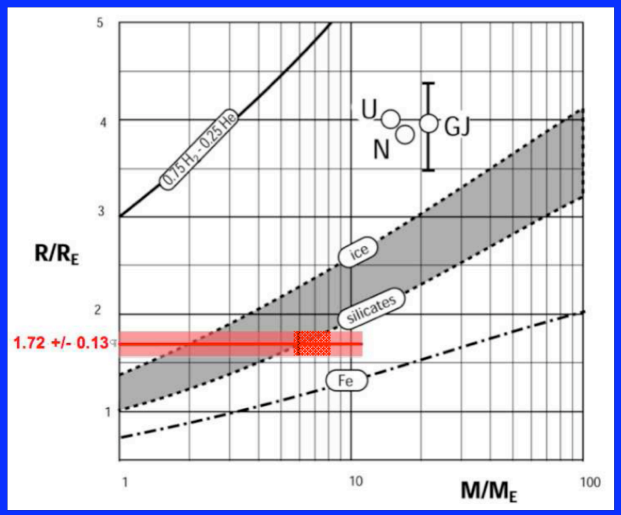


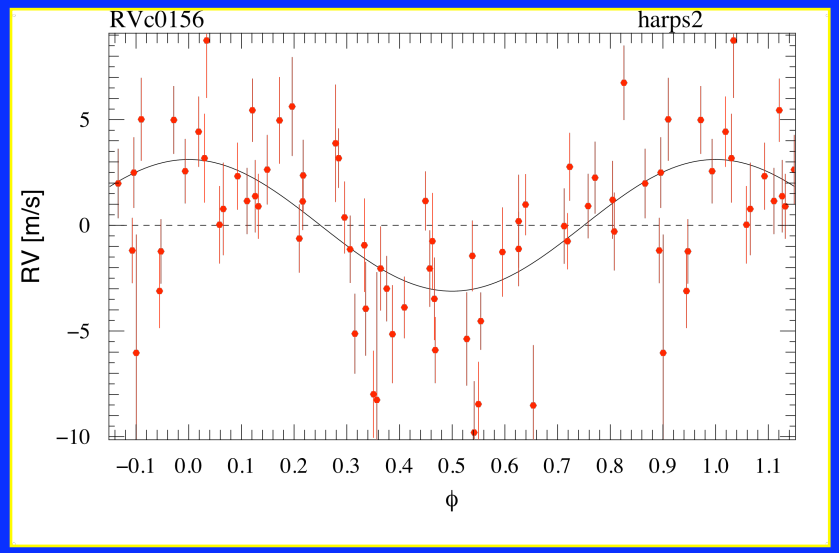
Corot 7



Leger et al. submitted

HARPS 3.6m



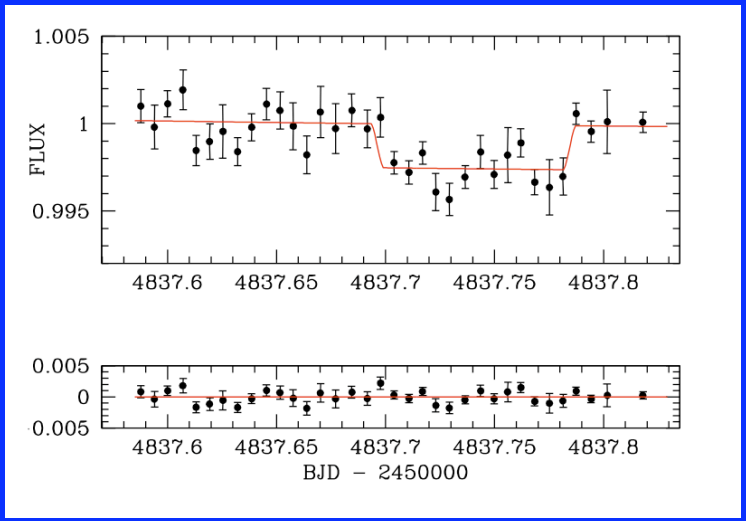


Queloz et al. in prep

Corot 1 at VLT

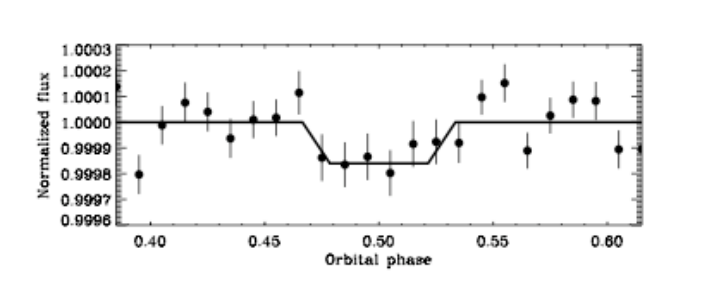
planetary eclipse

HAWK-I

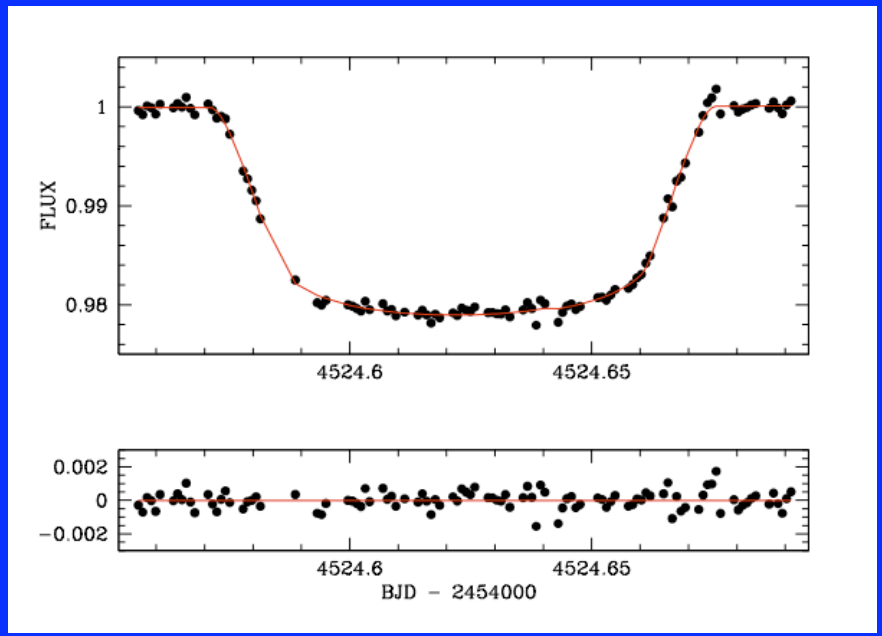


Gillon et al. Submitted
Alonso et al Submitted

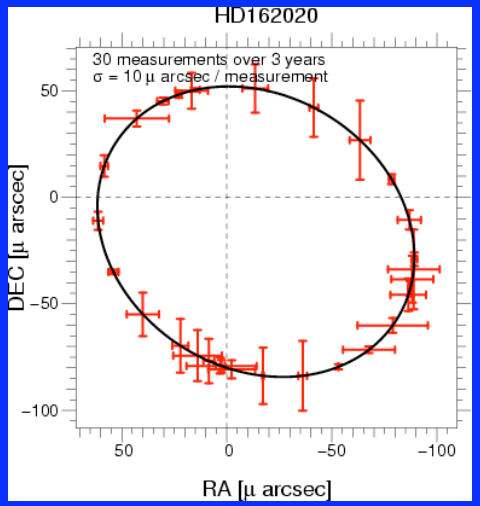
CoRot



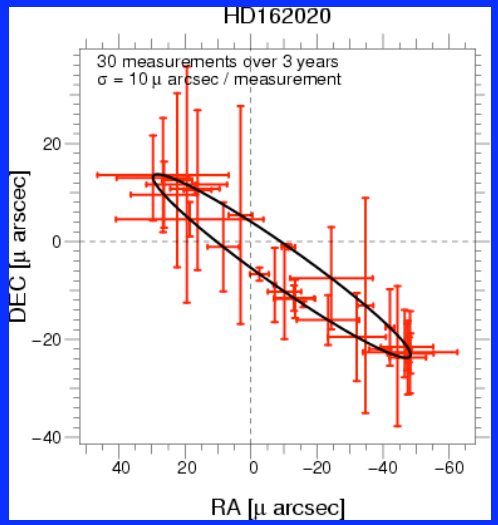
FORS z transit



The onset of the astrometry



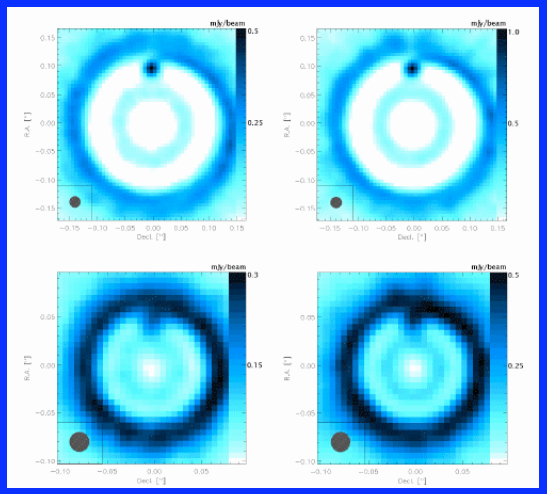
sin i =0.5

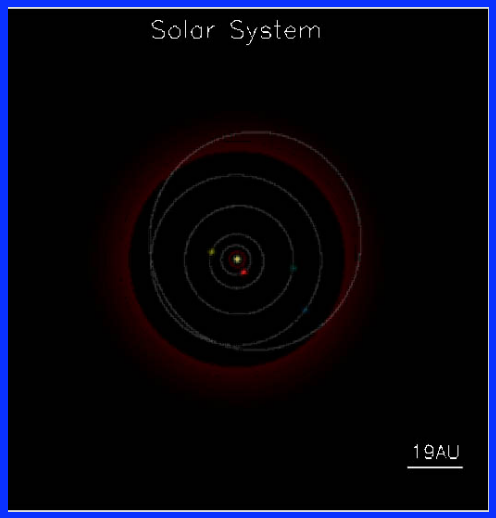


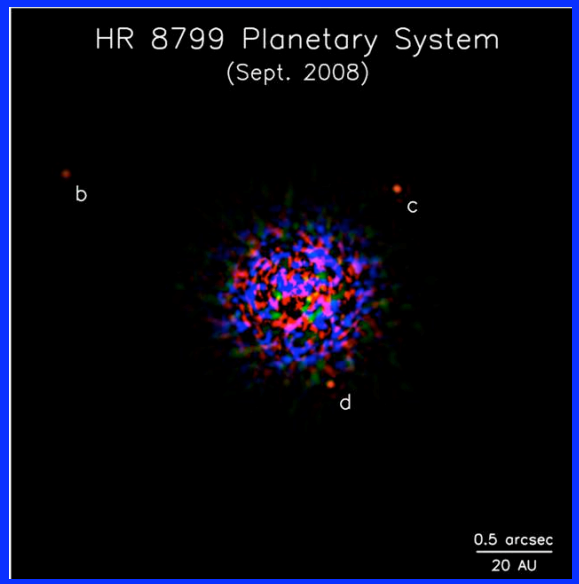
sin i =0.99

- Mass measurements of known systems
- Multiple systems inclinations
- Search on "other stars not RV suitable"
  - o active stars
  - o massive stars
- Search on "nearby stars"

Imaging a planet, the last frontier...







- SPHERE (VLT, 8-m telescope), 2011
  - Young self luminous exo-planets
    - Angular separation: $0.1 < \alpha < 1$ arcsec
    - Contrast (Near Infrared): 10^{-4} - 10^{-6}

- EPICS (E-ELT, 42-m telescope),
  - Mature gas giant and massive rocky exoplanets
    - Angular separation: $0.02 < \alpha < 1$ arcsec
    - Contrast (Near Infrared) H: 10^{-7} - 10^{-9}

In ELT's time

- Planet most relevant questions are likely to have changed, be flexible and build on « smaller » telescope sucesses at this time:
  - A lot more planets shall be known
  - Some Earth mass/size object shall be identified
- Strength on programs and surveys with VLT and space mission. The most interesting targets will become ELT targets:
  - Precise spectrographs
  - high contrast imaging
  - IR and mid-IR spectroscopic facilities