PLATO from the exoplanet point of view

VIEW

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or why



WE WANT YOU!

er dense planets: real or not real?



 $M_p = 5.06 \pm 0.36 M_J$

 $R_p = 1.16 \pm 0.26 R_J$

$$\label{eq:rhop} \begin{split} \rho_p = 4.02 \pm 2.7 \; g/cm^3 \\ \text{Southworth, 2012} \end{split}$$

Issue : the age



Cazalet et al., in prep

Analyses	Deleuil et al. (2012)	Southworth (2012)
Star mass (M_{\odot})	1.14 ± 0.08	1.11 ± 0.10
Star radius (R_{\odot})	1.02 ± 0.05	1.34 ± 0.37
Stellar age (Gyear)	$0.1^{+0.800}_{-0.040}$	$5.9^{+1.6}_{-11.4}$
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Planet's composition



unique pair of core mass fraction and water mass fraction

Brugger et al. 2017

Planet's composition





Brugger et al. 2017

Constraints from stellar abundances



Limb darkening

theoretical predictions versus fitted limb darkening





Csizmadia et al, $2013 \rightarrow$ fit the LD coefficients Müller et al. $2013 \rightarrow$ do not fit the LD coefficients Espinoza & Jordan $2015 \rightarrow$ fit the LD coefficients



Stellar activity



CoRoT-2b: M_p = 3.31 ± 0.16 M_{jup} R_p = 1.465 ± 0.029 R_{Jup} P_{orb} = 1.743 jours ρ = 1.31 ± 0.04 g/cm³ Alonso et al. , 2008 A&A, 482, 21

77 transits

Silva-Valio et al., 2009

Effect on the planet's parameter



- At least 18 spots in total
- Average of 7 spots covered per transit
- spot size : 0.3 0.6 Rp
- Temperature : 4600 to 5400 K (R★ =5625K)
- rise & decay ~ 30 days

Silva-Valio et al., 2009 Wolter et al., 2009, Huber et al., 2009, 2010; Lanza et al. 2010

Spots & faculae



Habitable Zone



Long period planet detection



Host spectral type G2 obital period ~ 385d Kepler-452b :

Rp ~ 1.6 *R*⊕

Mass ???

Habitable Zone



Small stars parameters



Bruntt et al., 2010

Age of CoRoT- 7 from the rotation period and the activity index of the Ca H & K lines: 1.2–2.3 Gyr.

Léger et al., 2009



Trappist-1 system



masses (TTV): 0.4 to 1.4 ME

Gillon et al., 2017

M-dwarfs habitability...





η Earth: The fraction of stars hosting Earth-like planets in their habitable zone

From Kepler and radial velocity surveys:

reference	planet frequency	host stellar type
Catanzarite & Shao (2011) ApJ, 738, 151	1%- 3%	Sun-like stars
Traub (2012) ApJ, 745, 20	20%-58% (34%)	FGK stars
Gaidos (2013) ApJ, 770, 90	31%-64% (46%)	dwarf stars
Bonfils et al. (2013) A&A, 549, A109	28%-95% (41%)	M stars
Dressing & Charbonneau (2013) ApJ, 767, 95	9%-28% (15%)	M stars
Kopparapu (2013) ApJ, 767, 8	24%-60% (48%)	M stars

Batalha et al., 2014	7 – 22%	Sun-like stars	
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→ The fraction of (super)-Earths in the habitable zone of stars is not known.

In conclusion

We need from you:

- precise stellar parameters, especially the age (even for small size stars without asteroseismology)
- accurate stellar parameters
- detailed elementary abundances
- rotation periods
- a good understanding (and modeling) of the surface features
 - might impact the planet's parameters
- a good understanding of the erruptive events, their frequency and dependency with the stellar masses and ages