Sun-like Oscillations in the Population II giant HD122563

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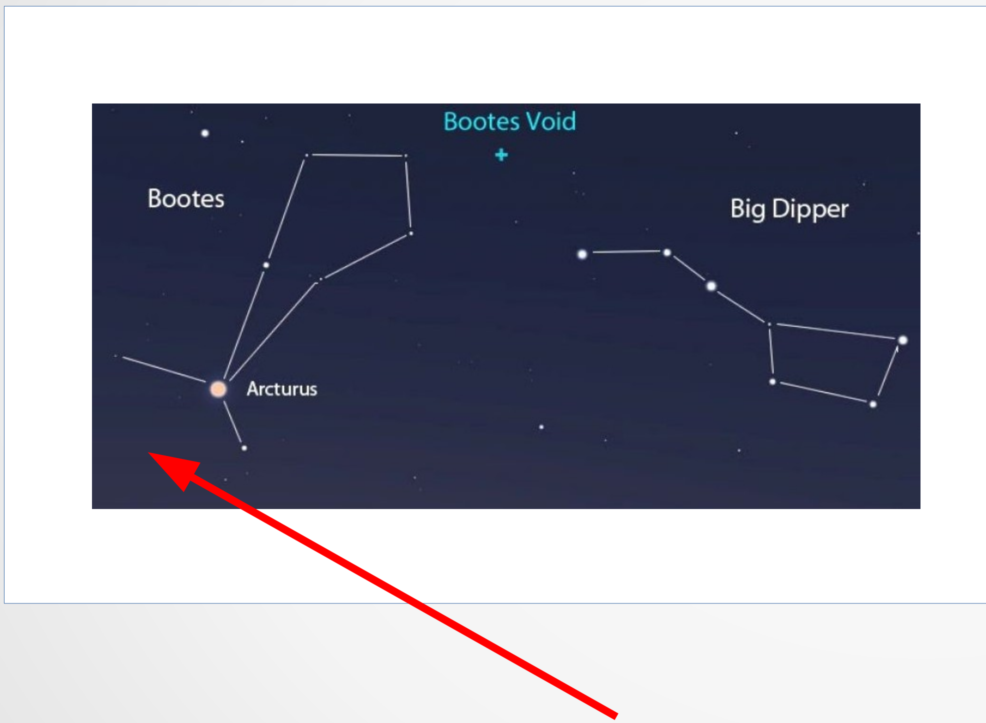
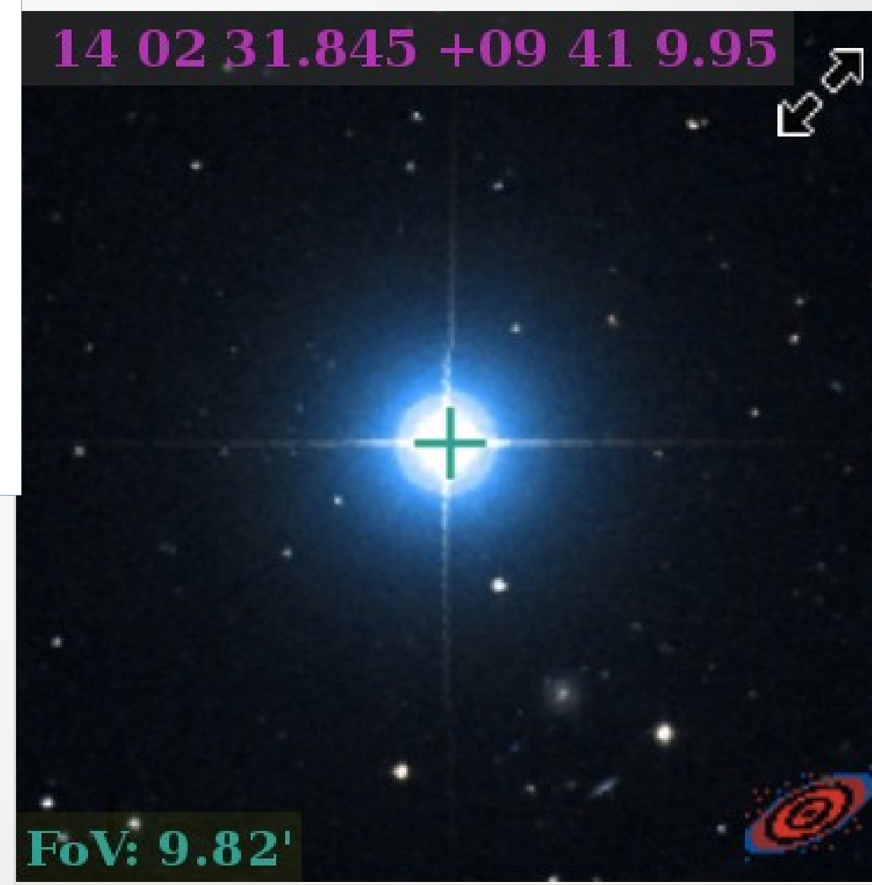
In collaboration with : Thevenin, Pichon, Bigot, Corsaro
And SONG collaborators

SF2A Nice 2019 : S15 PNPS 17 May 2019

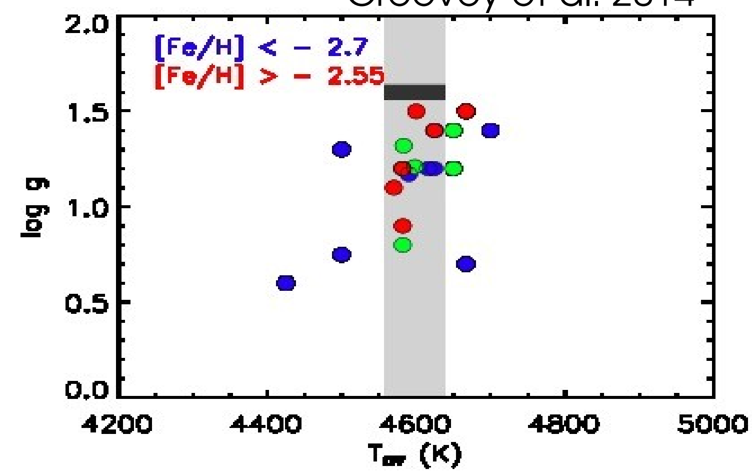
Pop(II)star HD122563 (M/H) = - 2.4, V=6.2





Pop(II)star HD122563

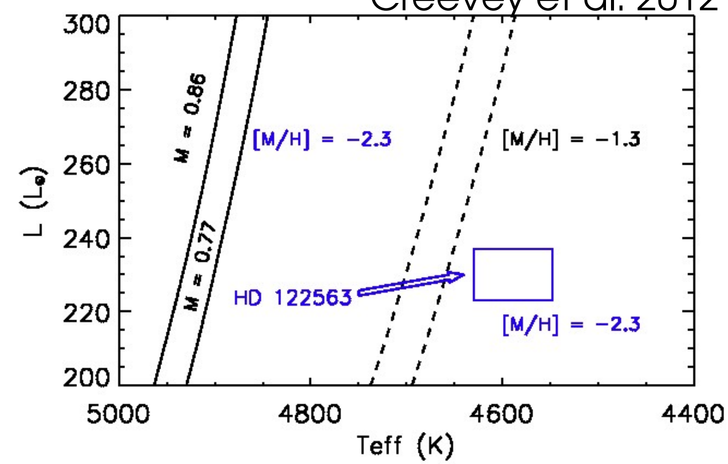
Creevey et al. 2014



Log g = 1.60 ± 0.04
Teff = 4598 ± 40 K

Comparison with other measurements.
Our measurements = grey boxes

Creevey et al. 2012



Rad = 23.9 ± 1.9 Ro
Lum = 230 ± 10 Lo

Comparison with stellar models

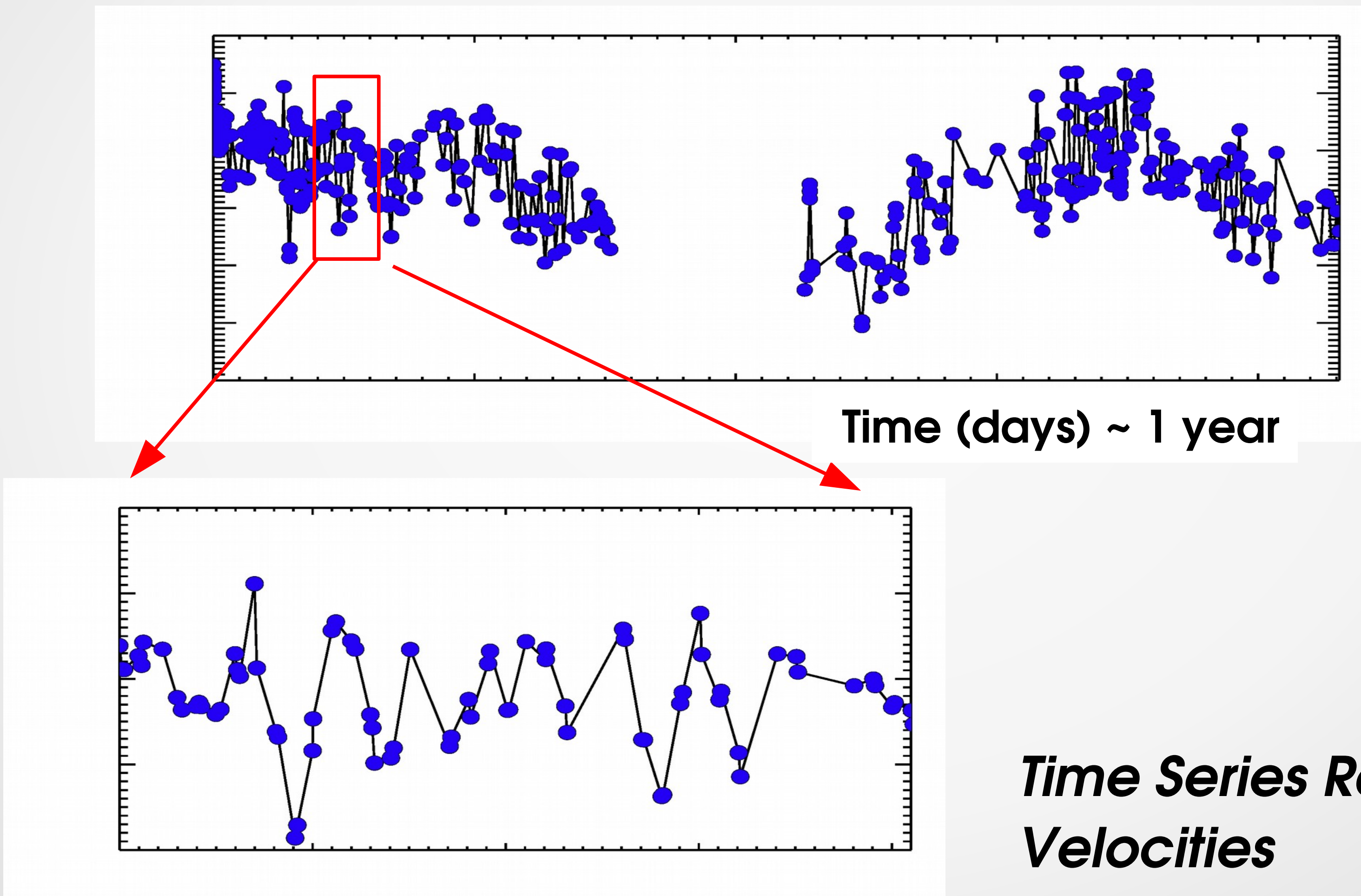
Its effective temperature

⊝	0.940 ± 0.011	vs	0.941 ± 0.019	vs	0.928 ± 0.011
Teff	4598 ± 41	vs	4600 ± 47	vs	4636 ± 36
Rad	23.9 ± 1.9				
log g	1.60 ± 0.05				
	Creevey et al. 2012		Casagrande et al. 2014		Karovicova et al. 2018

New observations : asteroseismology

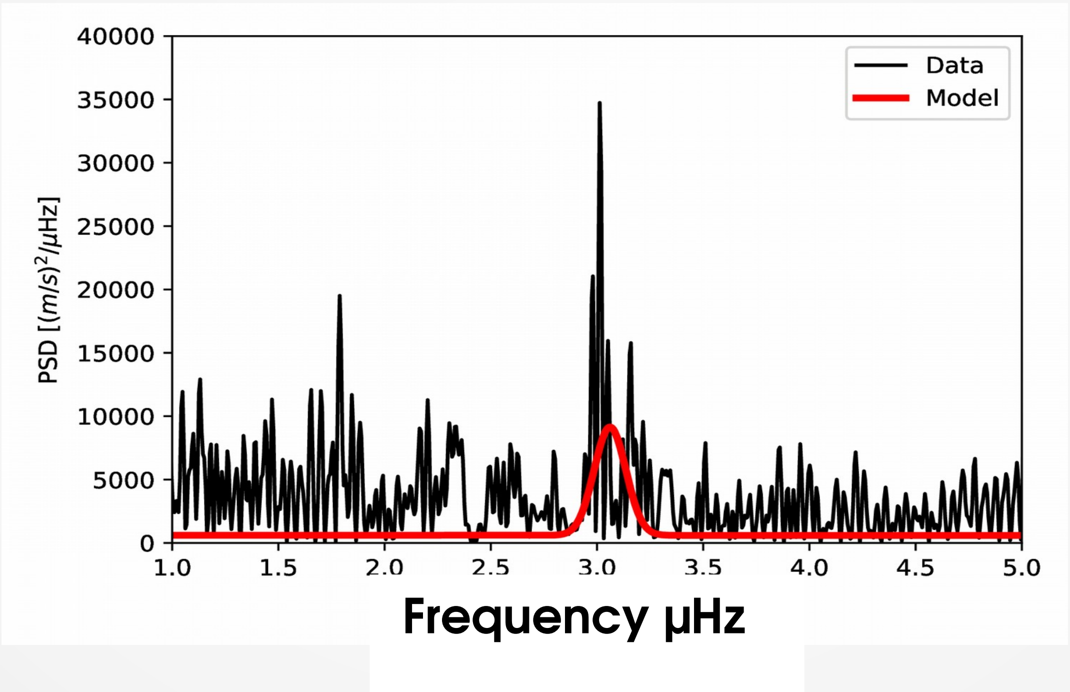
- SONG network
- Observing HD122563 since May 2016 from Tenerife
- Time series allows seismic investigation

New observations : asteroseismology



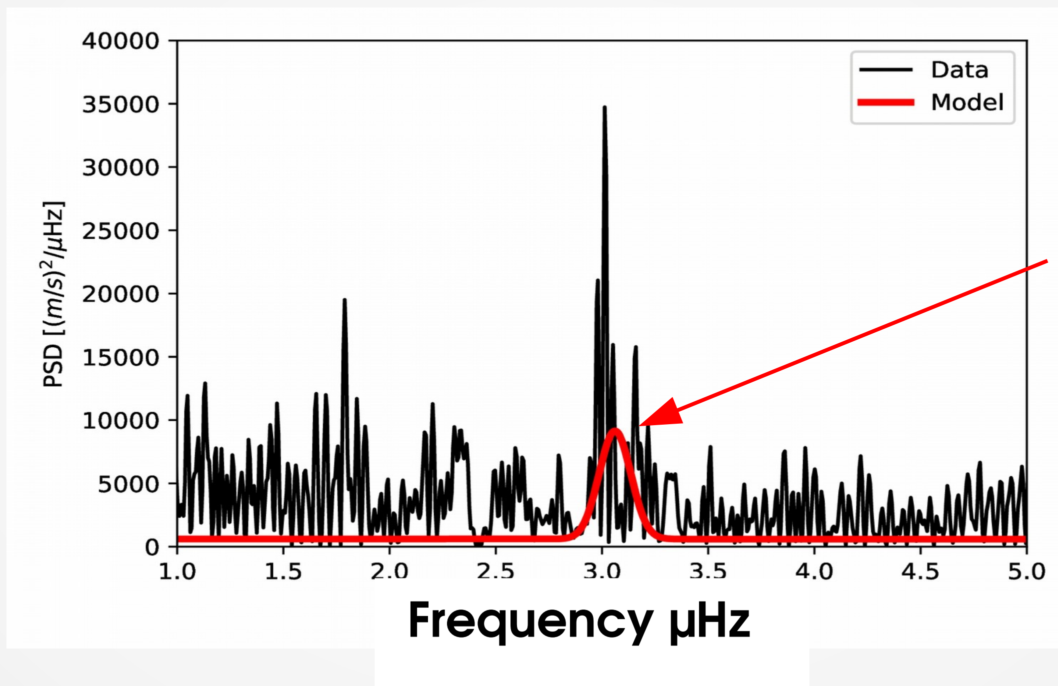
Time Series Radial Velocities

New observations : asteroseismology



Power Spectrum

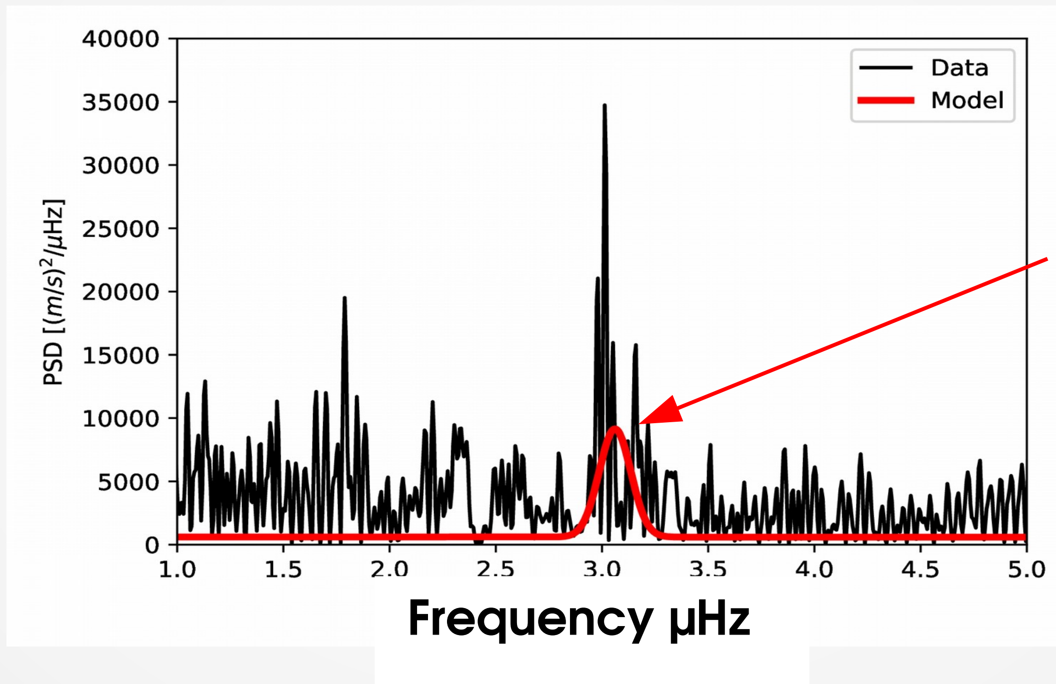
New observations : asteroseismology



$g \sim \nu_{max} \; T_{eff}^{-0.5}$

Power Spectrum

New observations : asteroseismology



$g \sim \nu_{max} \; T_{eff}^{-0.5}$

Proven for stars like the Sun !

Power Spectrum

Asteroseismology to distance

- $g = \nu_{max}\ Teff^{-0.5}$
- $g = G\ Mass\ /\ Radius$
- $Radius = distance * AngularDiameter$

car masse ~ 0.8-0.9 $M_\odot$

Mesured in Creevey et al 2012 and Karovicova et al. 2018

Asteroseismology to distance

- g = ν_{max} Teff$^{-0.5}$
- g = G Mass / Radius
- Radius = distance * AngularDiameter
- Distance = 305 ± 10 pc

car masse ~ 0.8-0.9 M$_\odot$

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Asteroseismology to distance

- g = ν_{max} $Teff^{-0.5}$
- g = G Mass / Radius
- Radius = distance * AngularDiameter
- Distance = 305 ± 10 pc

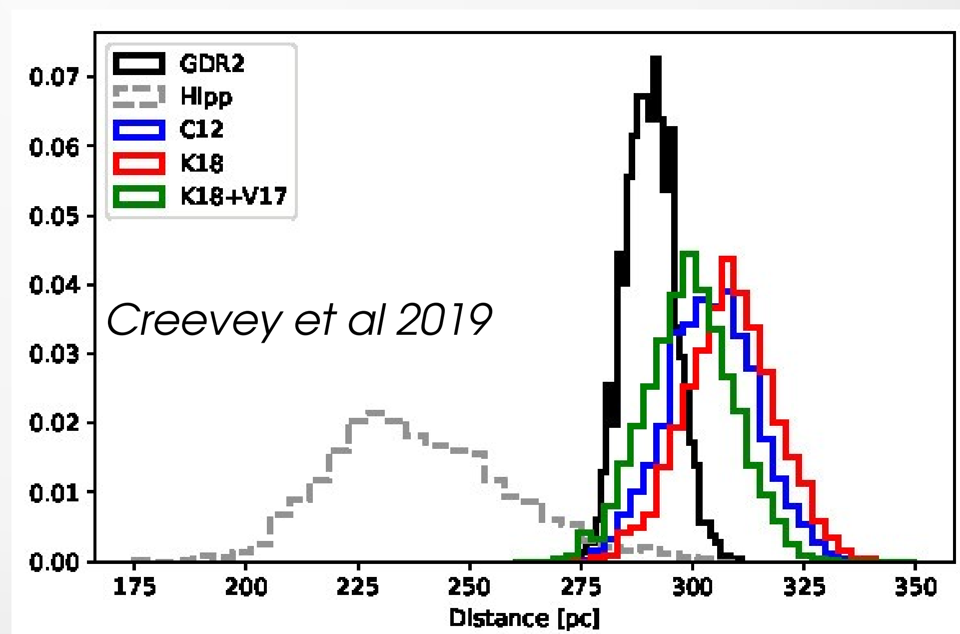
  but

- Distance = 290 ± 5 pc

  (Gaia)

car masse ~ 0.8-0.9 $M_\odot$

Mesured in Creevey et al 2012 and Karovicova et al. 2018



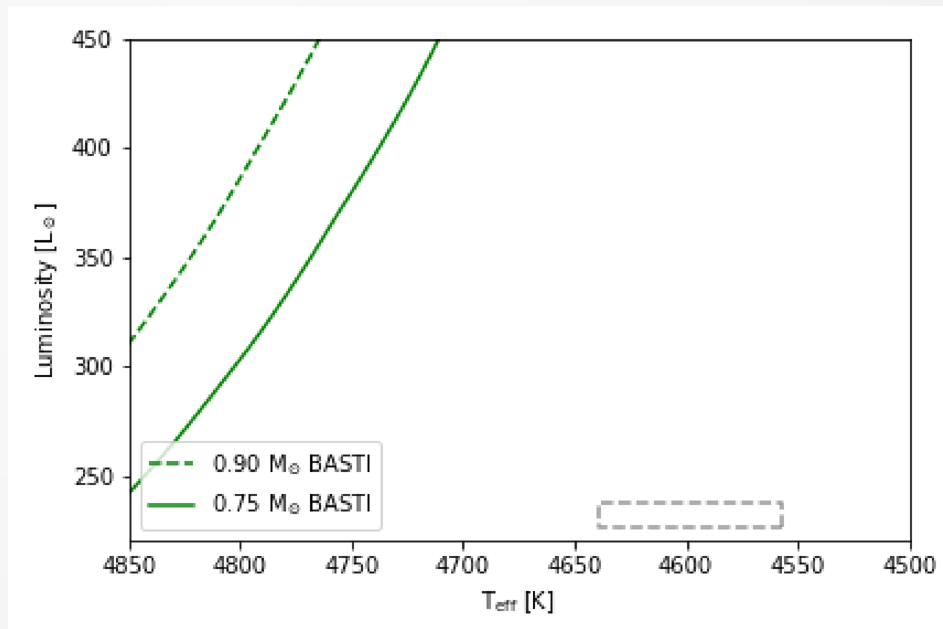
Implications : scaling relations

- $g = \nu_{max}$ $Teff^{-0.5}$
  → 1st time proven for so evolved and metal-poor
  → 1000s of giants with Vmax
  → g accesible for all of these stars ~0.05 dex precision

Implications : evolution tracks

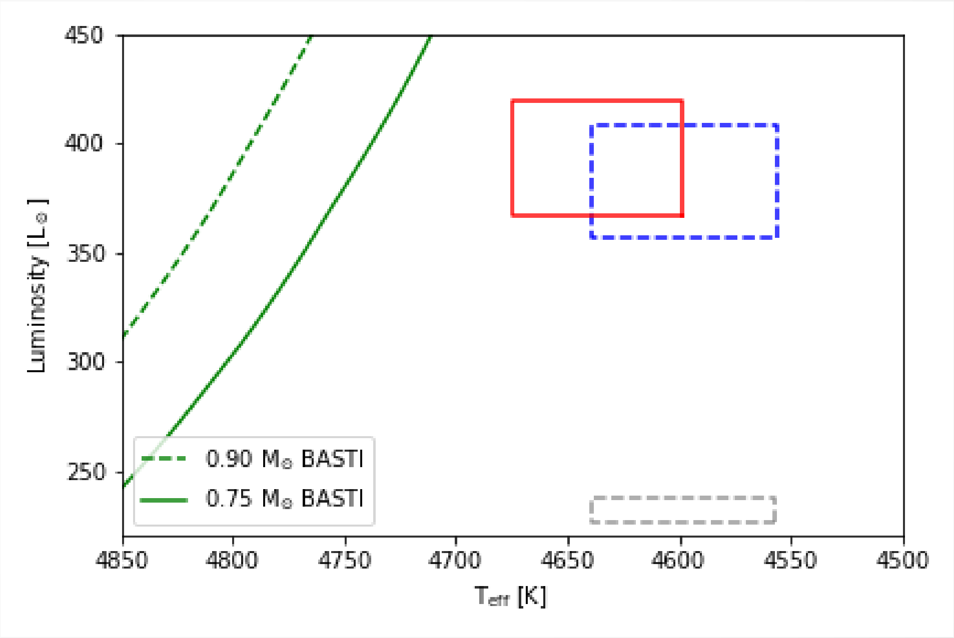
- Evolution models : new constraints
- Creevey et al. 2012

  ~ ΔT = 300 K



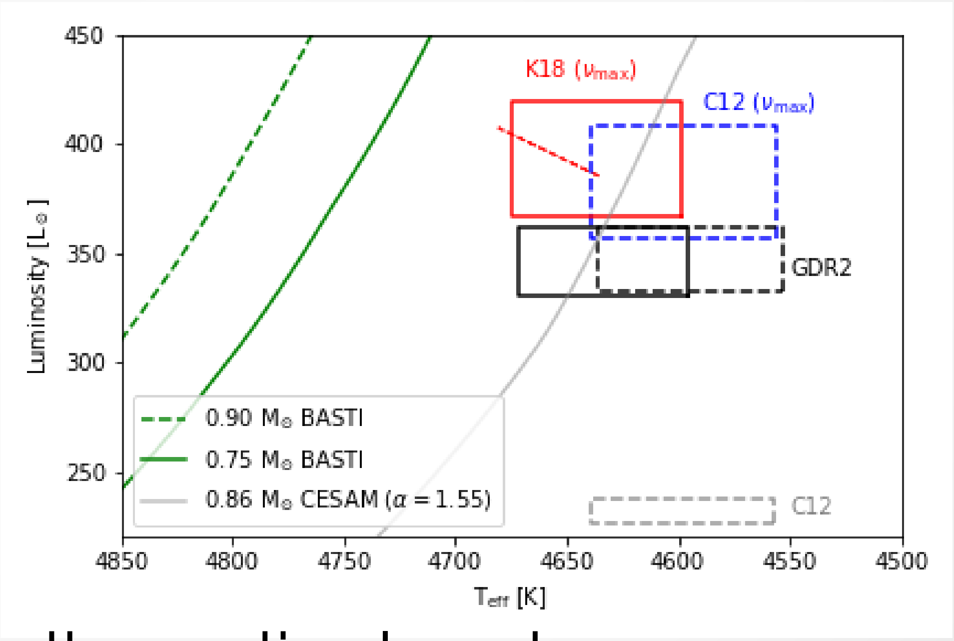
Implications : evolution tracks

- Evolution models : new constraints
- Creevey et al. 2012
  ~ ΔT = 300 K
- Creevey et al. 18
  ~ ΔT = 100 K



Implications : evolution tracks

- Evolution models : new constraints
- Creevey et al. 2012
  ~ ΔT = 300 K
- Creevey et al. 18
  ~ ΔT = 100 K
- Modify parameter in models
  ~ agreement with theoretical and empirical results



Conclusions

- We detected oscillations in the most metal-poor star
- Comparing our results with Gaia proved that the scaling relations for surface gravity work (Kepler,...)
- New fundamental parameters for this star (precise and accurate)
- Less tension between evolution models
- Less tension with 3D models (not discussed)
- Continue collecting data (frequencies, separation, numax width, …)

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Merci beaucoup pour votre attention !