# A bimodal correlation between host star chromospheric emission and the surface gravity of hot-Jupiters

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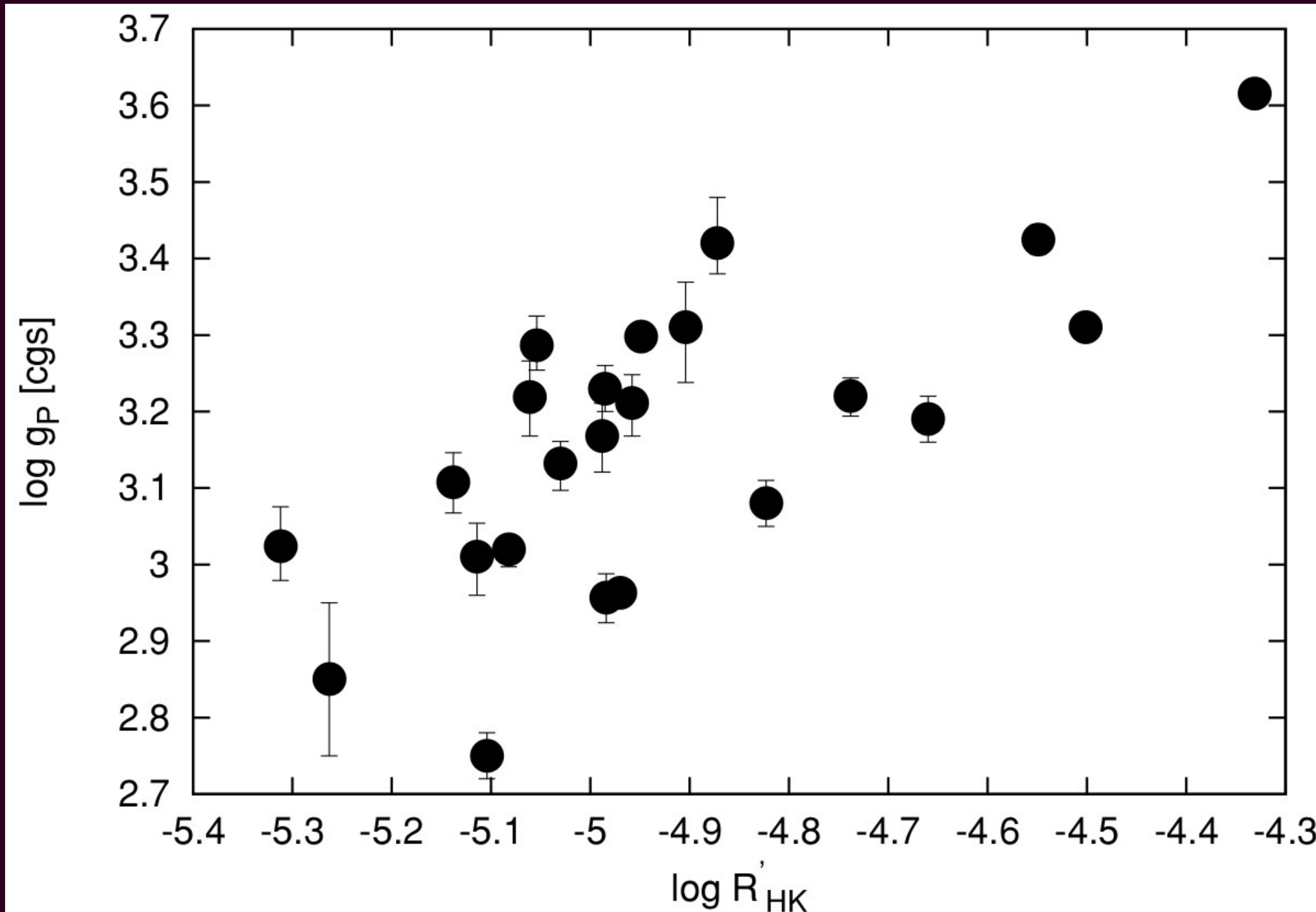
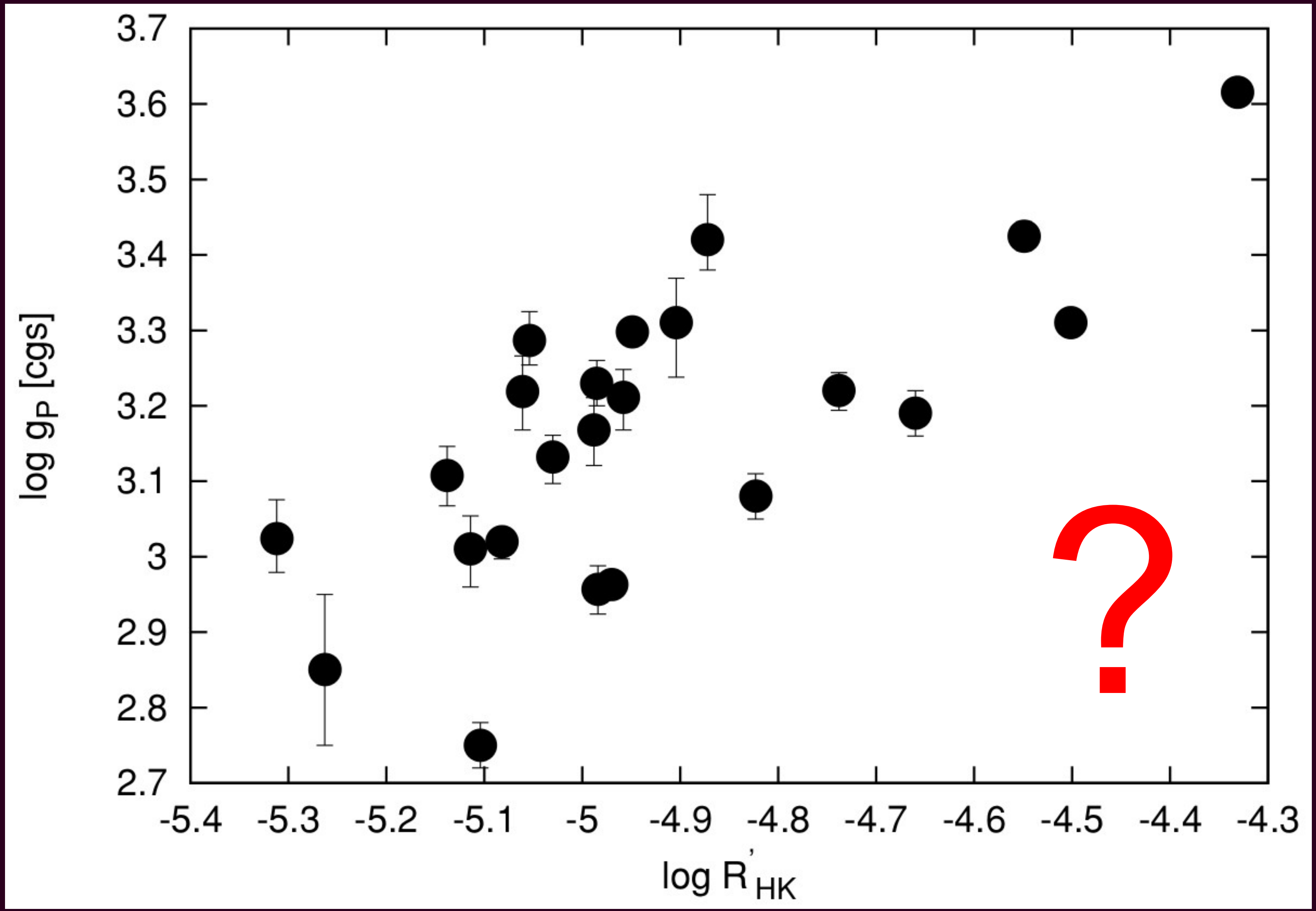
# Star-Planet interactions




Hartman 2010: stellar activity – planet surface gravity correlation

Confirmed by Figueira et al. 2014

# Star-Planet interactions




Hartman 2010: stellar activity – planet surface gravity correlation

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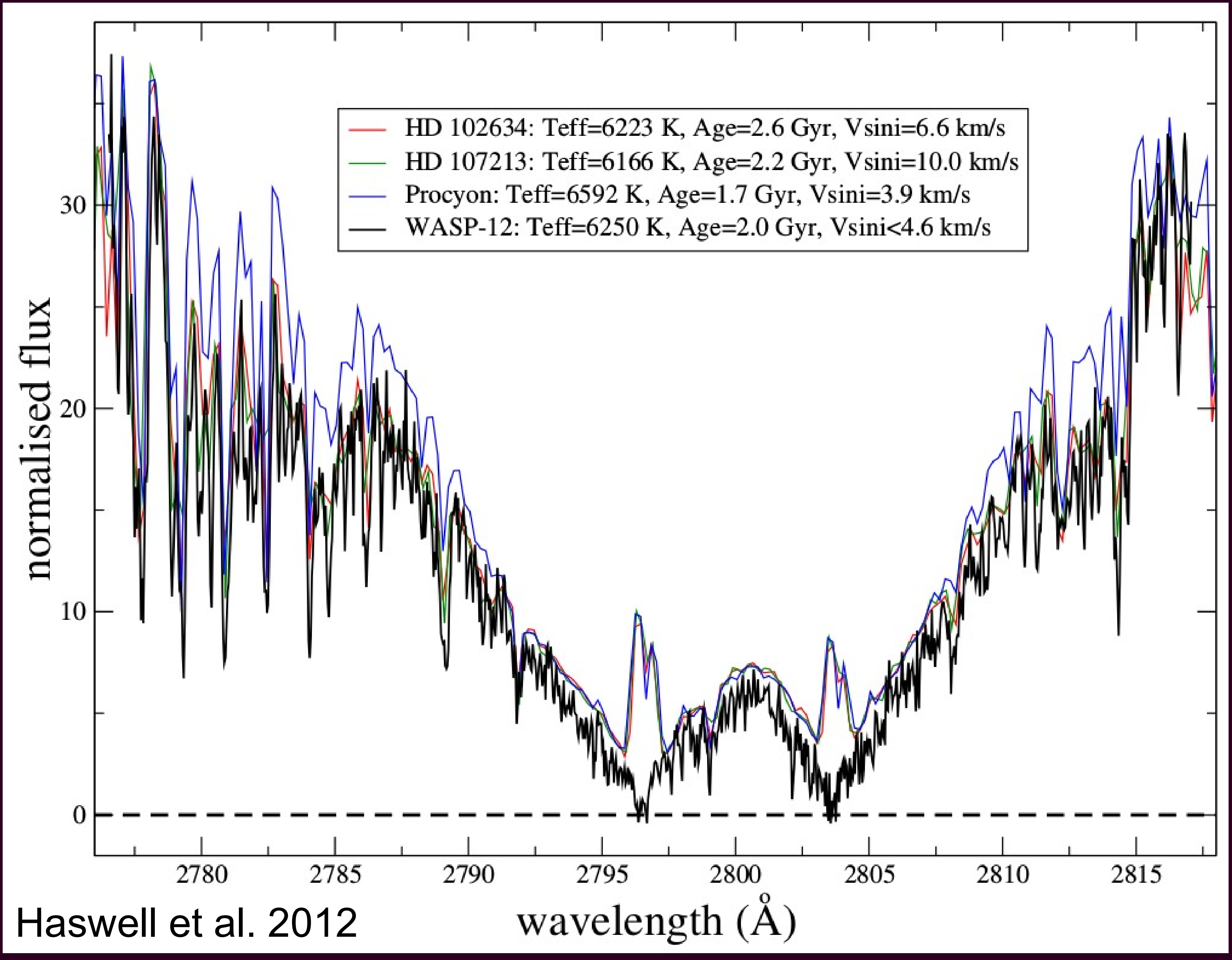
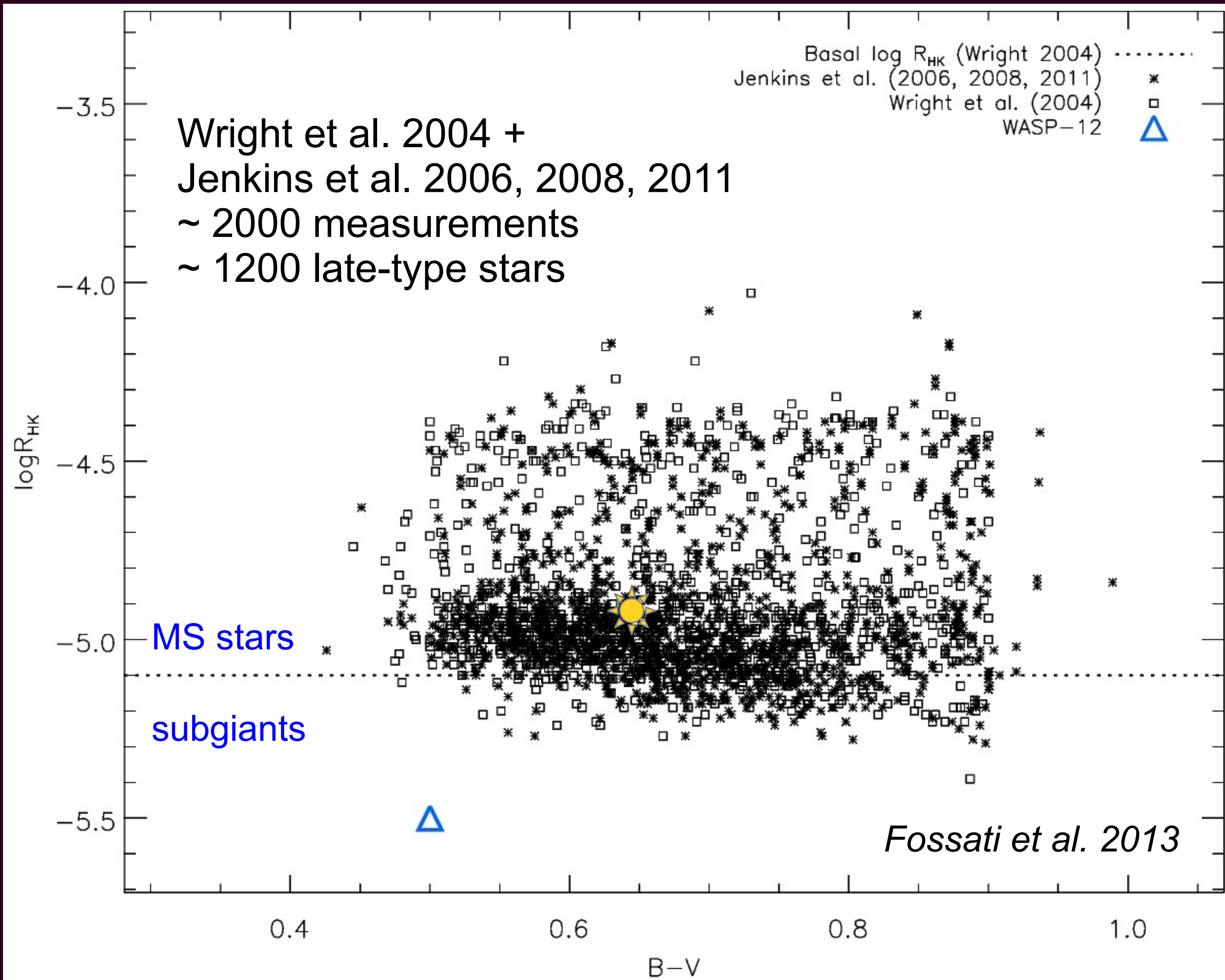
# Planet evaporation and circumstellar clouds



# Planet evaporation and circumstellar clouds

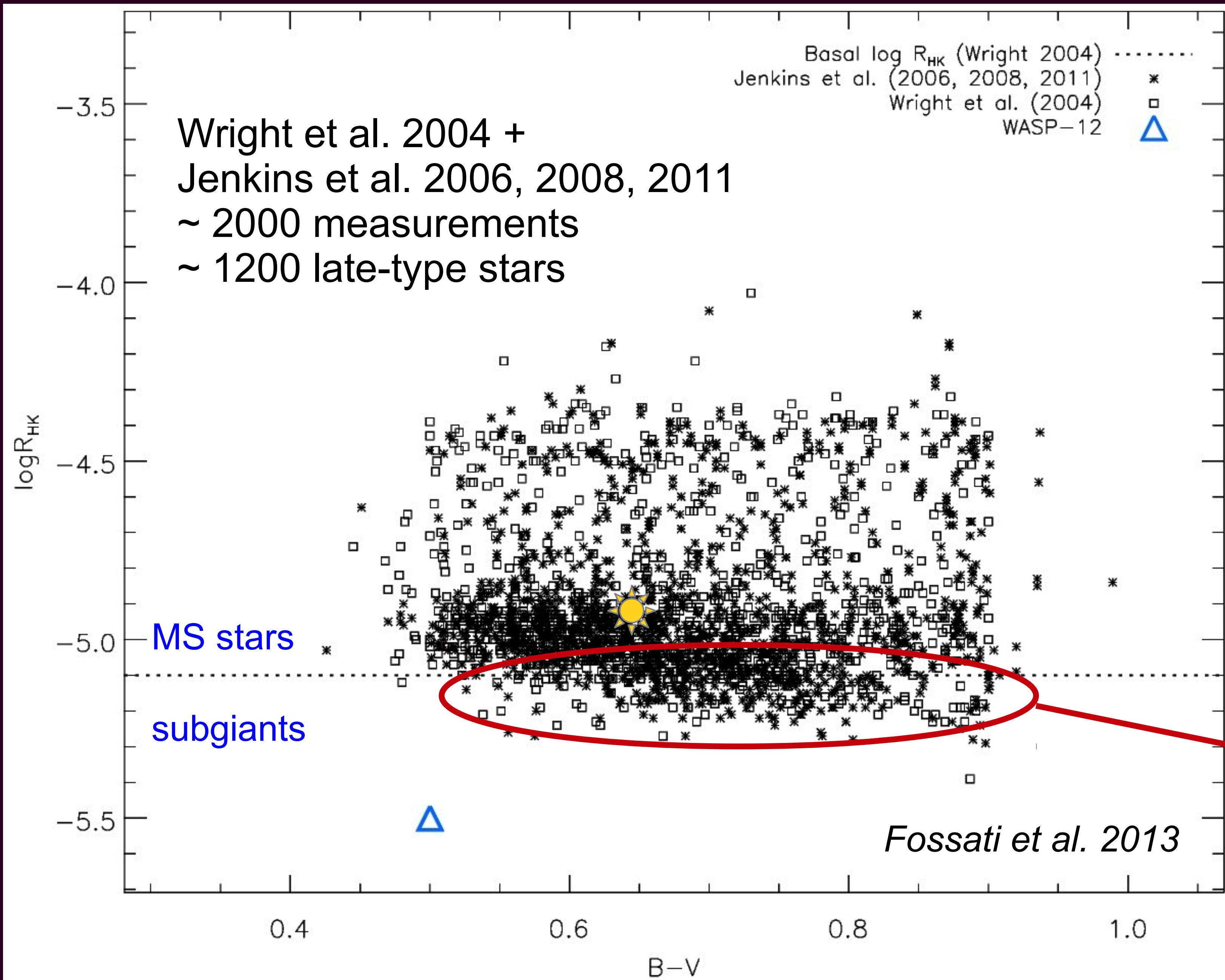



– Intrinsic lack of activity

– ISM absorption

– Absorption from material local to the WASP-12 system

# Planet evaporation and circumstellar clouds




– Intrinsic lack of activity

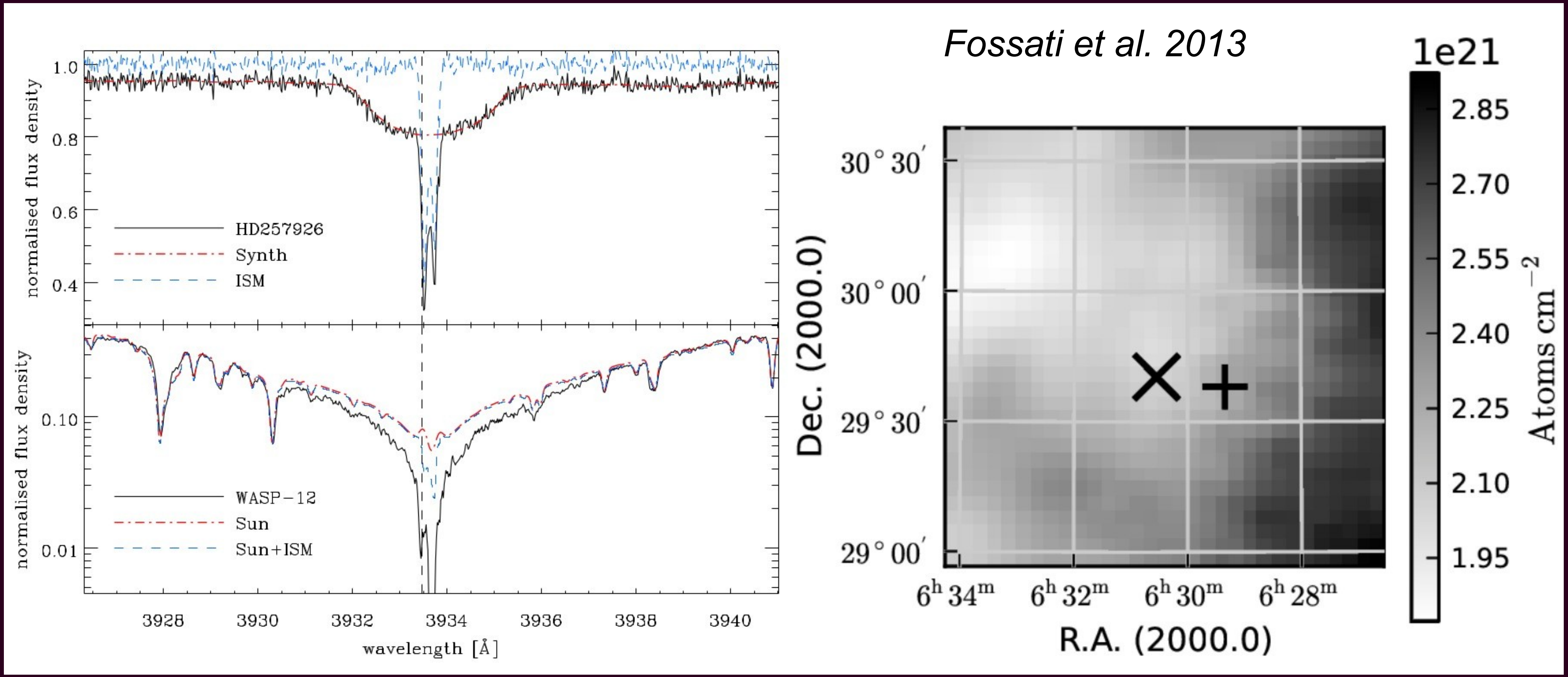
– ISM absorption

– Absorption from material local to the WASP-12 system

Not all of these are subgiants: possible presence of KIC1255-like planets orbiting bright stars

Ideal CHEOPS targets

# Planet evaporation and circumstellar clouds

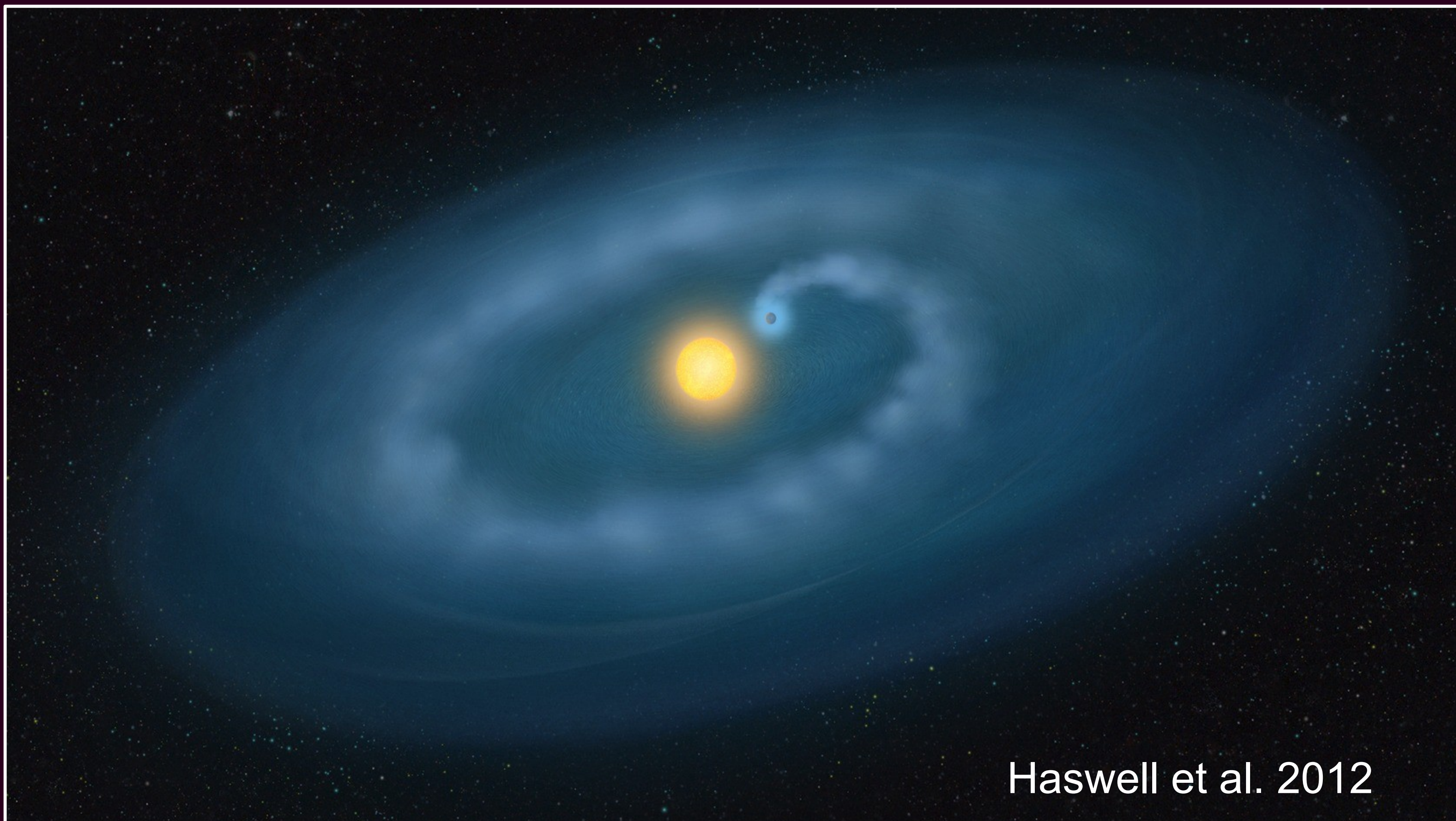



– A low activity level is not the origin of the anomaly

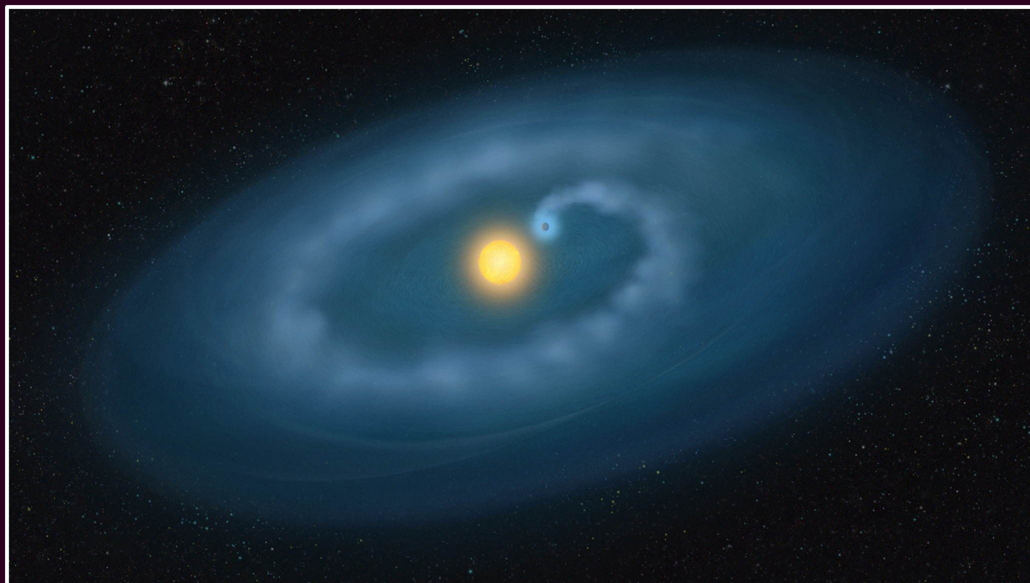
– ISM absorption is not enough to be the origin of the anomaly

# Planet evaporation and circumstellar clouds

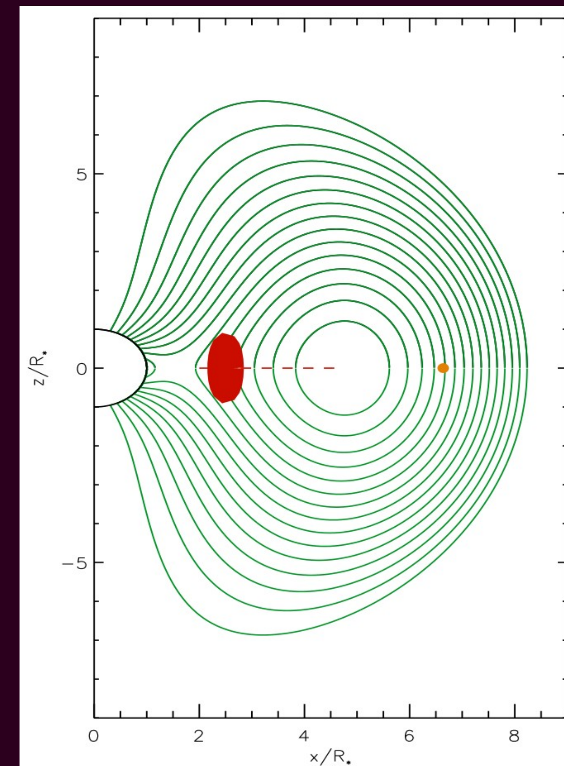
The only other available solution is something like an optically thick circumstellar cloud/torus of material, presumably lost by the planet



# The model



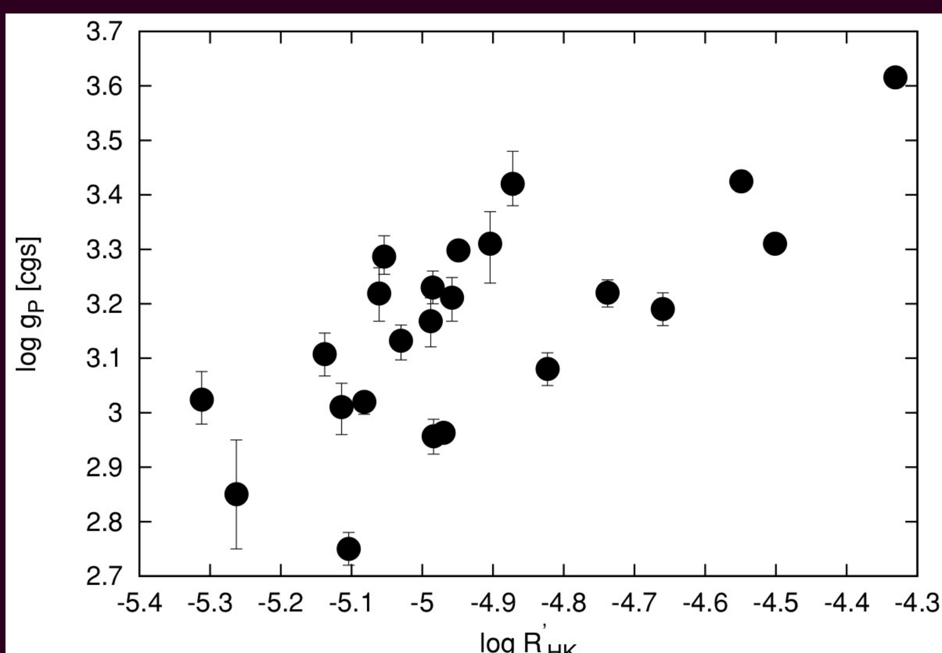
Lanza 2014




$$\dot{M} = \pi \, \eta \, F_{\mathrm{EUV}} \left(\frac{R_*}{a}\right)^2 g^{-1} R$$

$$\log R'_{\mathrm{HK}} = \log R'^{(0)}_{\mathrm{HK}} - \gamma g^{-1}$$

$$\gamma \equiv 0.0434 \, (\alpha \, \eta \, F_{\mathrm{EUV}})/(m_{\mathrm{p}} c_{\mathrm{s}})$$



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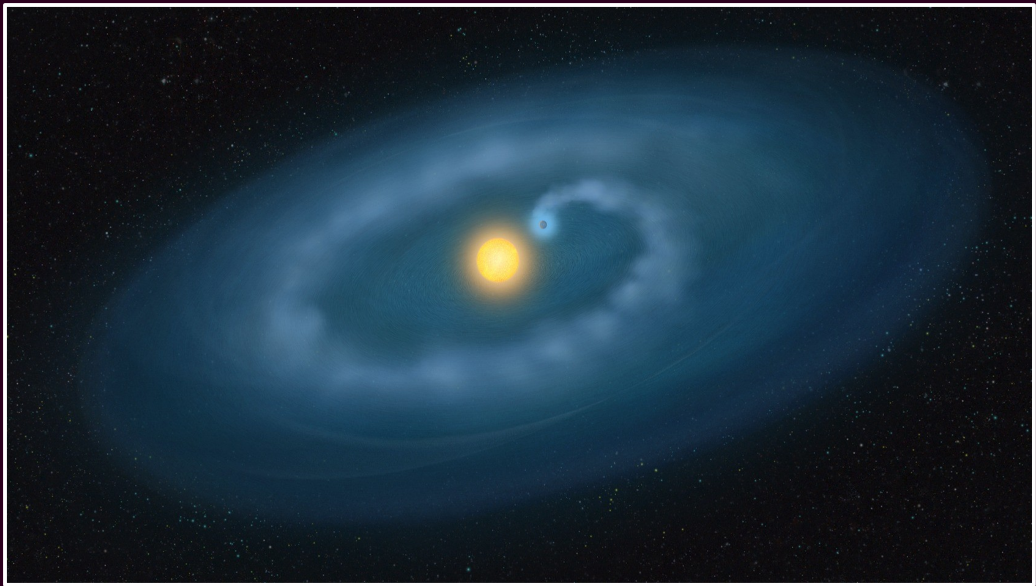
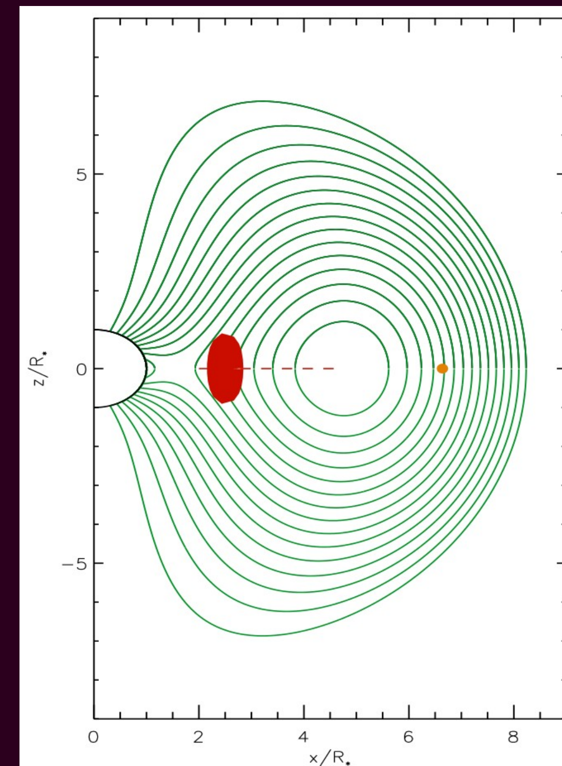


Lanza 2014

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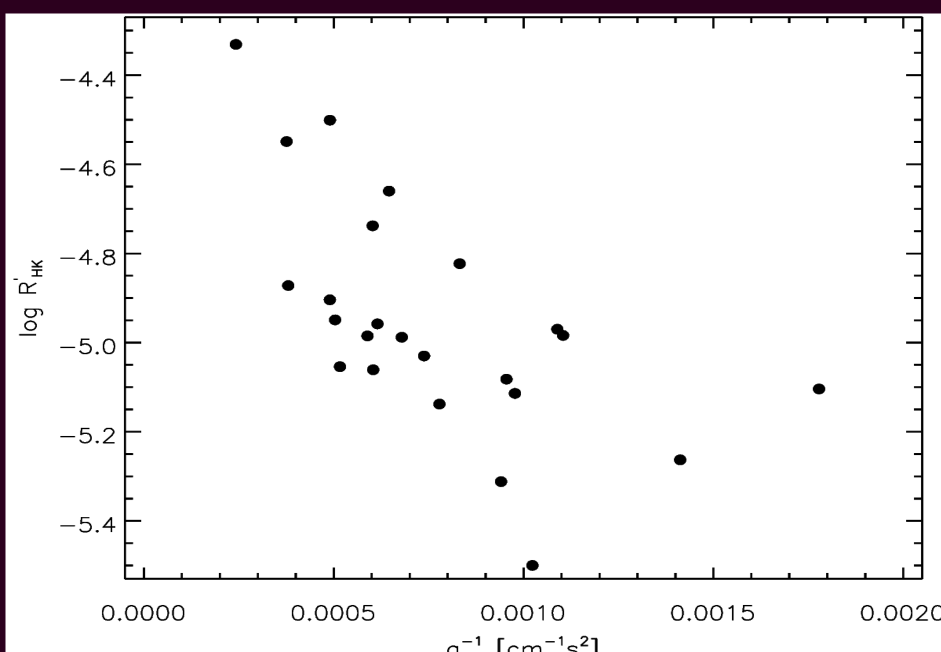
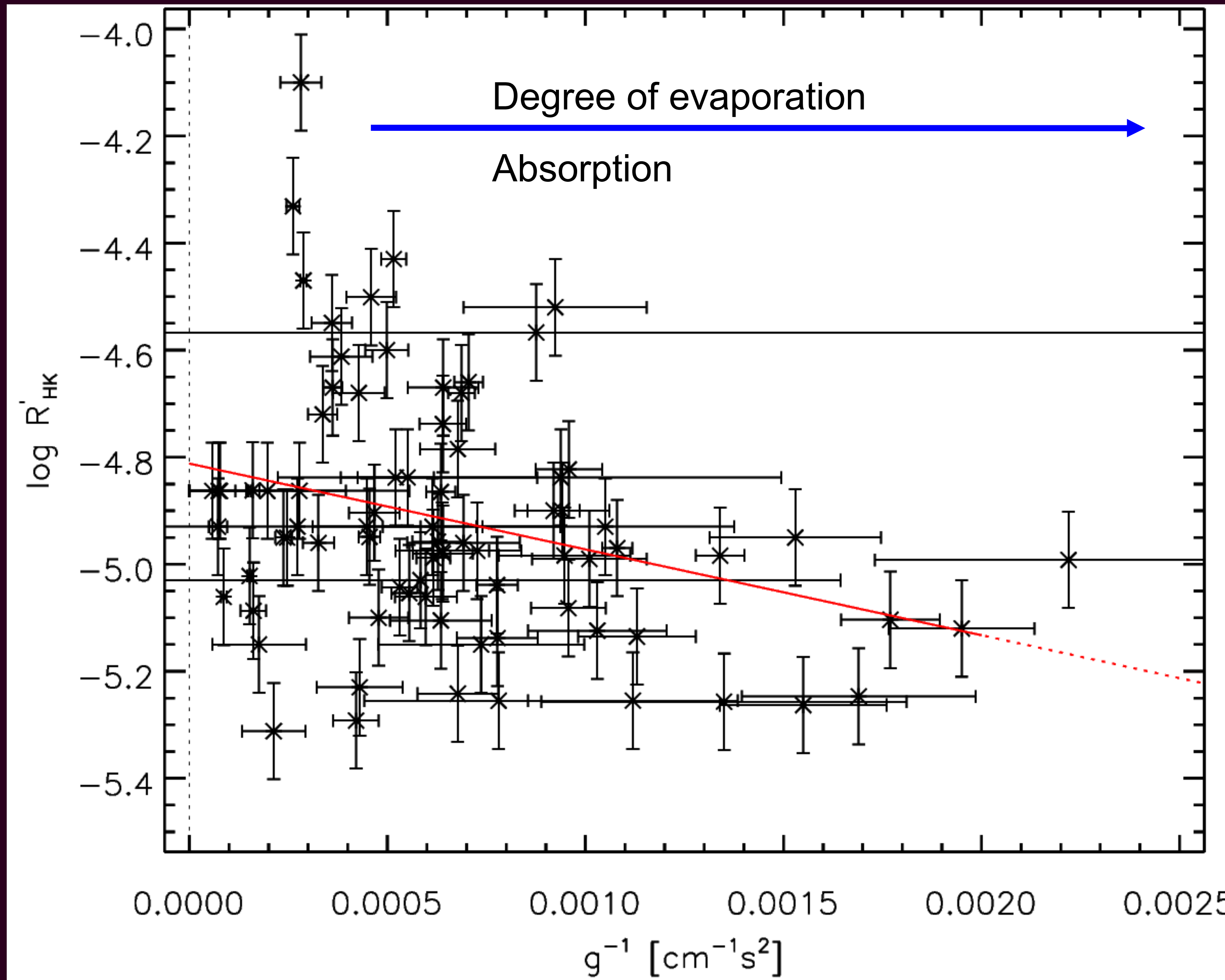


# The model

Data from Figueira et al. 2014

4200 < Teff < 6200 K



# The model

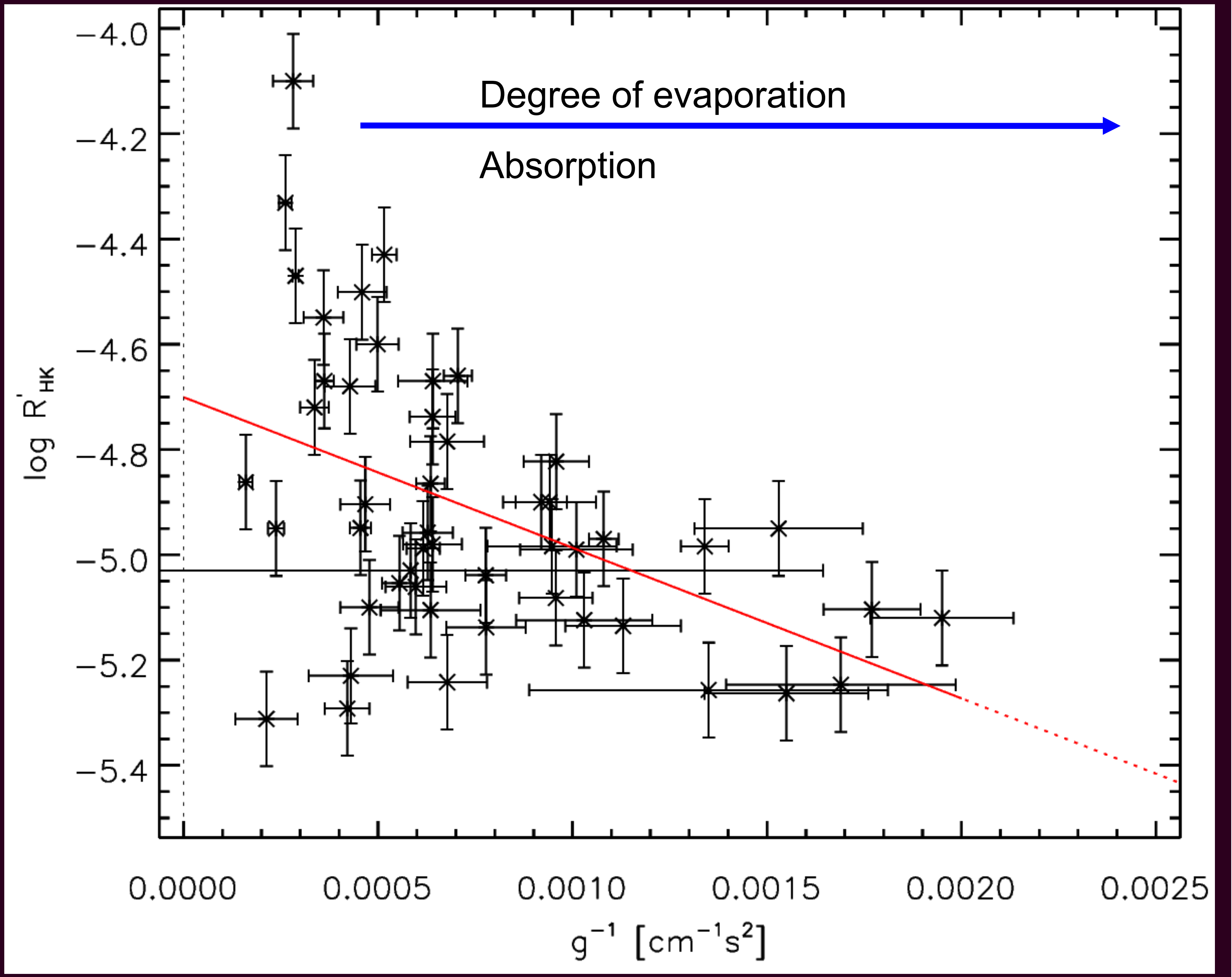
Data from Figueira et al. 2014

4200 < Teff < 6200 K

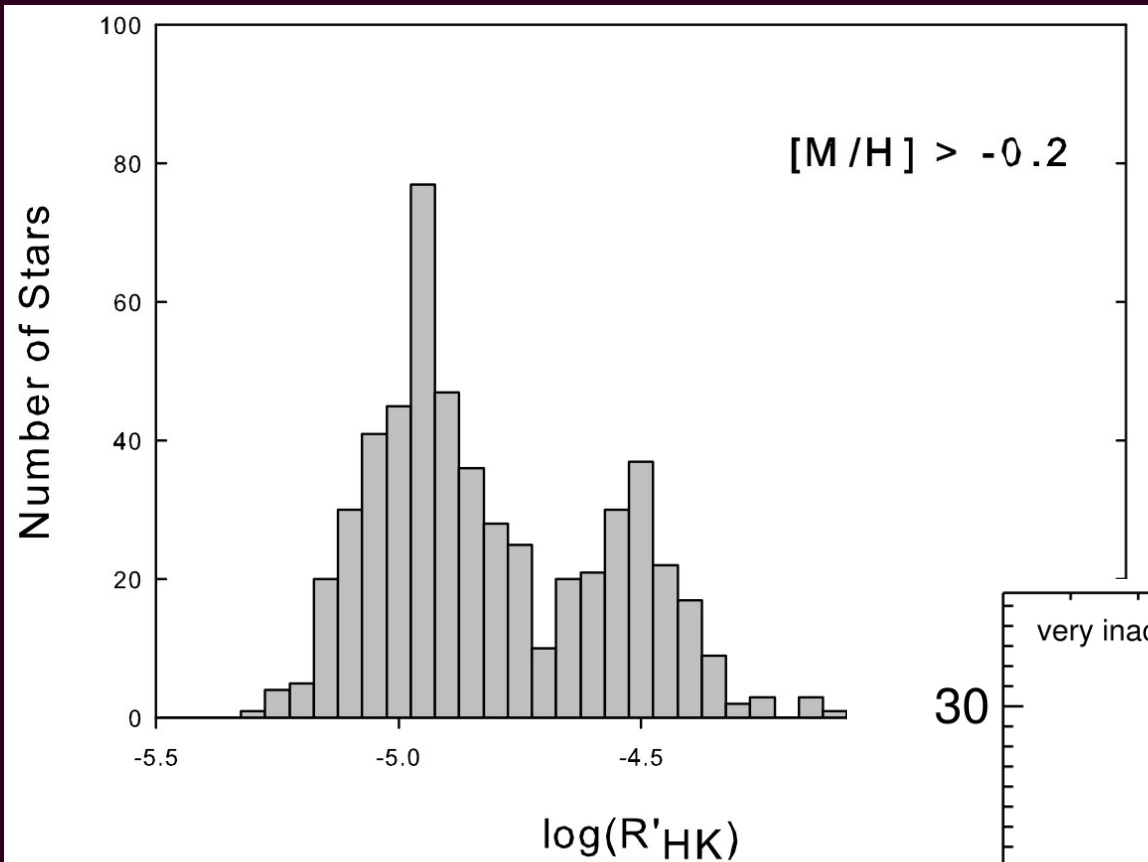
M > 0.1 $M_J$
a < 0.1 AU

No rocky planets
No multiple systems

HOT-JUPITERS



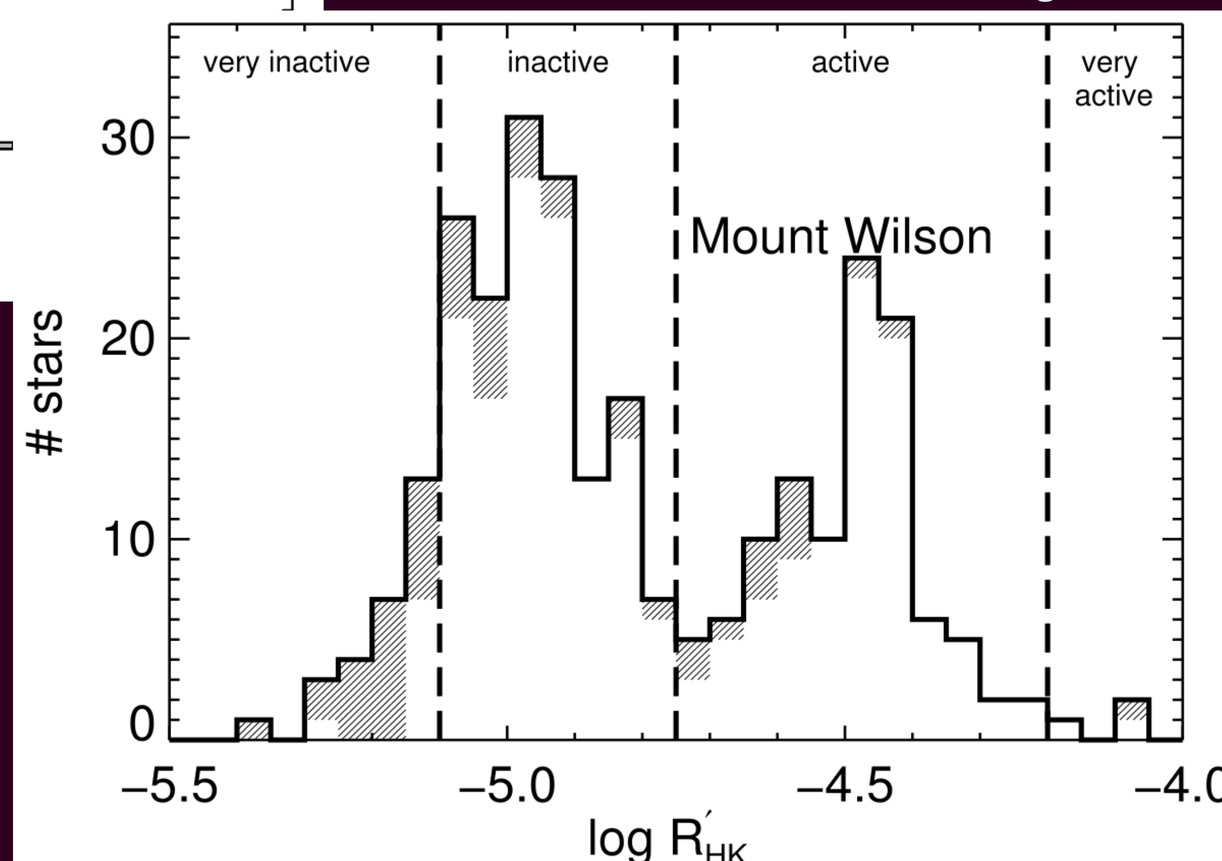
# Results




Peak active stars at $\log R'_{HK} \approx -4.5$

Peak inactive stars at $\log R'_{HK} \approx -5.0$

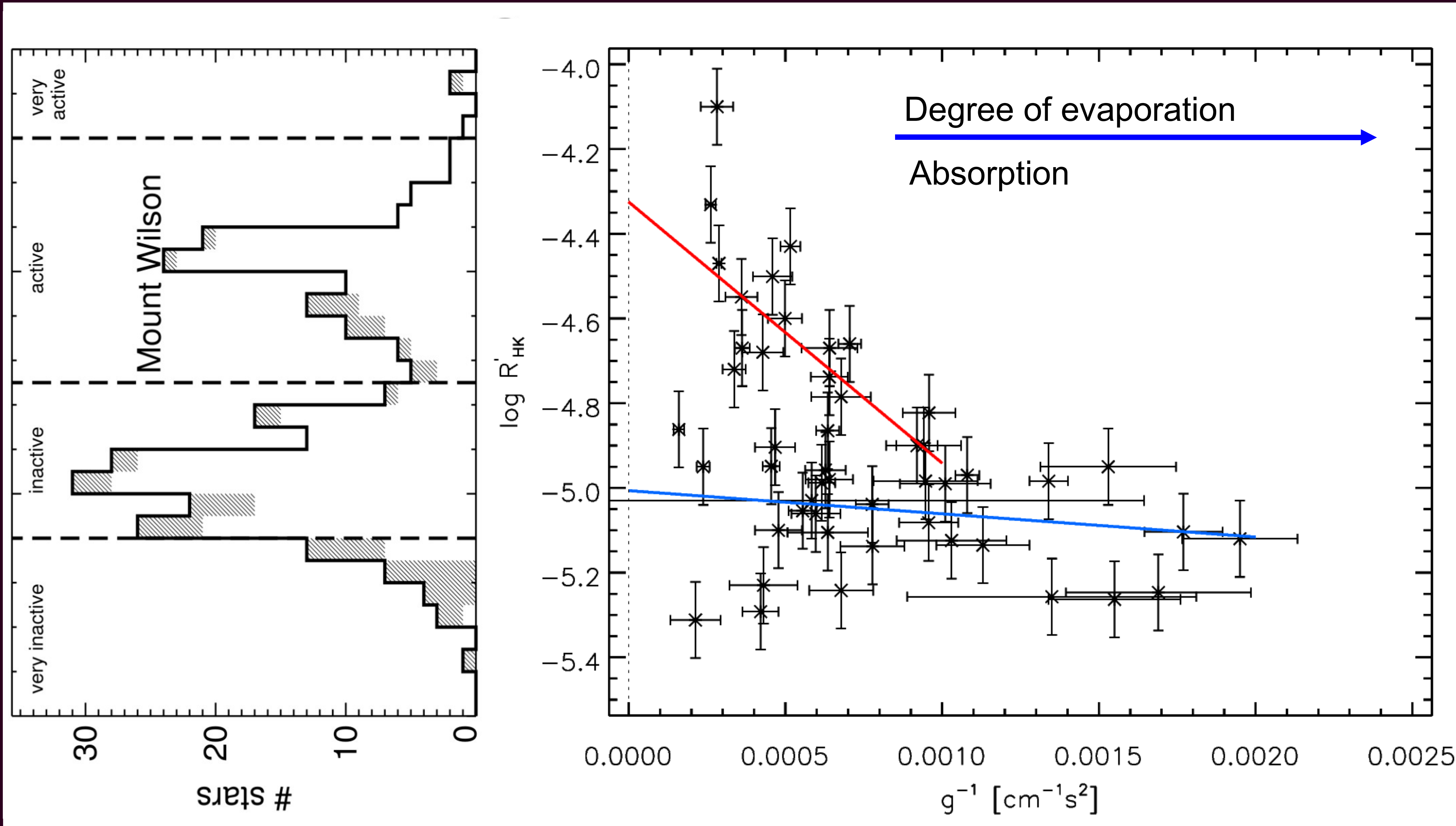
Wright 2004




Gray et al. 2006

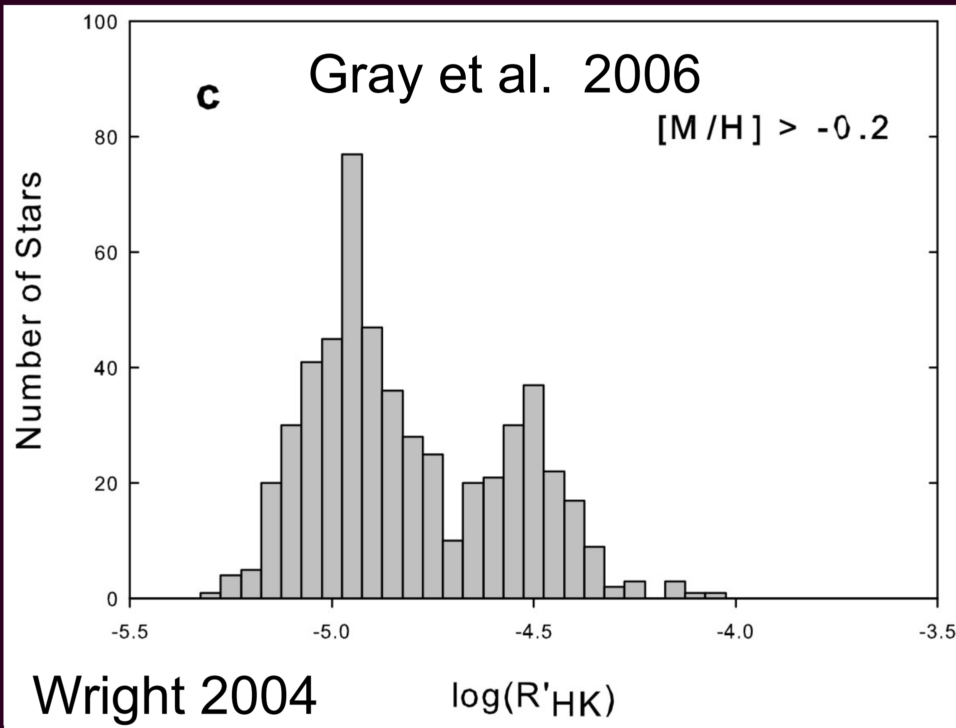
The $\log R'_{HK}$ value has a bimodal distribution!

# Results

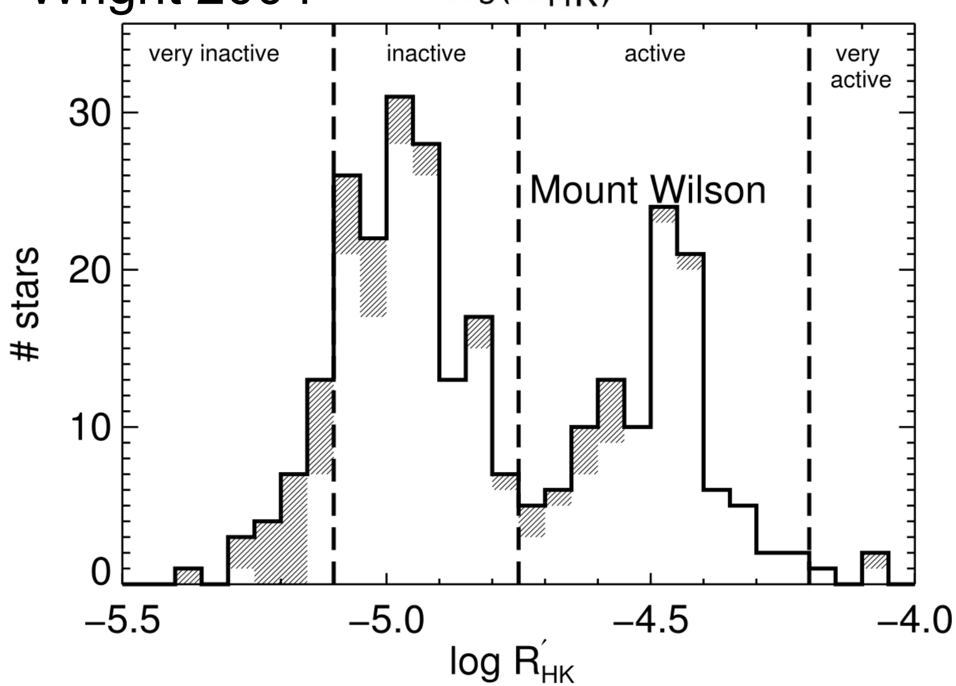



The best fit to the data is found by a mixture of 2 linear models

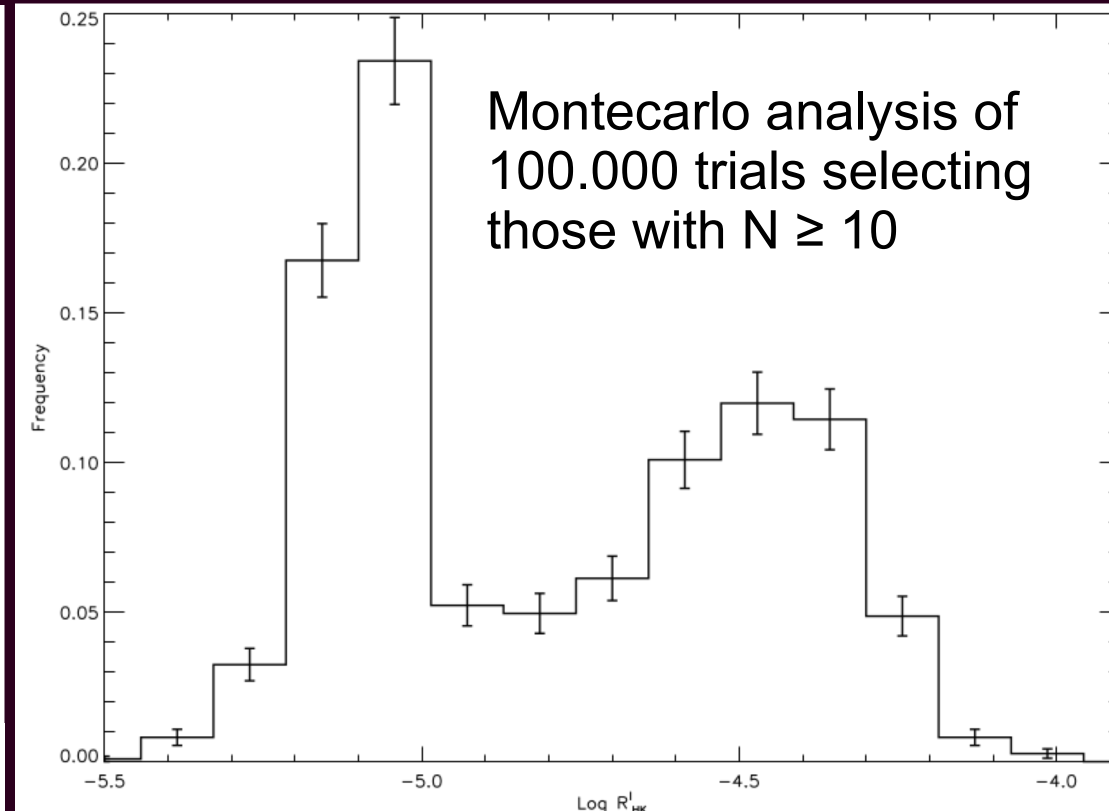
# Results



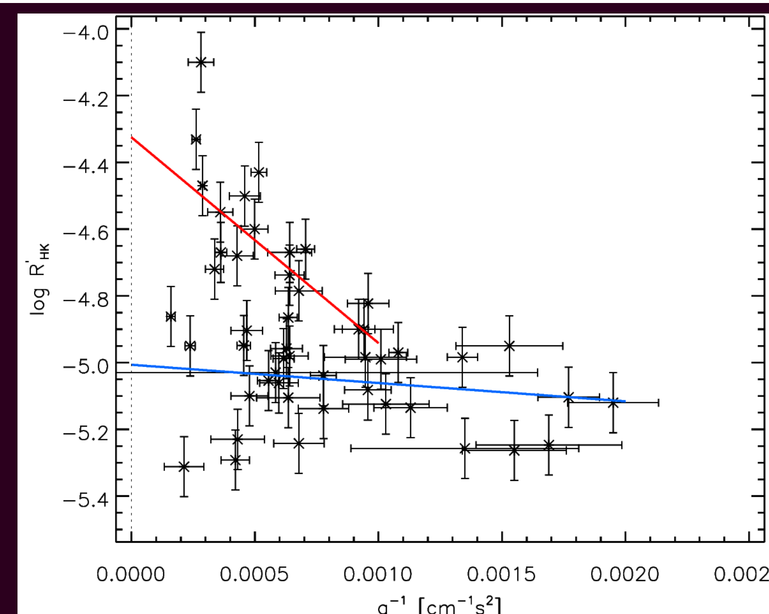
c
Gray et al. 2006
[M/H] > -0.2
Number of Stars
100
80
60
40
20
0
-5.5
-5.0
-4.5
-4.0
-3.5
log(R'HK)

Wright 2004
very inactive
inactive
active
very active
Mount Wilson
# stars
30
20
10
0
−5.5
−5.0
−4.5
−4.0
log R′HK

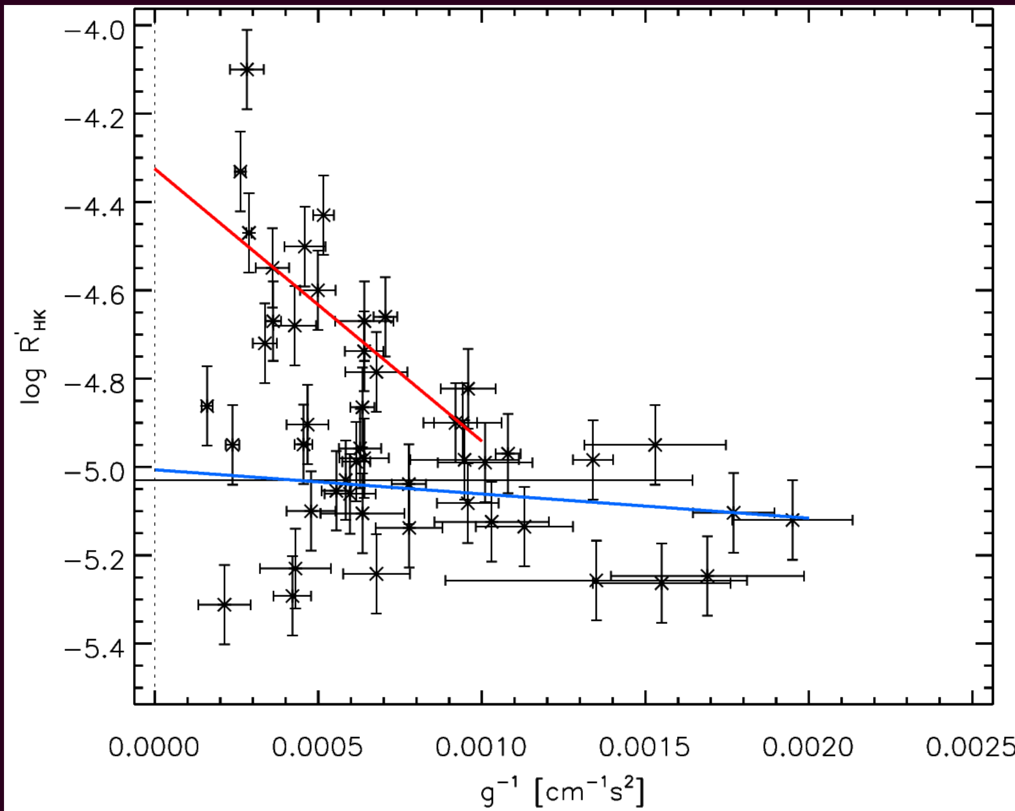



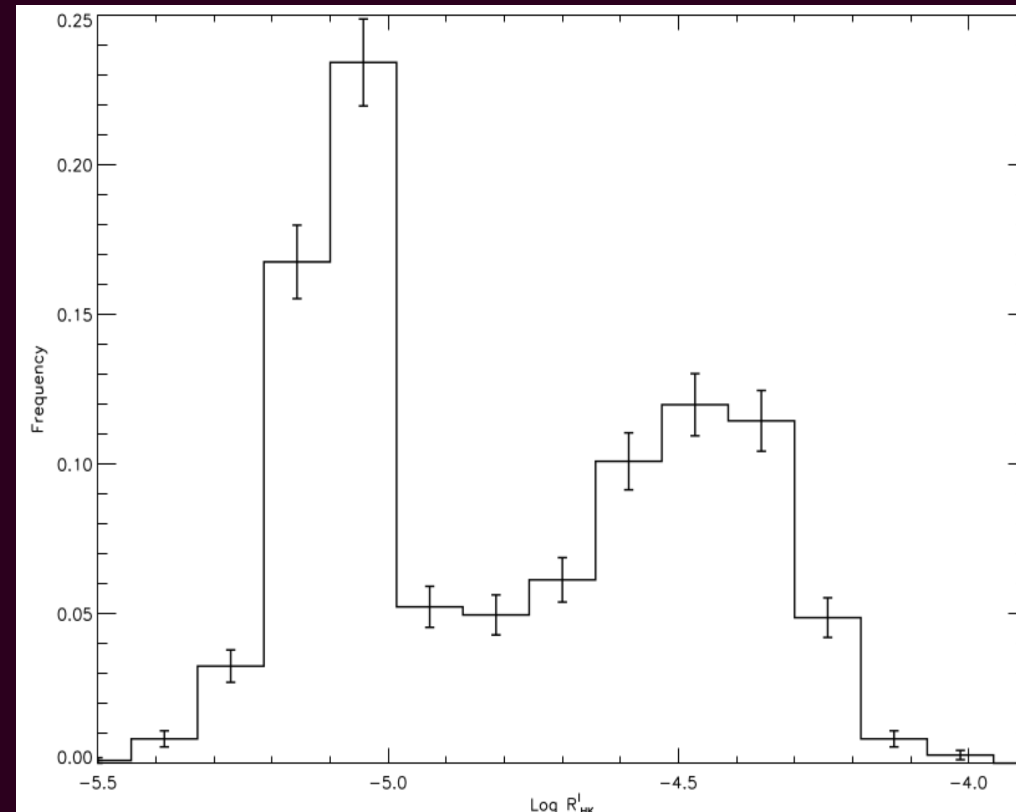
Montecarlo analysis of
100.000 trials selecting
those with N ≥ 10
Frequency
0.25
0.20
0.15
0.10
0.05
0.00
−5.5
−5.0
−4.5
−4.0
Log R'HK

log R'HK
−4.0
−4.2
−4.4
−4.6
−4.8
−5.0
−5.2
−5.4
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
g⁻¹ [cm⁻¹s²]

# Conclusions




– Does this work also for lower mass planets (e.g., Neptunes, mini-Neptunes, and SuperEarths)?
CHEOPS will give us the tools to answer this question