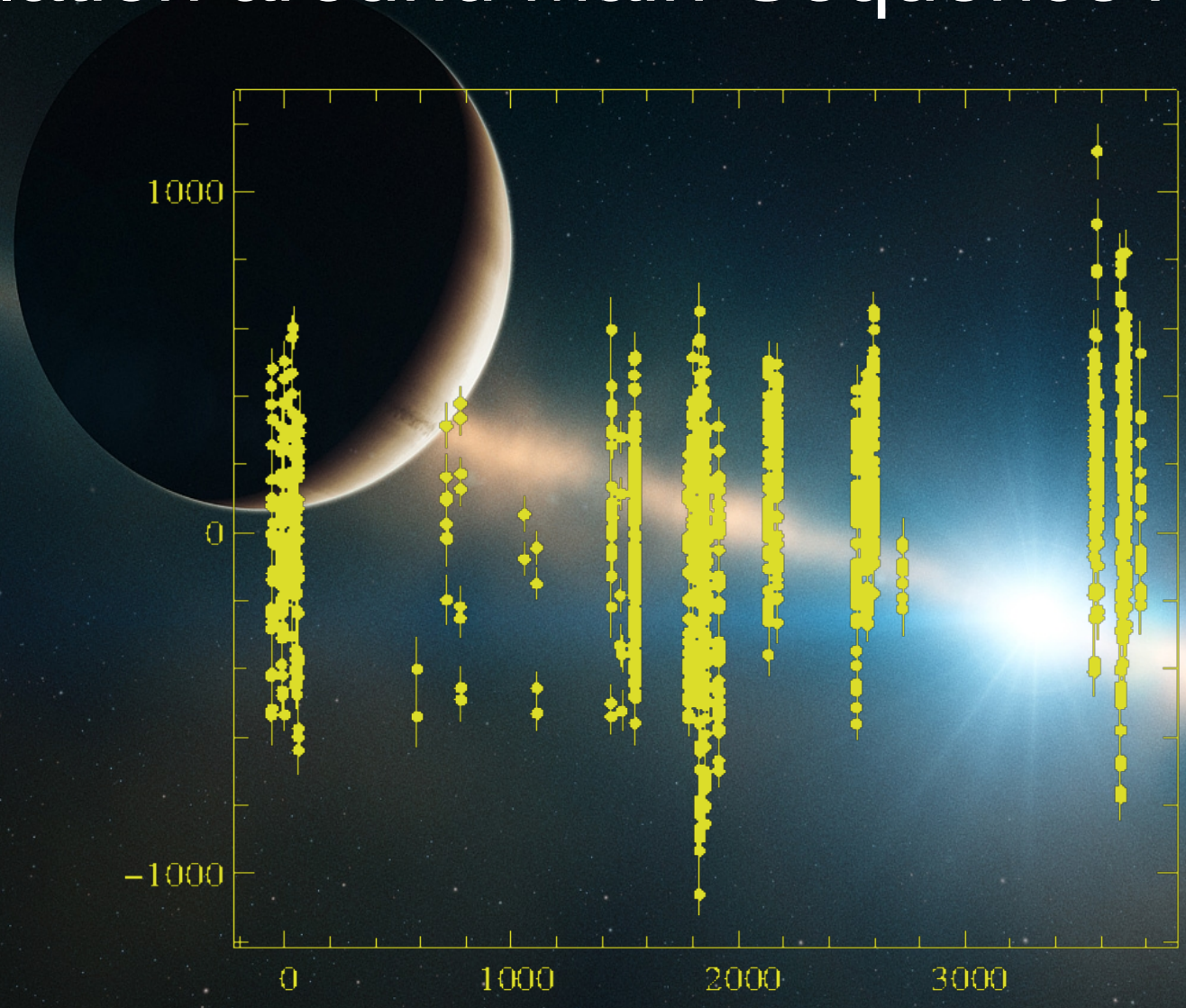
The close (0.02-2.5 AU) giant planet population around Main-Sequence AF stars



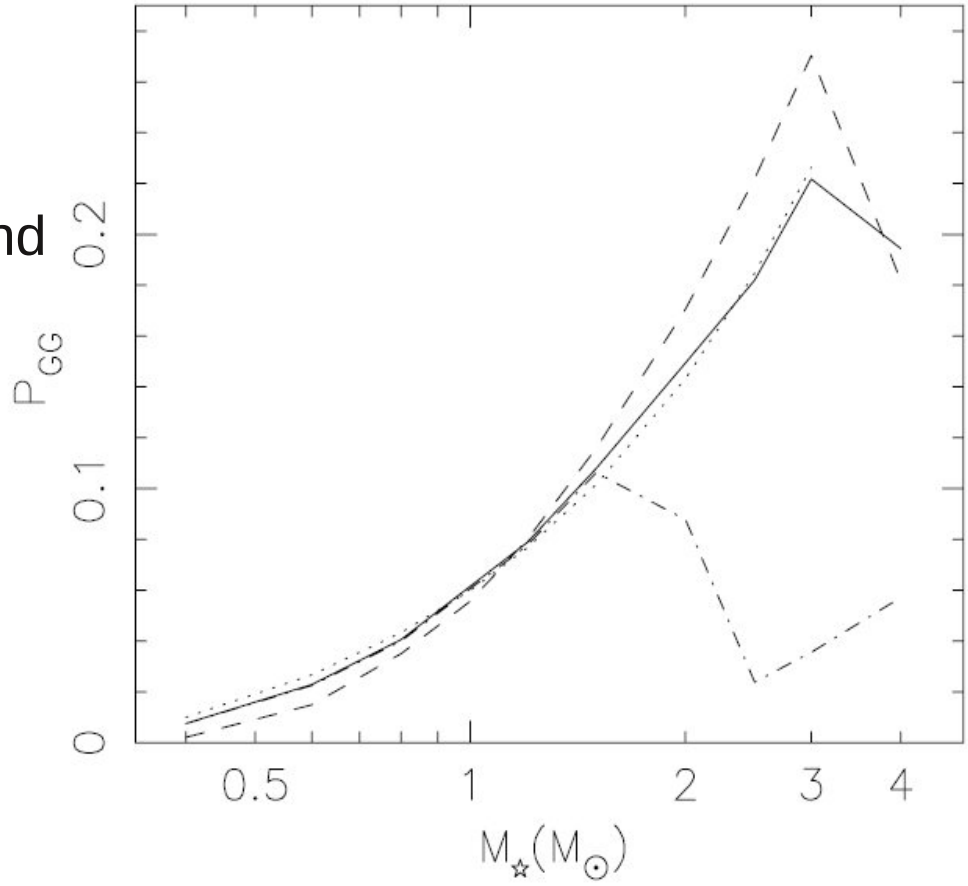
S. Borgniet, A.-M. Lagrange, N. Meunier
Institut de Planétologie et d'Astrophysique de Grenoble

(Close) GP occurrence rate vs stellar mass

Core-accretion model:

More GPs around higher-mass stars

GPs form at larger separations around higher-mass stars



GP occurrence rate vs stellar mass predicted by CA model

Kennedy & Kenyon, 2008

Precise RV computation for early-type stars

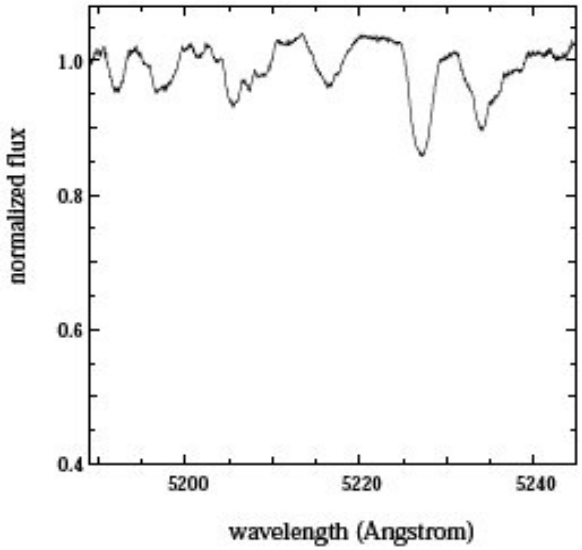
AF stars: usually not suited for RV studies (fewer lines, rotational broadening)

SAFIR method for AF stars: cross-correlation with reference spectrum (median of all spectra) instead of with classical binary mask

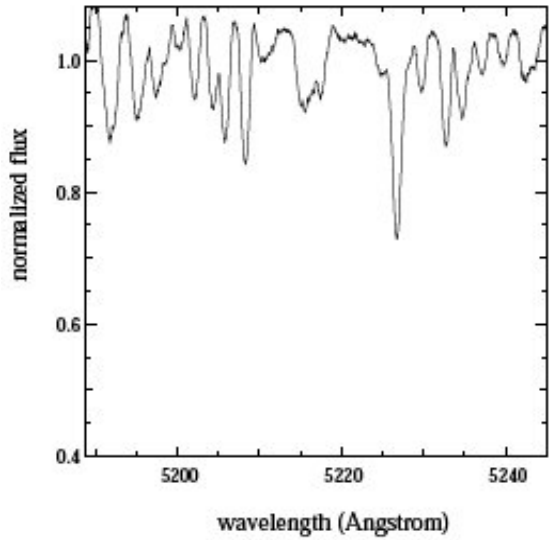
Get RV, CCF, BIS

Galland et al. 2005a, 2005b, 2006

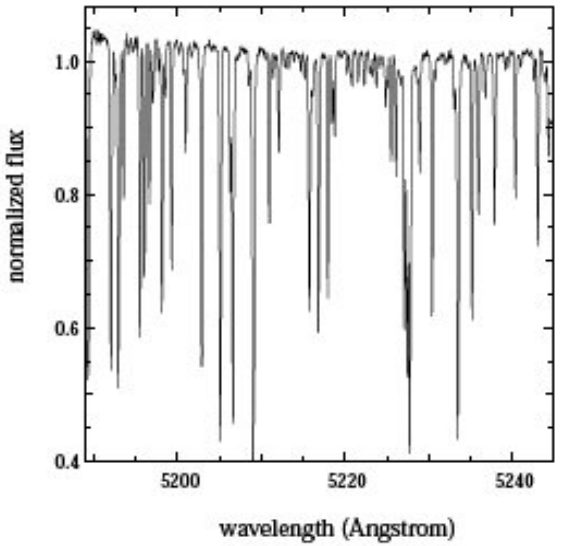
A7V, vsini= 91 km/s



F5V, vsini= 45 km/s

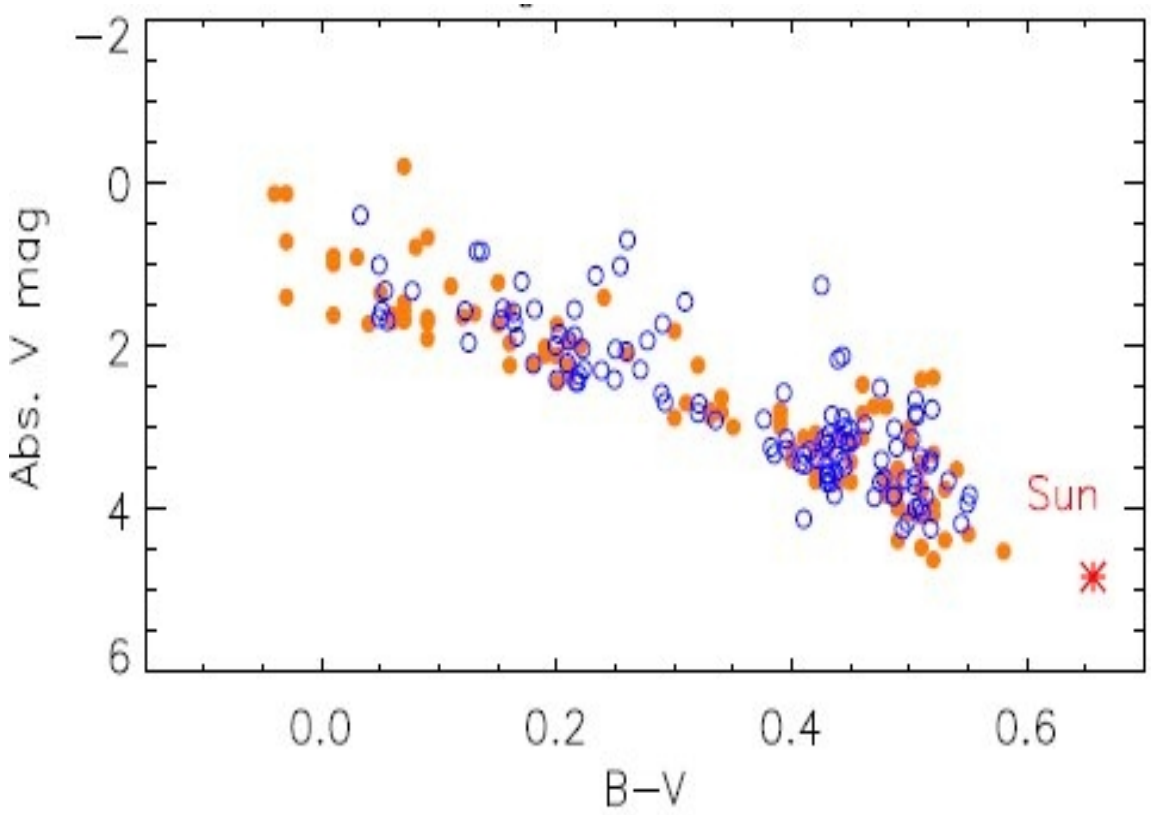


F6V, vsini= 5 km/s



Galland et al., 2005

Sample

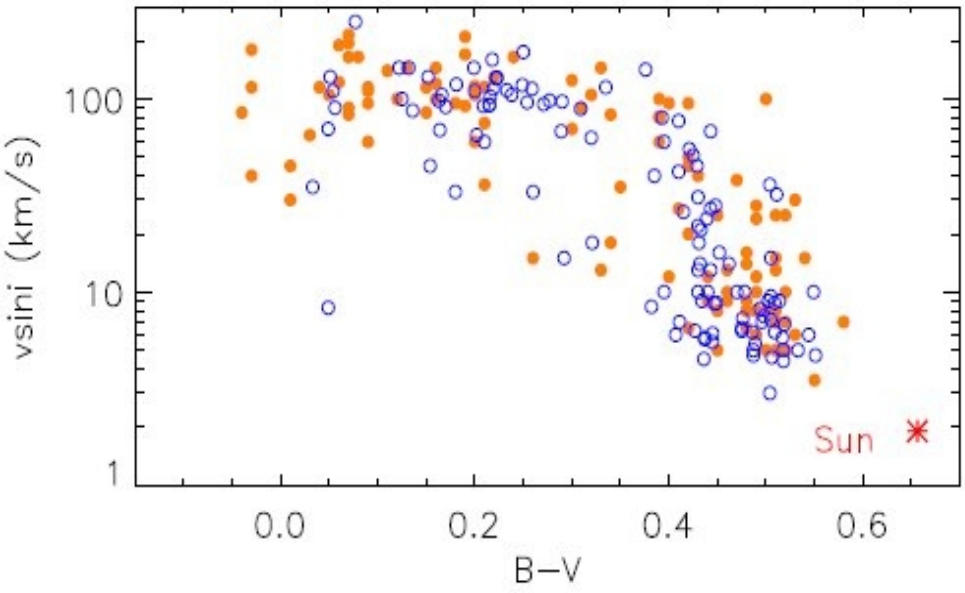


Two RV Large surveys (2005-2013)

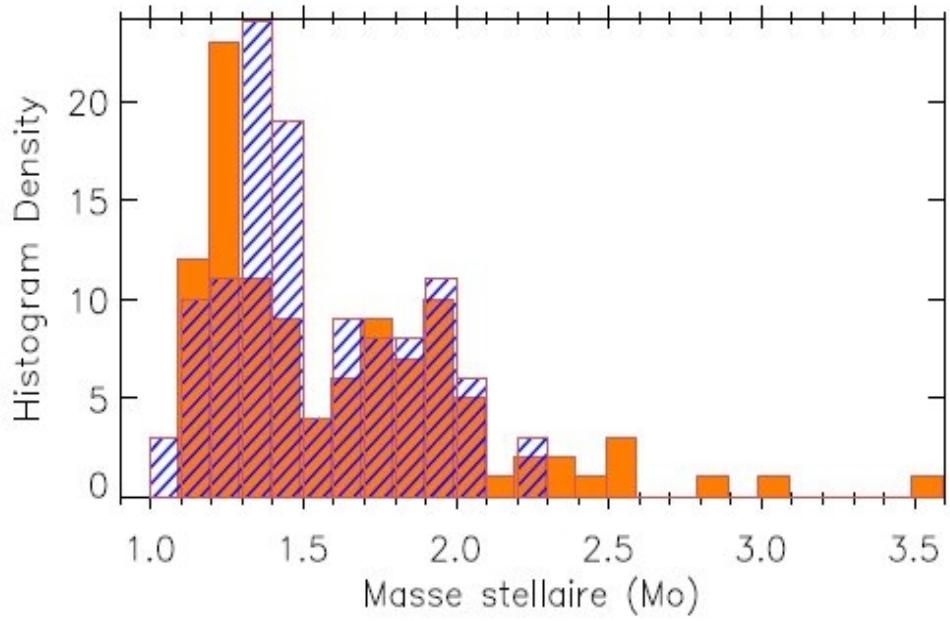
North: OHP/SOPHIE (115 targets)
South: La Silla/HARPS (108 targets)

Sample

Early-type stars
Faster-rotators

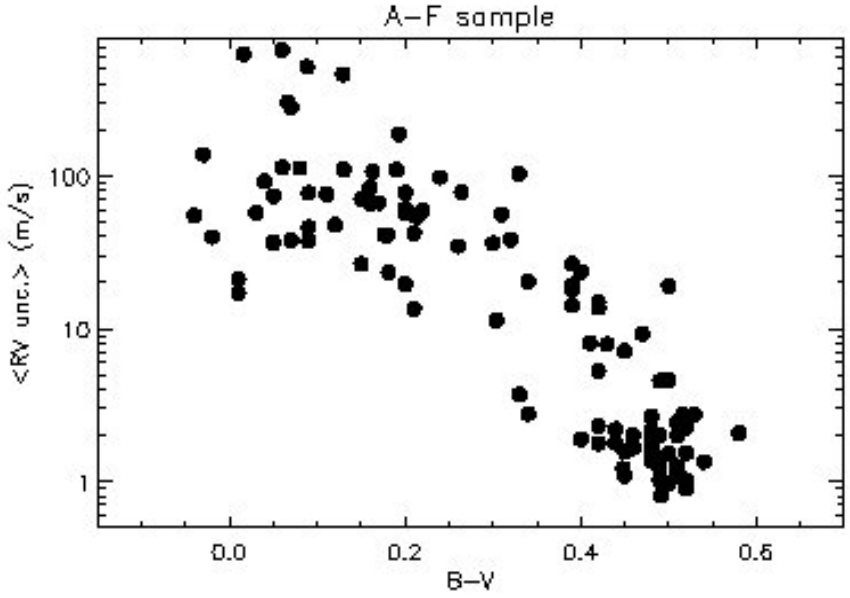


Stellar mass range
~1.1-2.5 Mo

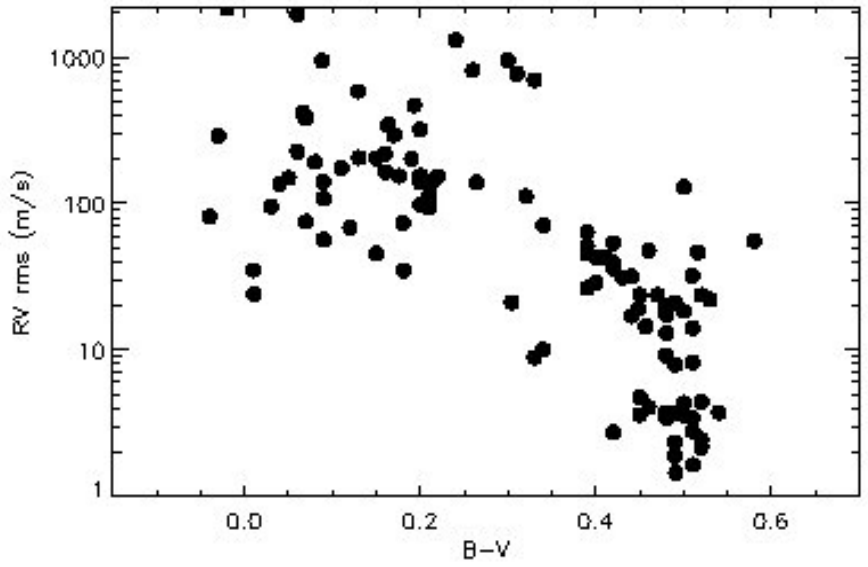


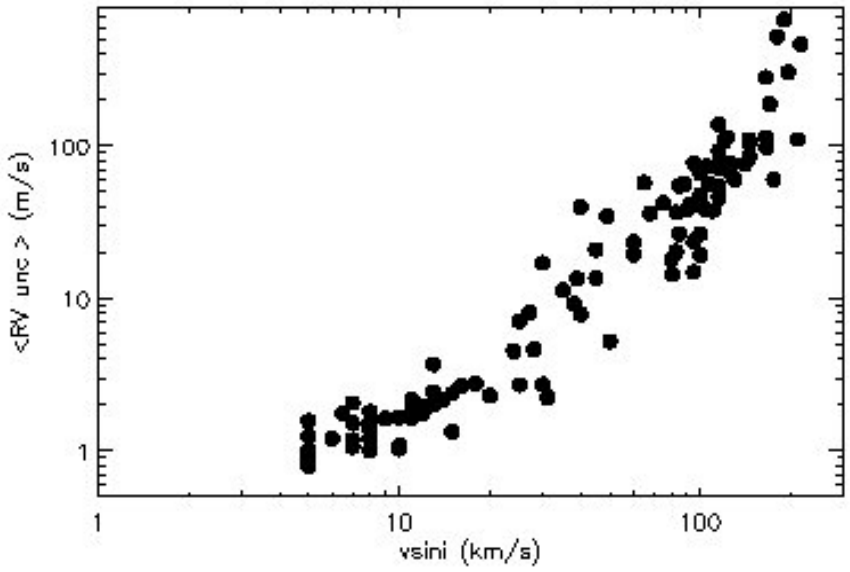
Stellar intrinsic variability

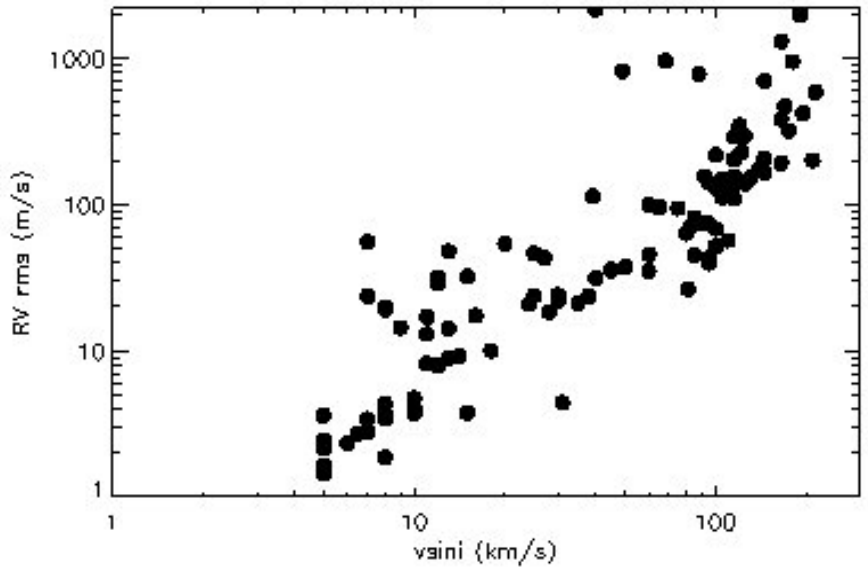
<RV uncertainty> (m/s)



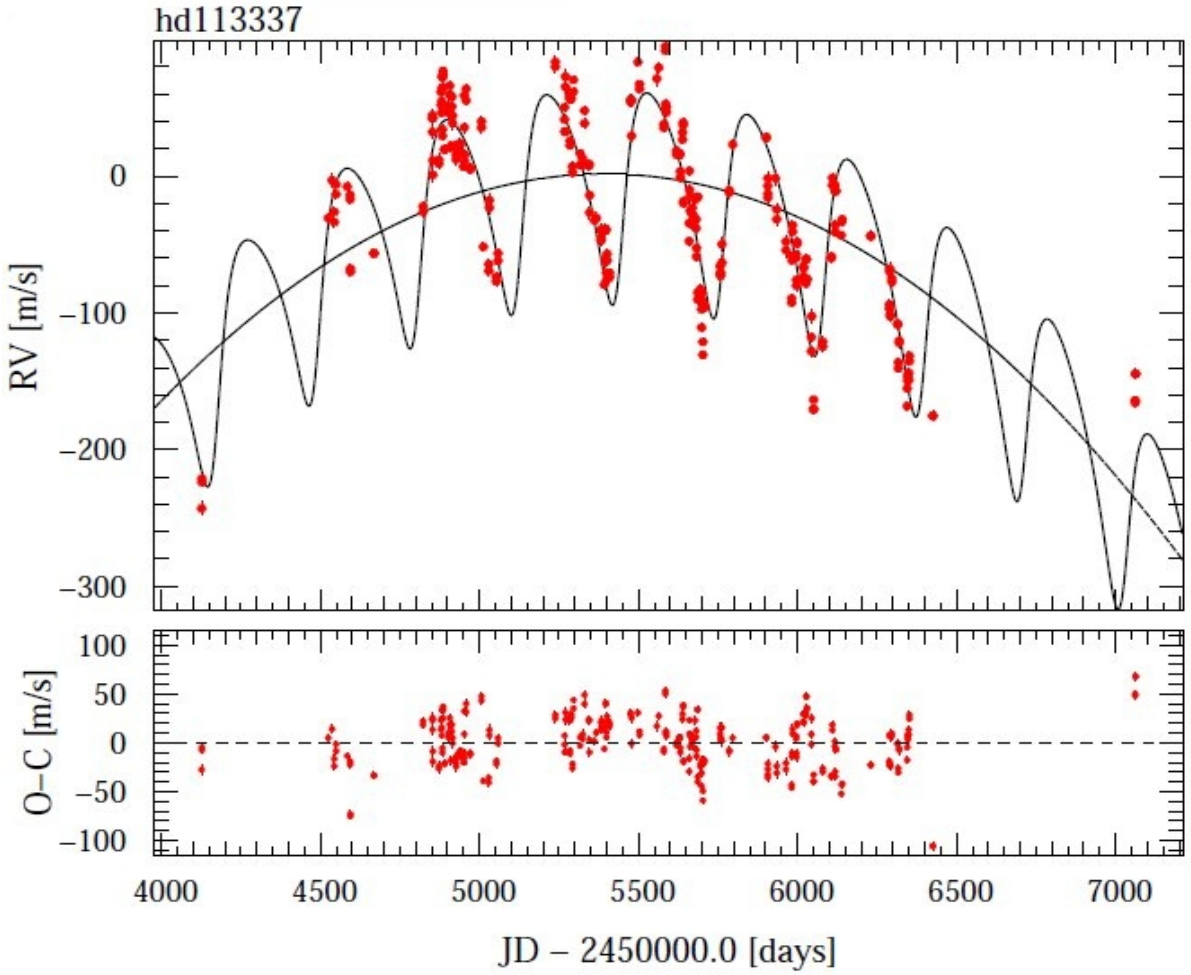
RV rms (dispersion) (m/s)

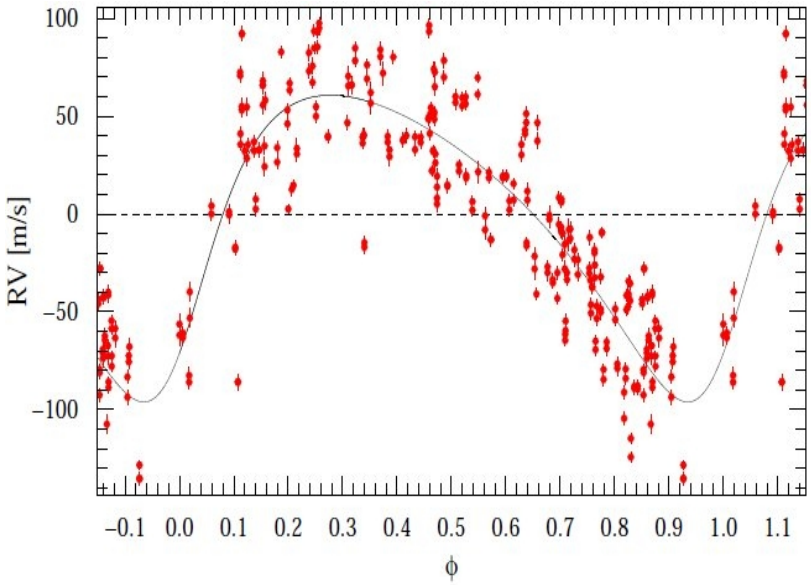






GP detections





Borgniet et al., 2014

Example: at least one GP detected w. SOPHIE around HD 113337 (F5V, M~1.4 Mo)

P ~325 days, mpsin*i* ~2.85 Mjup, e~0.46

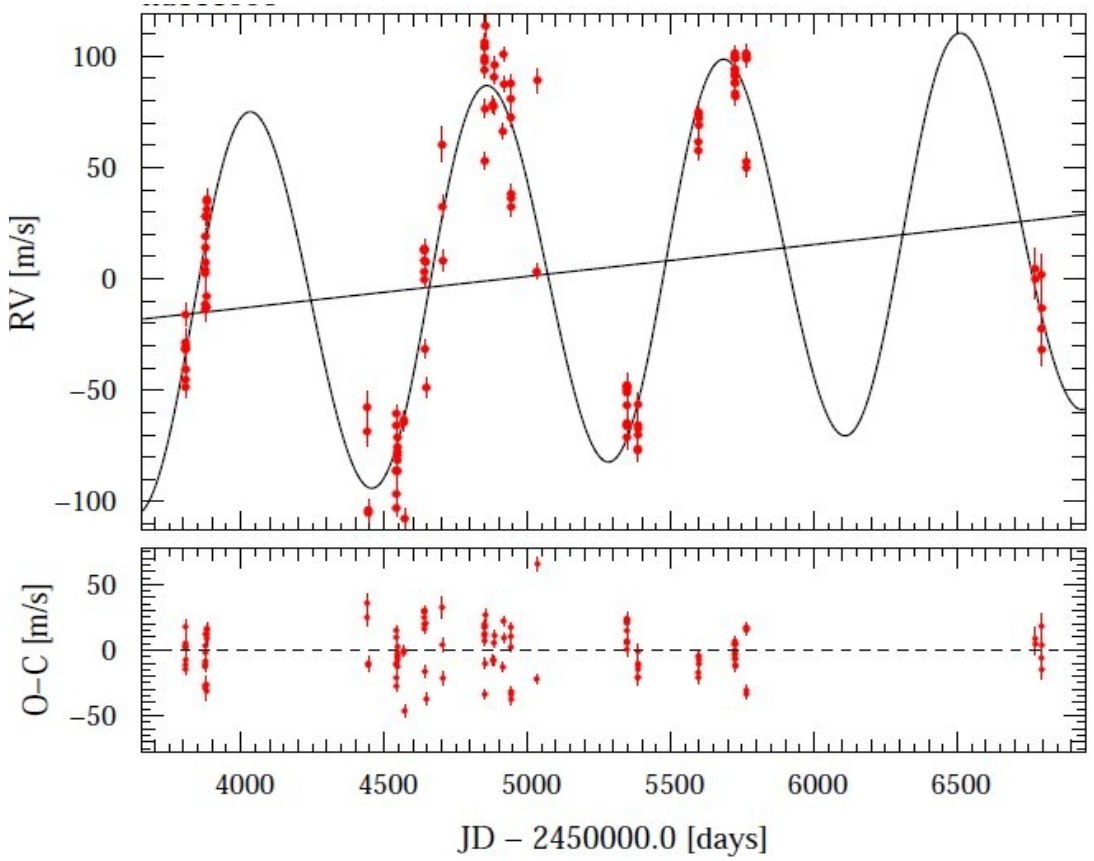
GP detections (Harps sample)

Harps sample (only)

4 GPs detected in all

14 spectroscopic binaries (SB1 mainly)

Borgniet et al., 2015
(to be subm.)

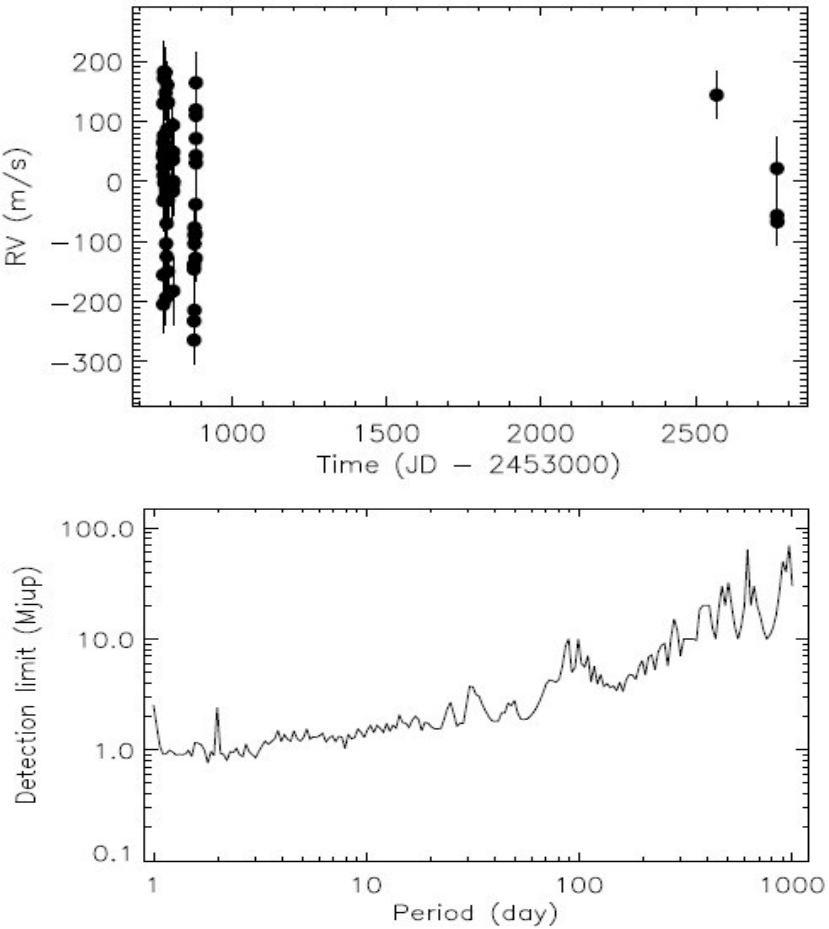


P=820 days, mpsin*i* = 4.51 Mjup
(F5-6V star, M~1.2 Mo)

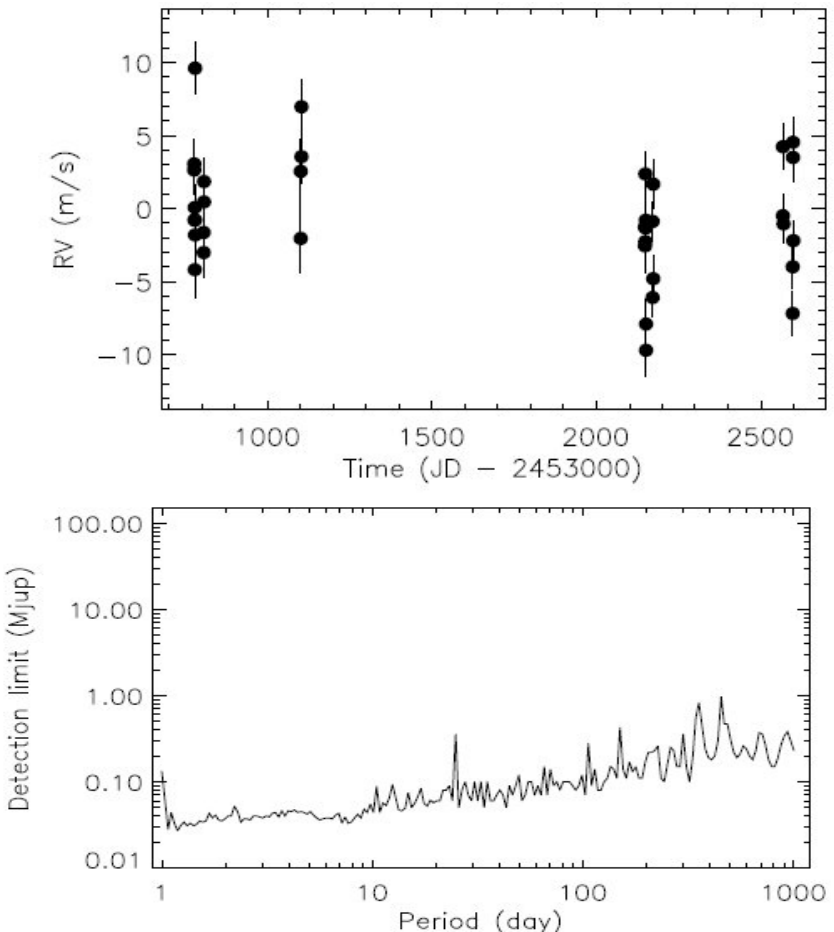
Detection limits

Computed with LPA (periodogram analysis) method
(Meunier et al., 2012; Lagrange et al., 2013)
Period range: 1-1000 days (~0.02 - ~2. AU)

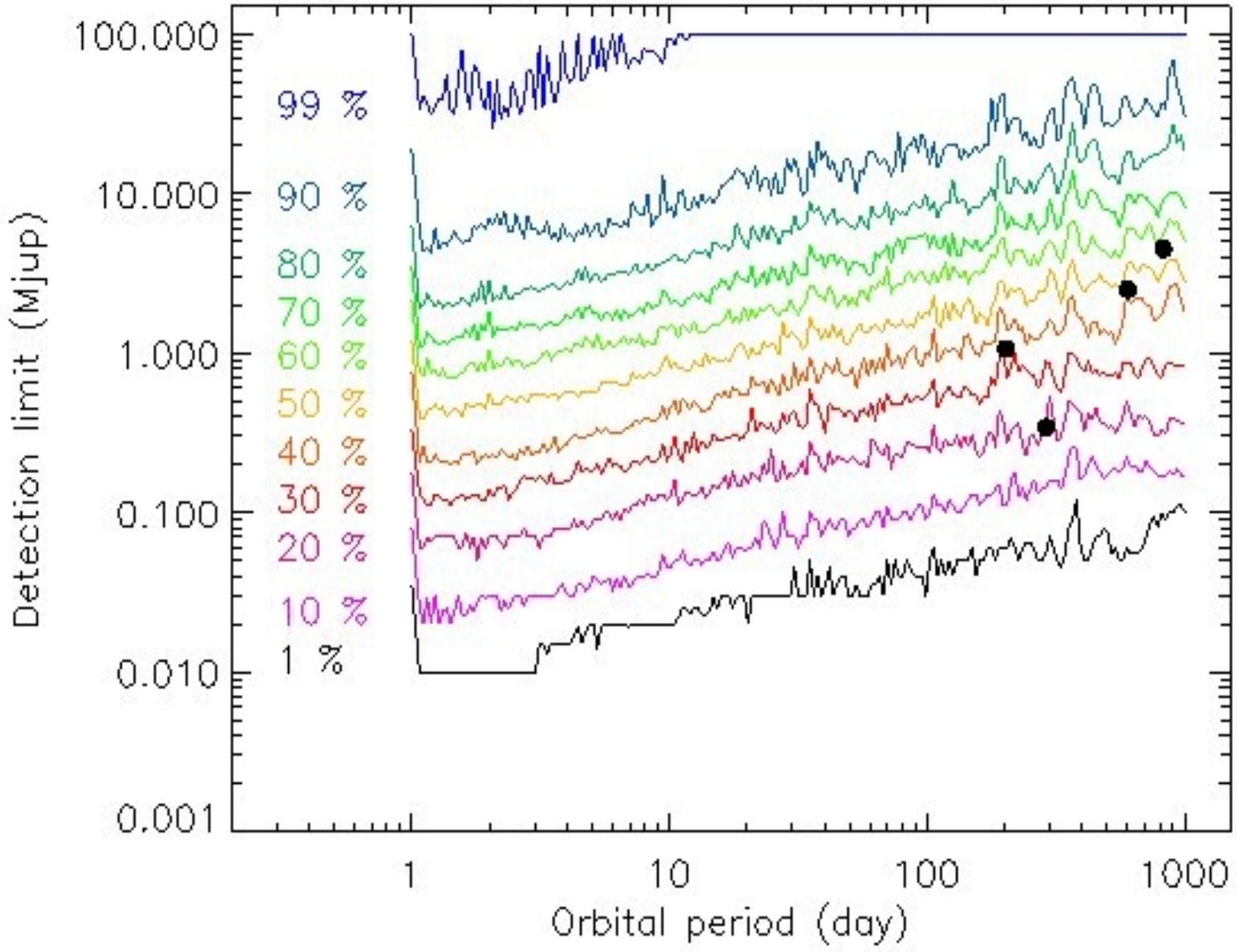
A3V, vsini= 115 km/s



F6V, vsini= 5 km/s

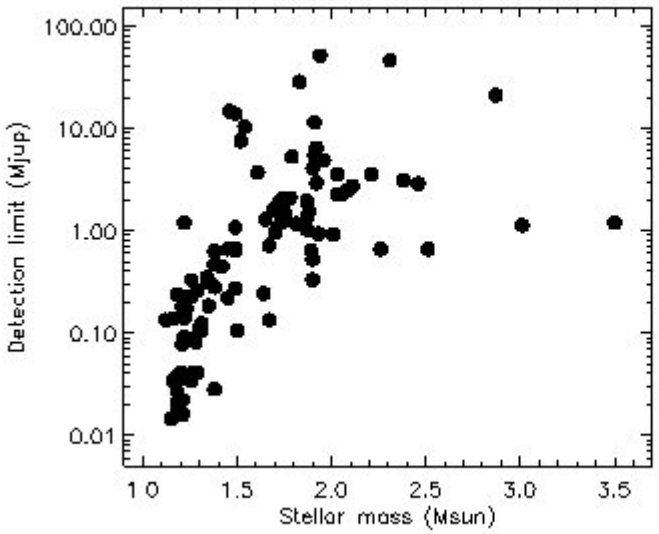


Search completeness (Harps sample)

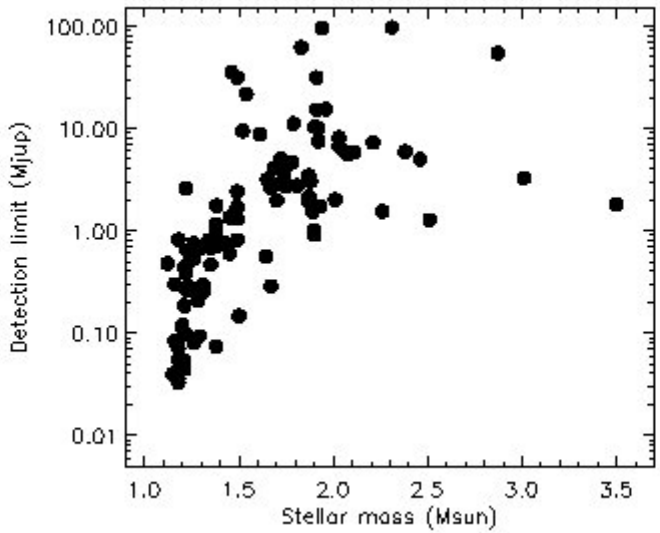


Detection limits vs stellar mass

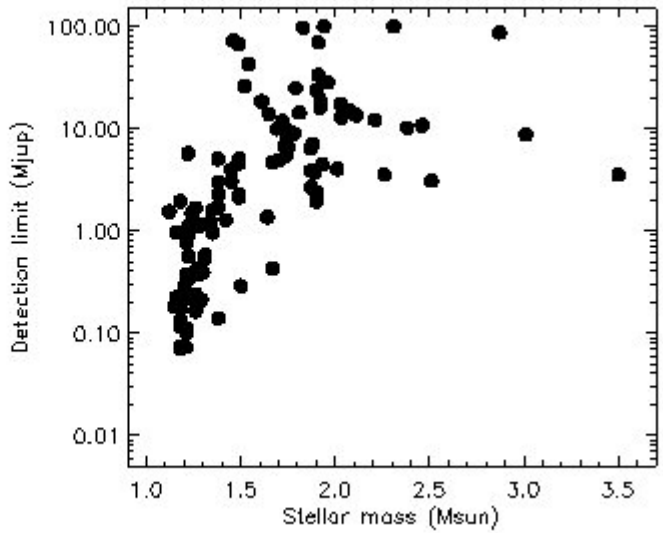
P=10 days



P=100 days



P=1000 days



Two subsamples
M < 1.5 Mo and M > 1.5 Mo

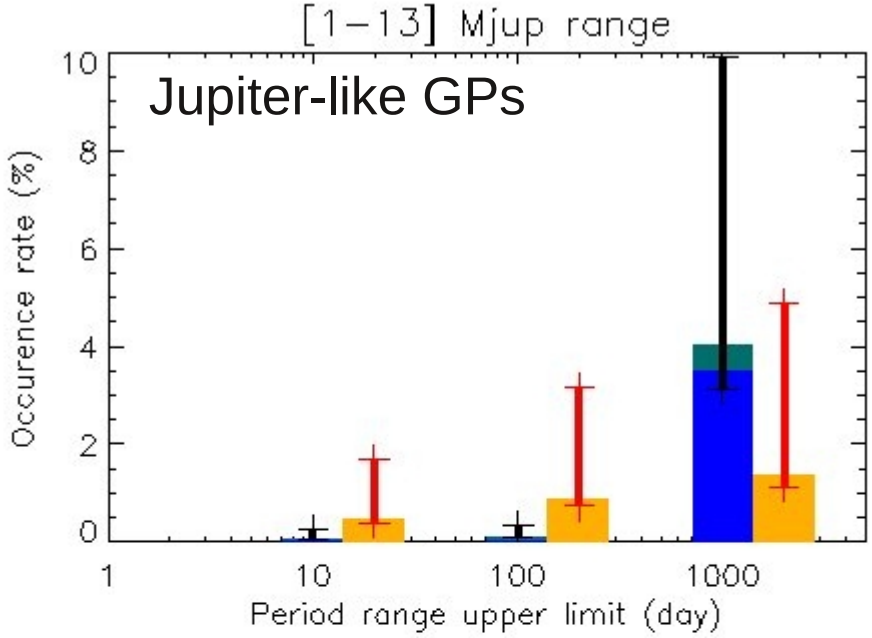
Constrains on close GP occurrence rate vs stellar mass

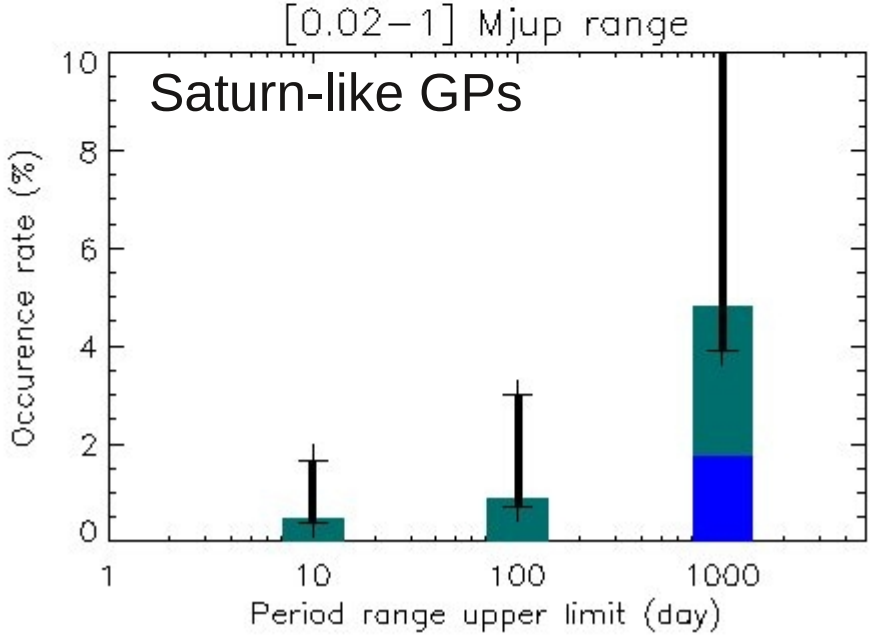
1-13 Mjup GP rate vs stellar mass (**full period range**):

M < 1.5 Mo: 4^{+5}_{-1} %

M > 1.5 Mo: $< 2^{+2}_{-1}$ %

Borgniet et al., 2015
(to be subm.)

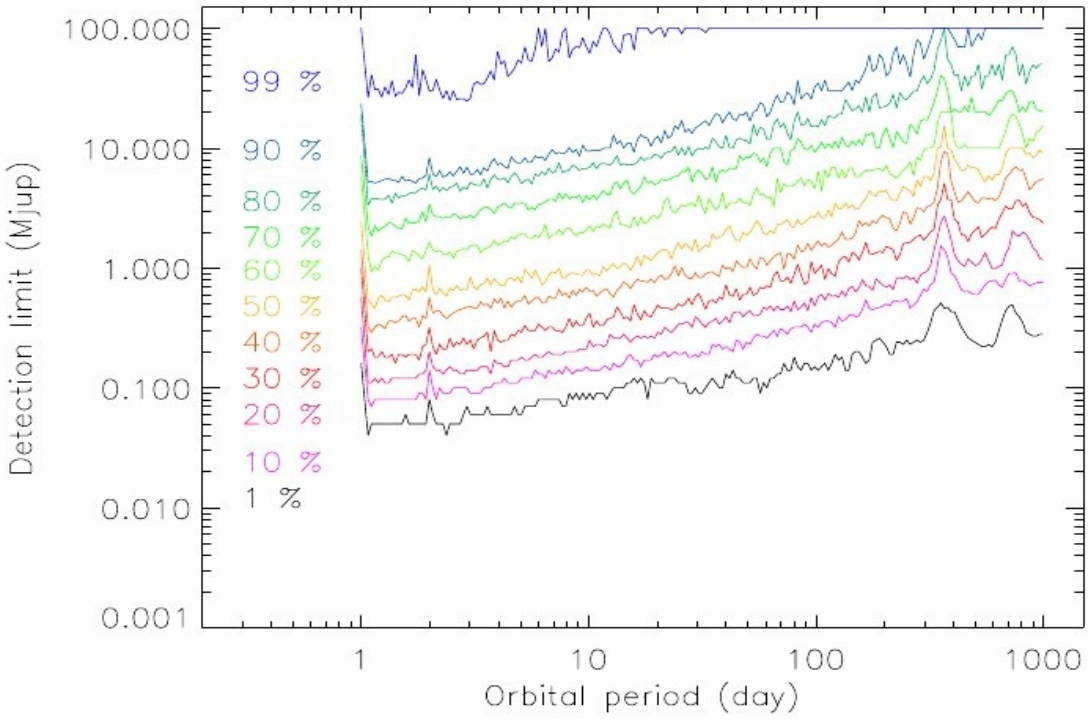




Conclusion and perspectives

Constrains on lack of GPs very close to the star (<0.5 AU)

In agreement w. RV observations of subgiant stars (lack of HJs compared to FGK stars)

Connection with CA model predictions: inward migration phenomenon weakened for higher-mass stars ?

Complete with Sophie survey data