Chemistry, Dust, Gas Dynamics, Atmospheres of Planets and Stars

DISCUSSION

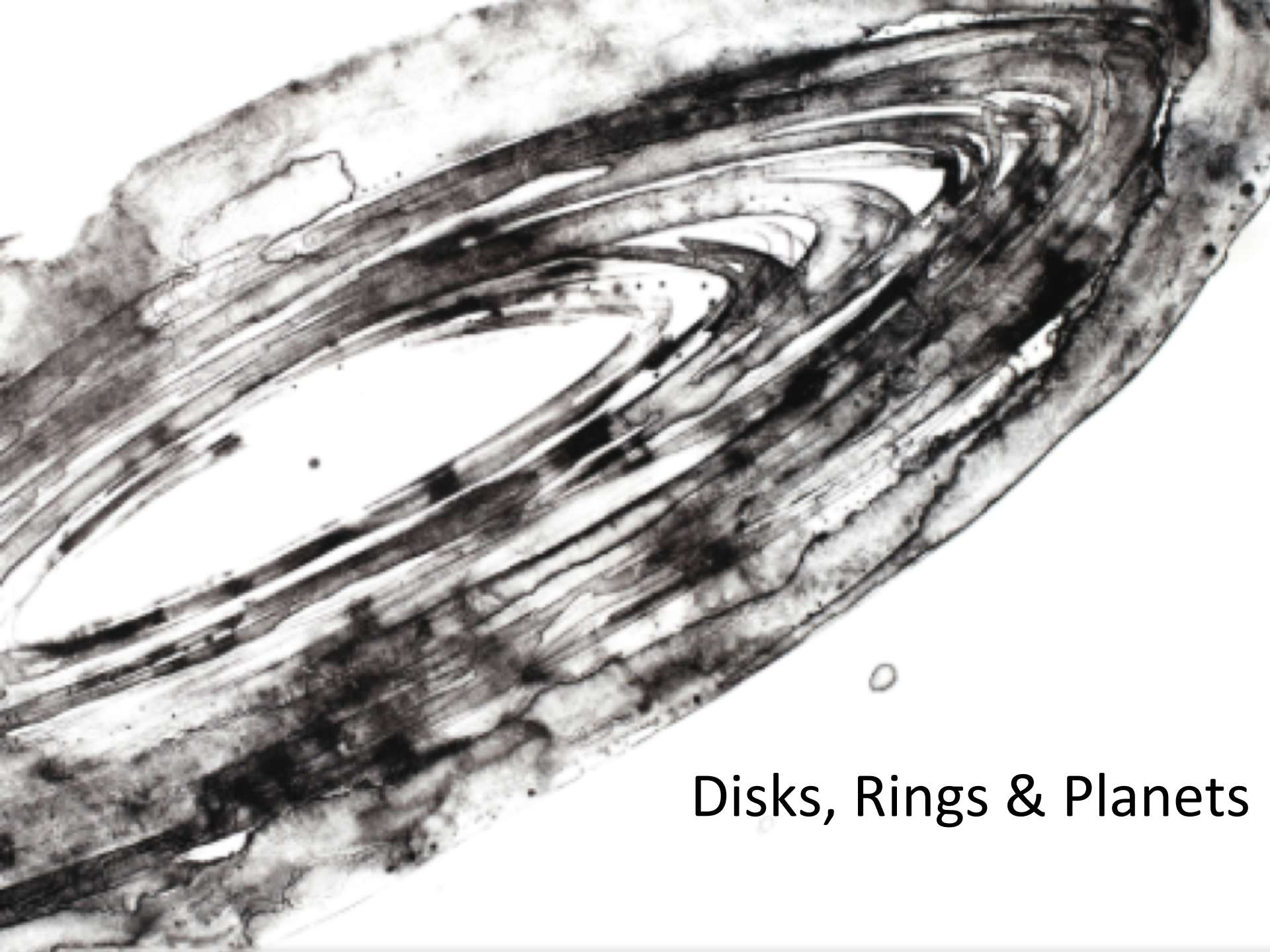
Sheep in Scotland

> A mathematician, a physicist, and an engineer are riding a train through Scotland.
>
> The engineer looks out the window, sees a black sheep, and exclaims, "Hey! They've got black sheep in Scotland!"
>
> The physicist looks out the window and corrects the engineer, "Strictly speaking, all we know is that there's at least one black sheep in Scotland."
>
> The mathematician looks out the window and corrects the physicist, " Strictly speaking, all we know is that is that at least one side of one sheep is black in Scotland."

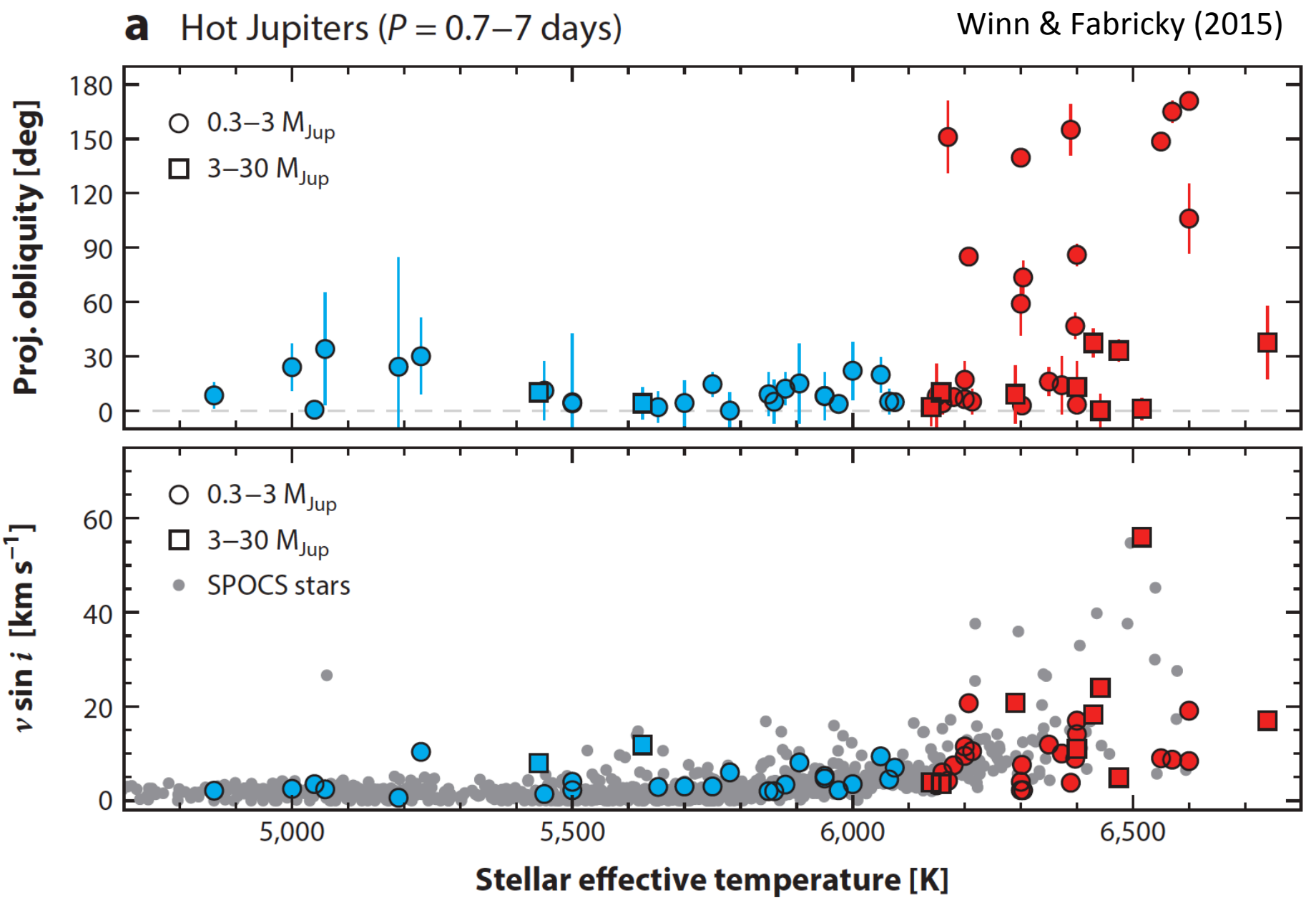
Counting Sheep

$$\sum_{s=0}^{\infty}$$ 

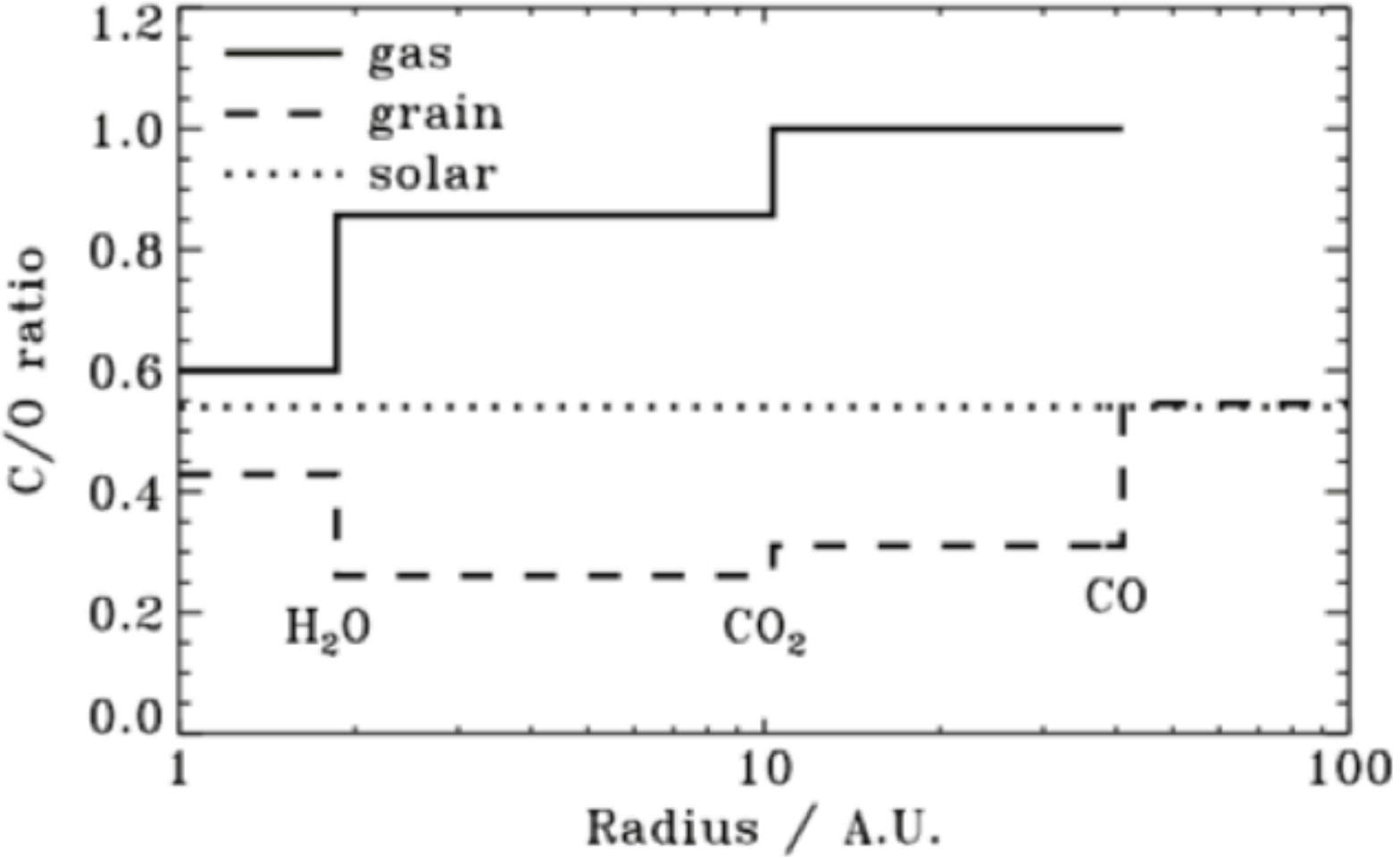
The Sum of All Sheep from 1 to Infinity



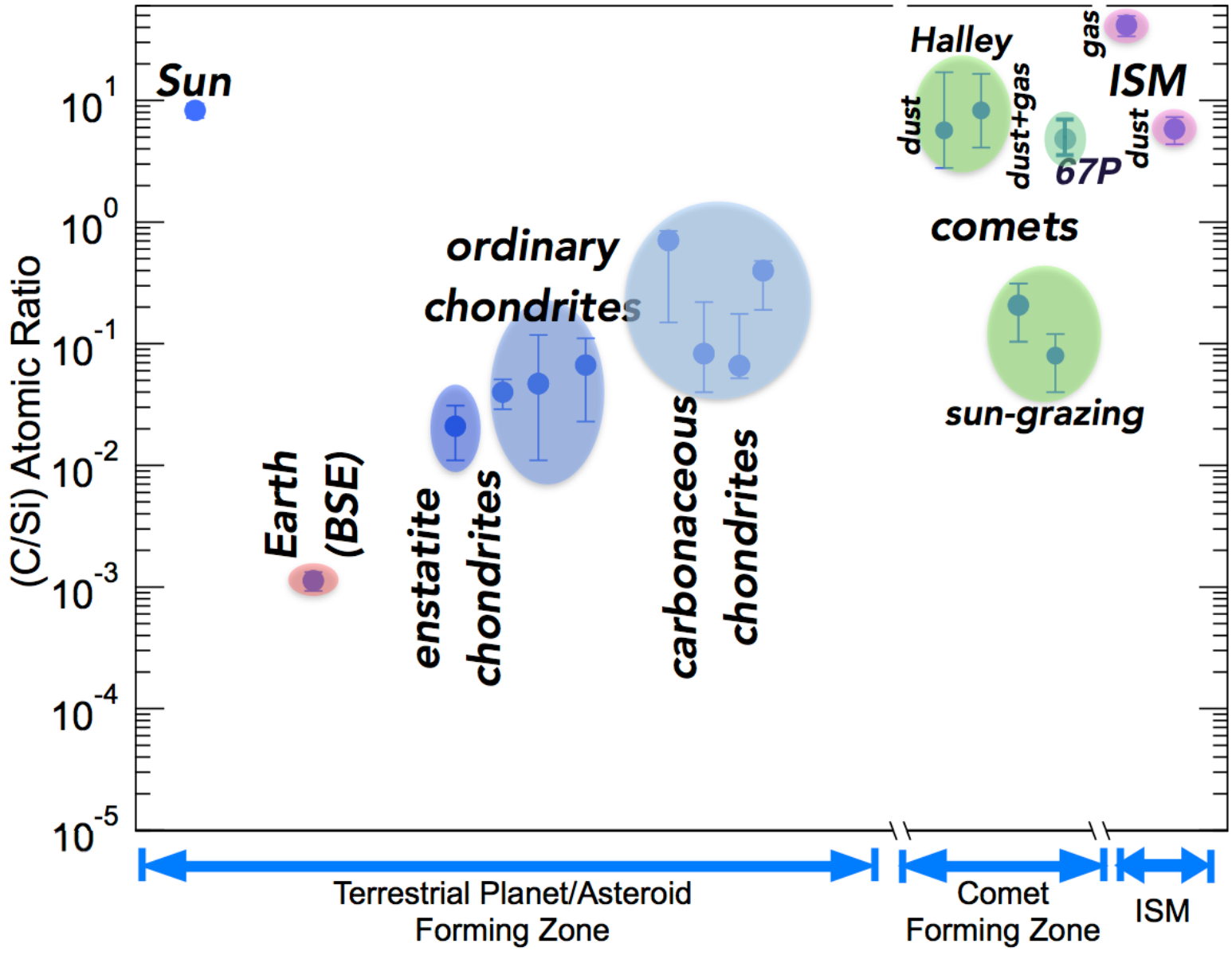
Disks, Rings & Planets

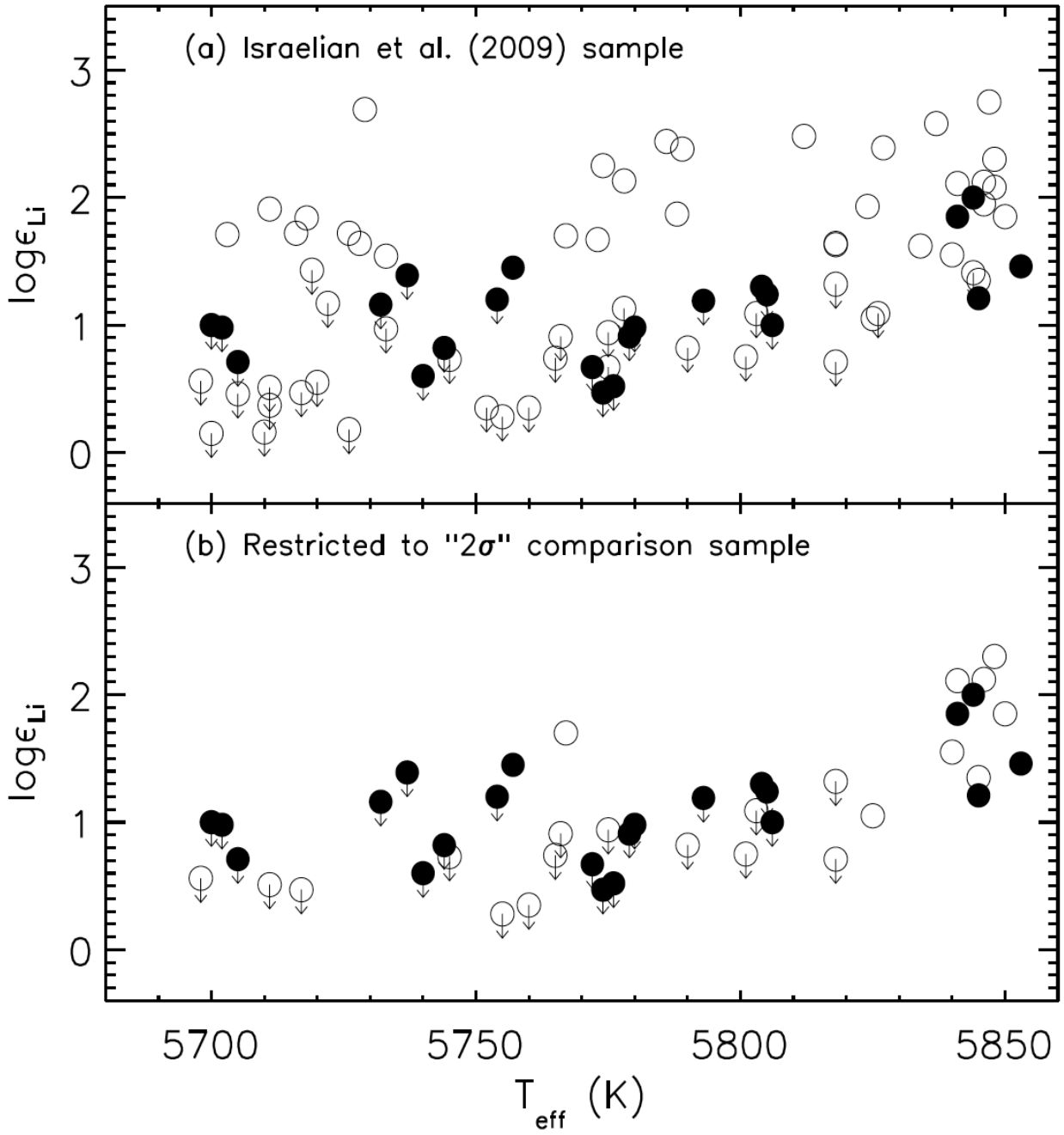

a Hot Jupiters (P = 0.7–7 days)
Winn & Fabricky (2015)
Proj. obliquity [deg]
180
150
120
90
60
30
0
0.3–3 M_Jup
3–30 M_Jup
v sin i [km s^-1]
60
40
20
0
0.3–3 M_Jup
3–30 M_Jup
SPOCS stars
5,000
5,500
6,000
6,500
Stellar effective temperature [K]

Link between Formation & Composition

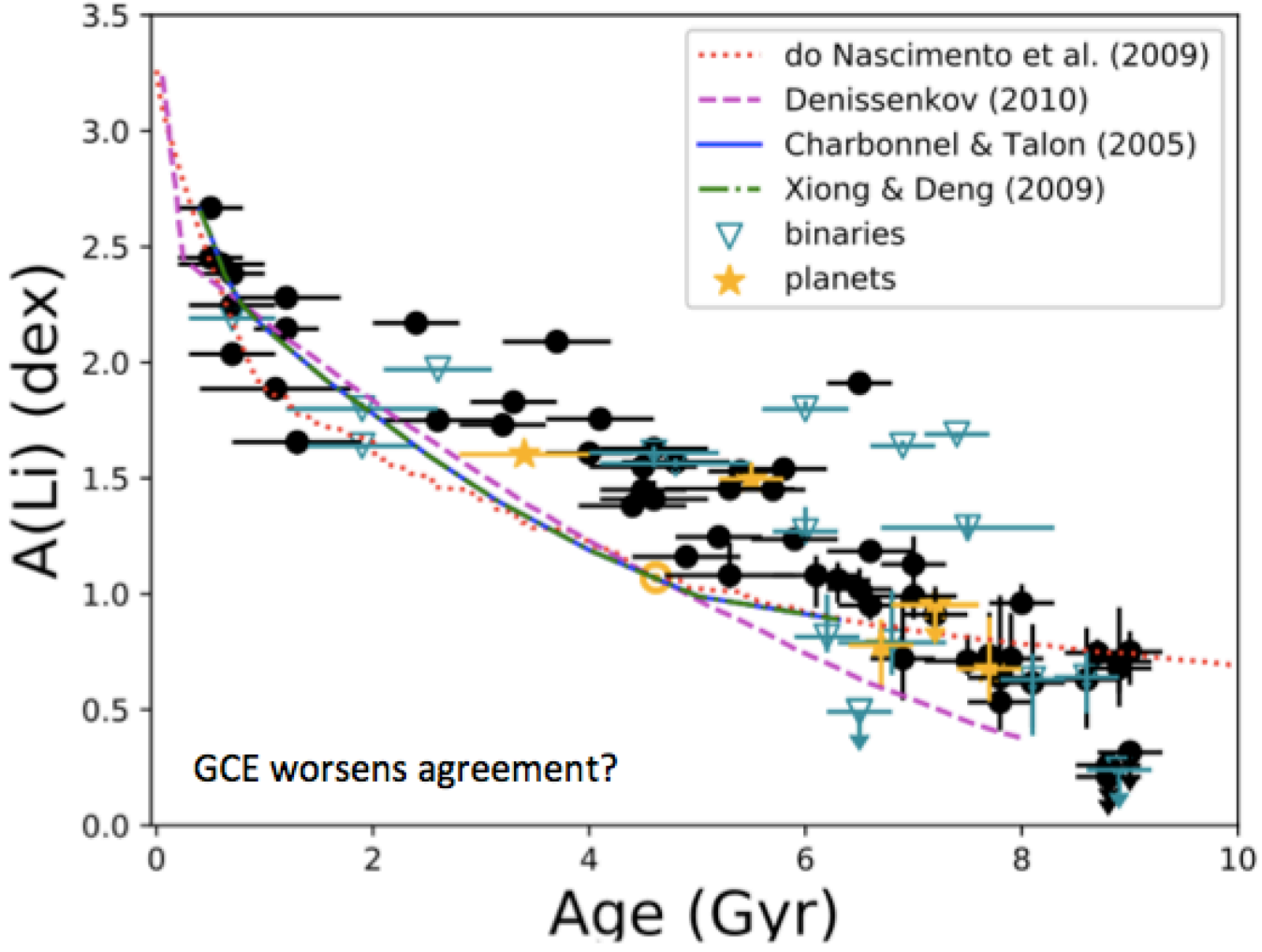


Carbon in the Earth

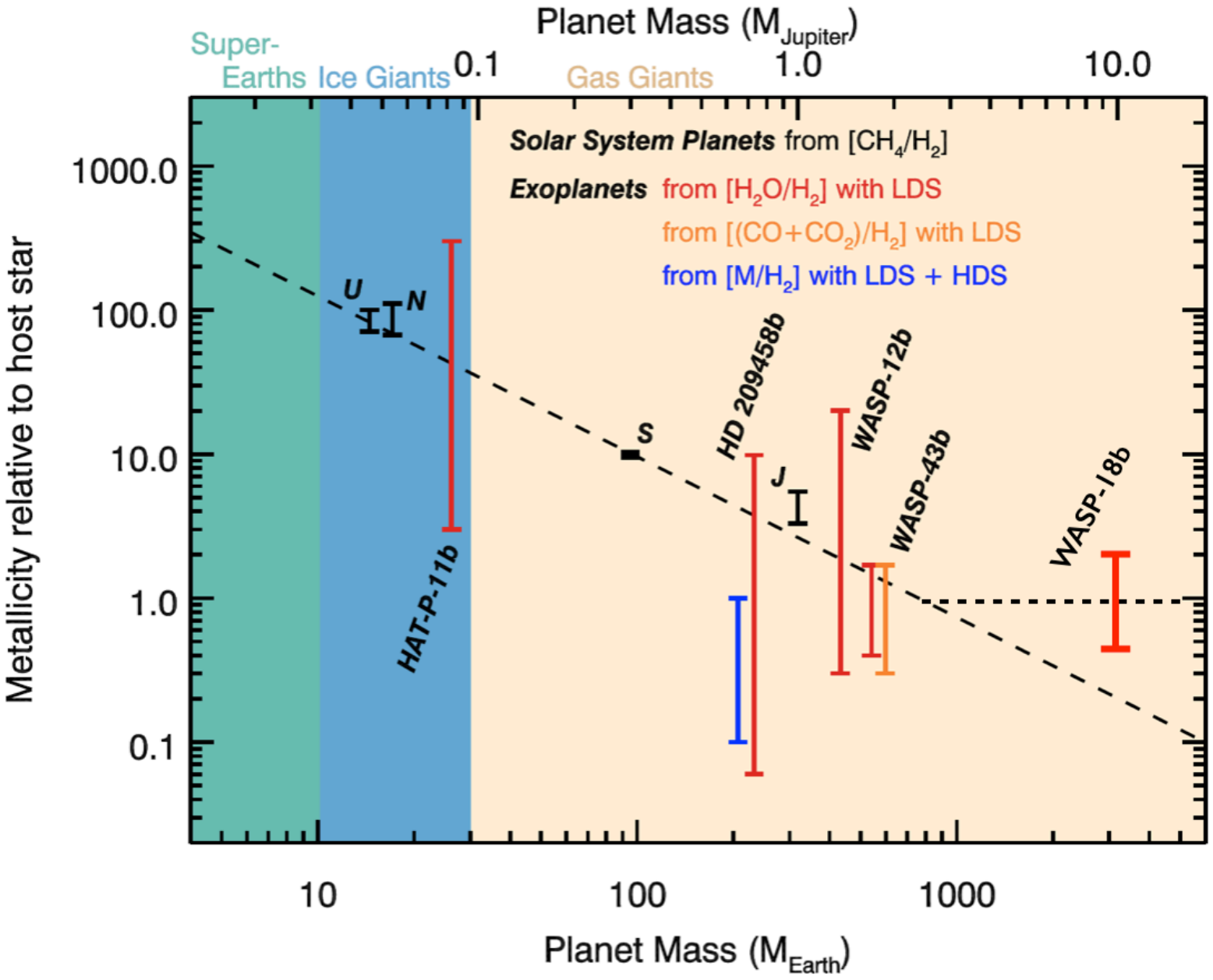



(a) Israelian et al. (2009) sample
(b) Restricted to "2σ" comparison sample
logϵ_{Li}
logϵ_{Li}
0
1
2
3
0
1
2
3
5700
5750
5800
5850
T_{eff} (K)

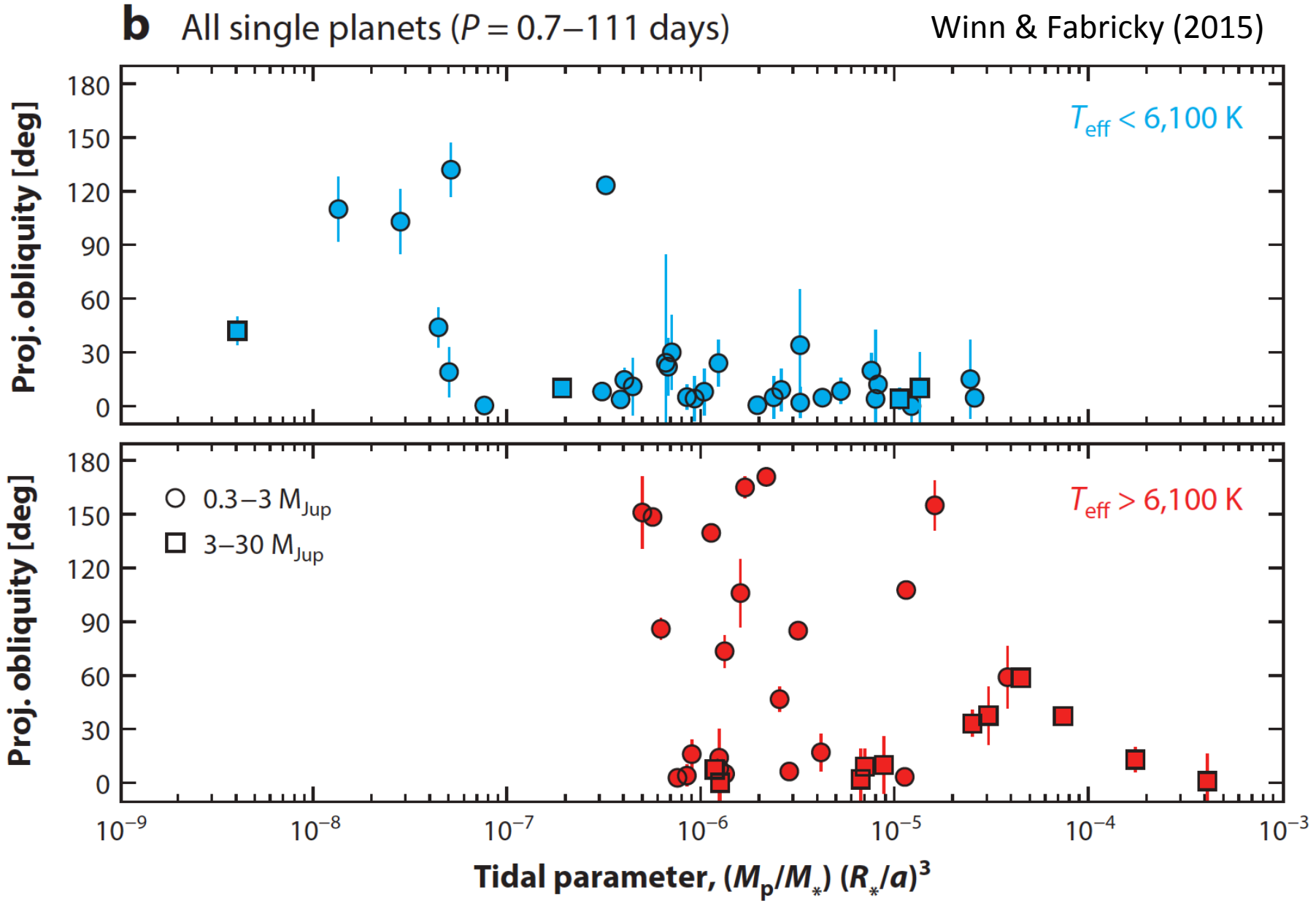
As we add more data and improve the ages, it seems that none of the models reproduce the solar twins



Carlos, Meléndez, Spina et al., in prep.


Planet Mass ($M_{Jupiter}$)
Super-Earths
Ice Giants
0.1
Gas Giants
1.0
10.0
Solar System Planets from [CH_4/H_2]
Exoplanets from [H_2O/H_2] with LDS
from [$(CO+CO_2)/H_2$] with LDS
from [M/H_2] with LDS + HDS
1000.0
100.0
10.0
1.0
0.1
Metallicity relative to host star
U
N
S
J
HAT-P-11b
HD 209458b
WASP-12b
WASP-43b
WASP-18b
10
100
1000
Planet Mass (M_{Earth})

What to look for in Exoplanets?


b All single planets (P = 0.7–111 days)
Winn & Fabricky (2015)
Proj. obliquity [deg]
180
150
120
90
60
30
0
T_eff < 6,100 K
T_eff > 6,100 K
0.3–3 M_Jup
3–30 M_Jup
10^−9
10^−8
10^−7
10^−6
10^−5
10^−4
10^−3
Tidal parameter, (M_p/M_*) (R_*/a)^3