First Detection of oscillations in the Halo giant HD 122563: log g and distance

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Pionering study: Wallerstein et al. 1961

V= 6.19, Galac. Coord. = 350.16 +65.80 : direction of the Galactic north pole

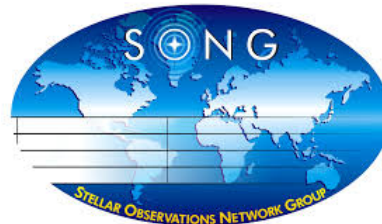Parallax=3.444+-0.063 mas (DR2), 4.22 (HIP)
PM=202.291 mas
Distance = 290 pc
Teff~4600K
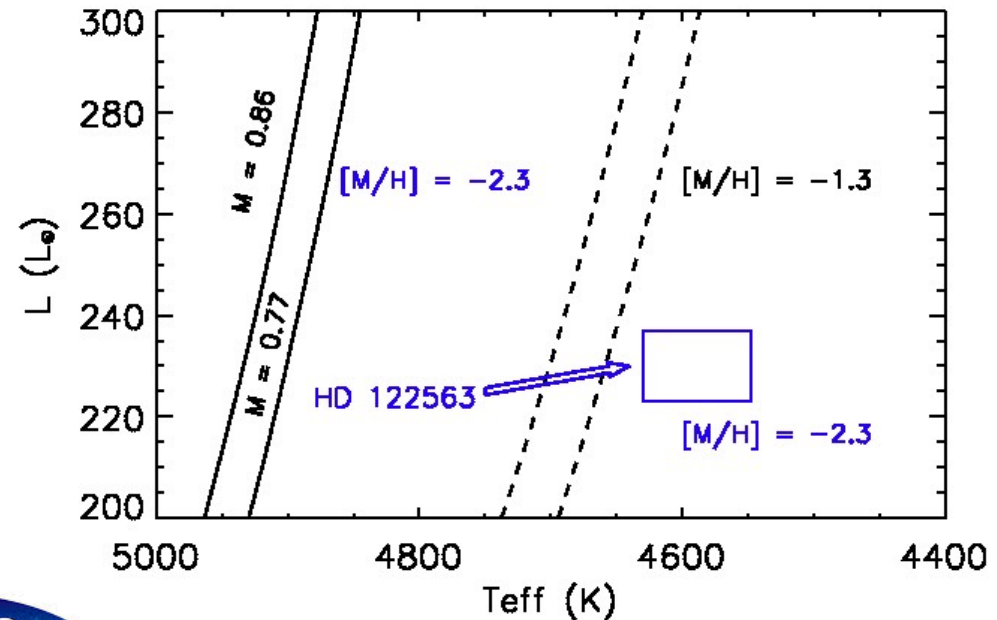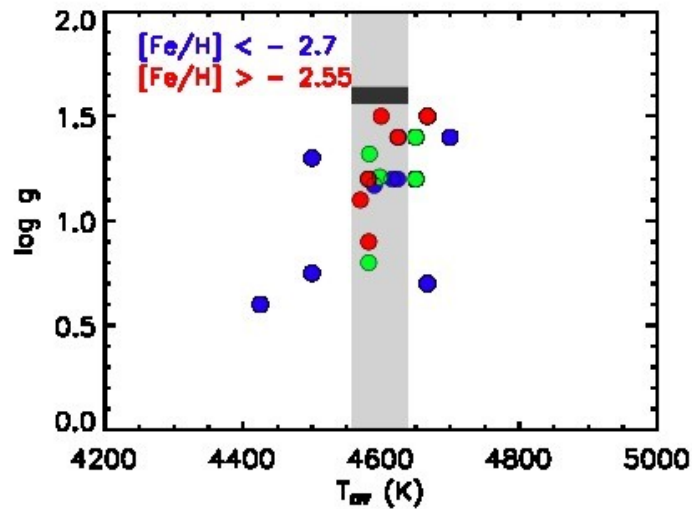Logg~1.3 (non-ETL), 1.6 (Creevey+12)
[Fe/H]~ -2.4, [alpha/Fe]~ +0.4
Age~ 11.2 Ga
nu_max(Creevey+12)= 5 microHz

HD 122563

- **Why to monitor that star?**

  - Problem with HR diagram, log g (evol vs spectro) : MLT (Creevey+12)

  - get an accurate age of PopII stars

  - use to calibrate scaling relations

HD 122563

- **The present status of the SONG observations**
- **Start JD = 2457509.4, ongoing (actually end JD 2458356.4), exp. time=900s**
- **Accuracy of the VRs measurements: (~11 to 14m/s, e.g. metal-poor)**
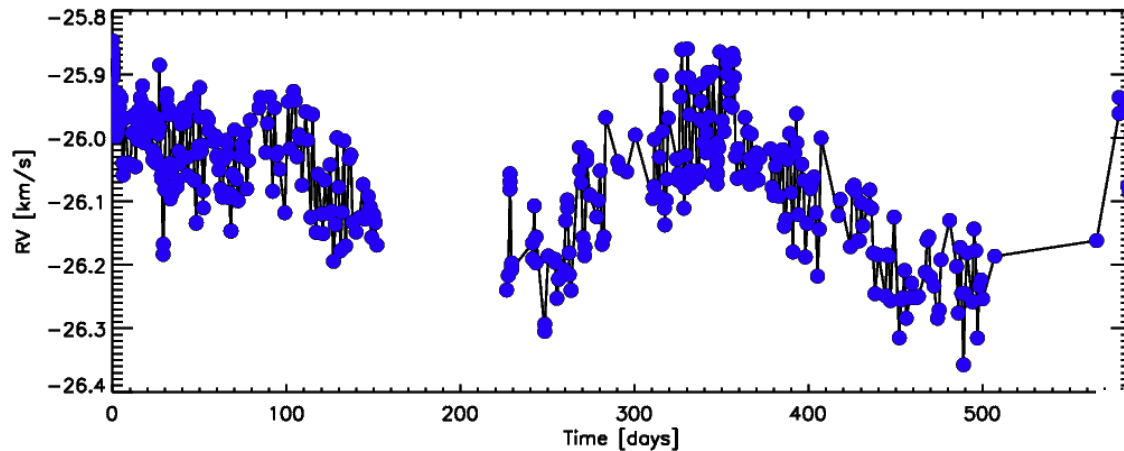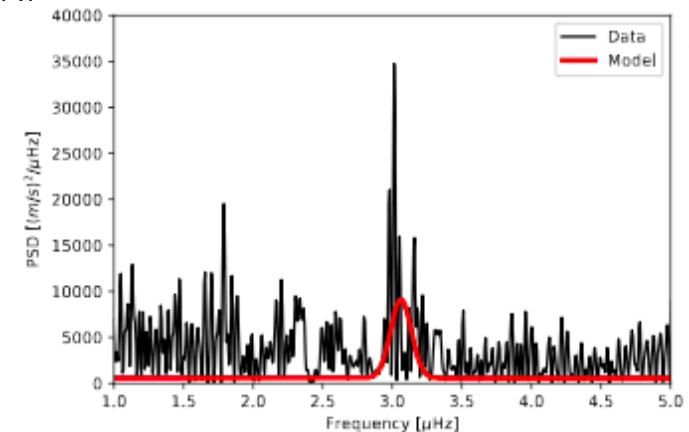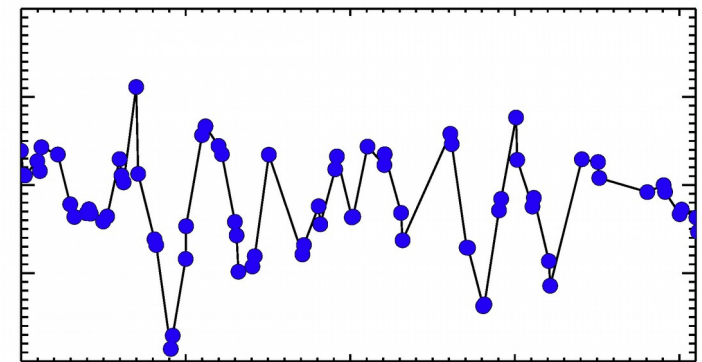

nu_max=3.093 +-0.014 microHz

Fig. 2. Power spectral density and background model fit with DIAMONDS to determine ν_{max}. The red line shows the total fit, including the oscillation power excess. See Sect. 2.1.2.

HD 122563

- **Creevey+12**
- **Karovicova+18**
- **Gaia DR2**
- **nu_max:3.09**

Table 1. Observed Properties of HD 122563 used in this work

Property		Value	Source
v_{max}	$[\mu Hz]$	$3.093^{+0.014}_{-0.011}$	this work
$\theta_{LD,A}$	[mas]	0.940 ± 0.011	C12
$F_{bol,A}$	$[erg^{-1}s^{-1}cm^{-2}]$	13.16 ± 0.36 e-8	C12
$T_{eff\,A}$	[K]	4598 ± 41	C12
$\theta_{LD,B}$	[mas]	0.926 ± 0.011	K18
$F_{bol,B}$	$[erg^{-1}s^{-1}cm^{-2}]$	13.20 ± 0.29 e-8	K18
$T_{eff\,B}$	[K]	4636 ± 36	K18
π_{HIPP}	[mas]	4.22 ± 0.36	van Leeuwen (2007
π_{GDR2}	[mas]	3.444 ± 0.063	Lindegren et al. (20,

We used nu_max scaling relation to infer the distance

HD 122563

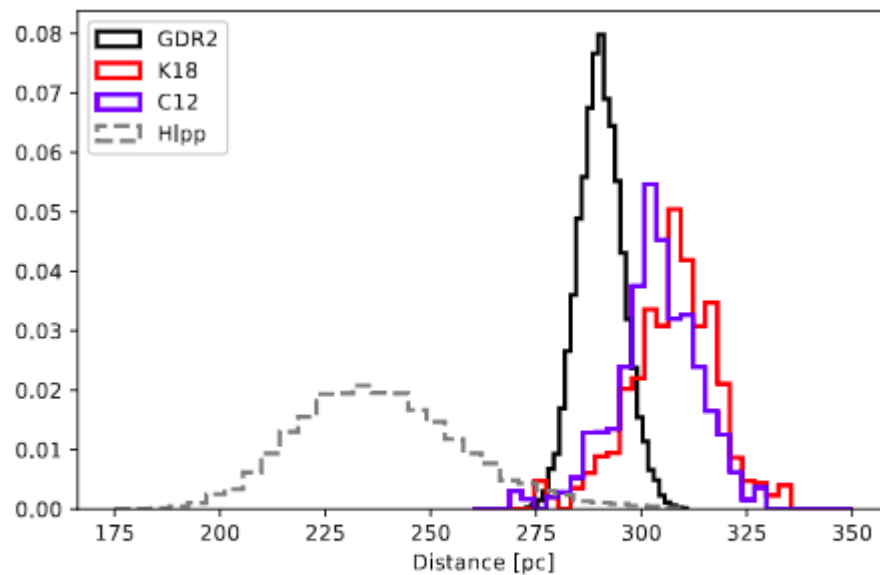- **The distance a key point**

- **0.926+-0.11 mas (Karovikova+18)**

P	Seismology		GDR2 Parallax	
	C12	K18	C12	K18
$\log g$ [dex]	1.395^{+2}_{-3}	1.397^{+3}_{-3}	1.43^{+3}_{-3}	1.45^{+3}_{-3}
d [pc]	304^{+10}_{-8}	309^{+8}_{-11}	290^{+5}_{-5}	$--$
$R_\star$ [$\mathcal{R}_\odot$]	30.8^{+7}_{-9}	30.7^{+8}_{-9}	29.3^{+6}_{-7}	28.9^{+6}_{-6}
$L_\star$ [$\mathcal{L}_\odot$]	379^{+24}_{-25}	393^{+23}_{-28}	346^{+17}_{-16}	348^{+15}_{-11}

Fig. 3. Distances to HD 122563 derived using parallaxes (black and grey) and asteroseismic inferences (red and blue)
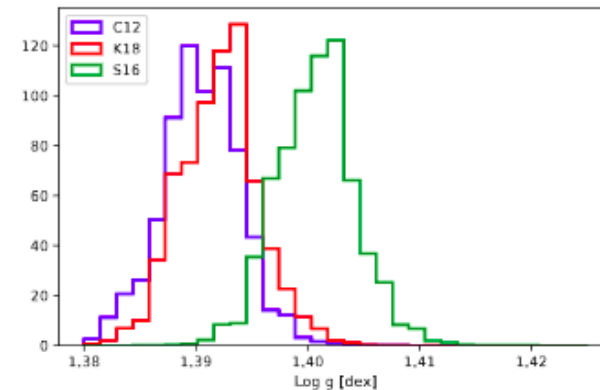
Fig. 3. Distributions of log g using asteroseismic data. The green and red indicate the classical relation along with the observed properties from C12 and K18, respectively. The blue lines indicate the revised parameters in Eq. 1. See Sect. 3.1 for details.

HD 122563

Collet+18

- **What the HR diagram teach us now?**
- **The mixing length problem: 3D prediction by Magic et al. or Ludwig et al. : ~1.6   OK?**
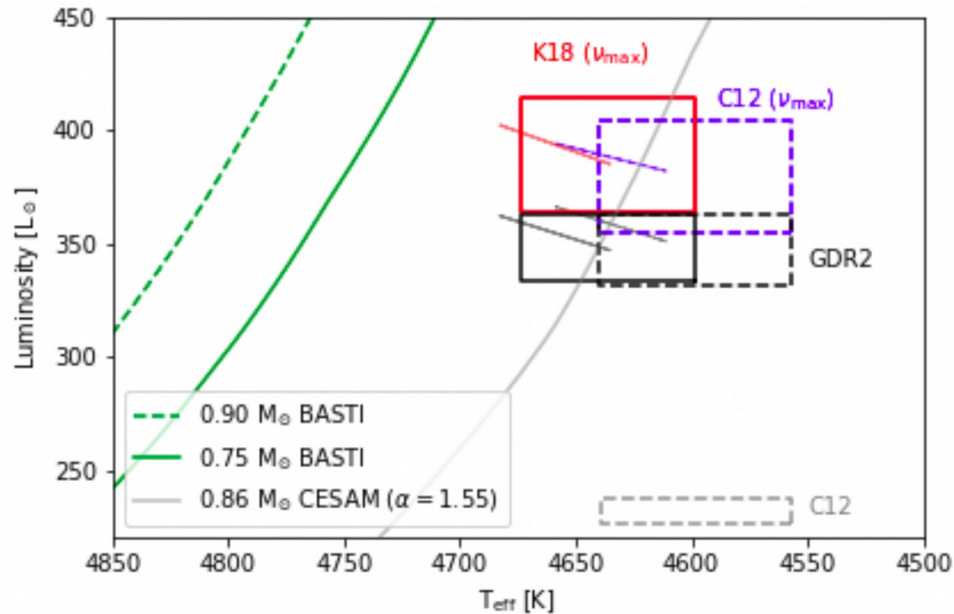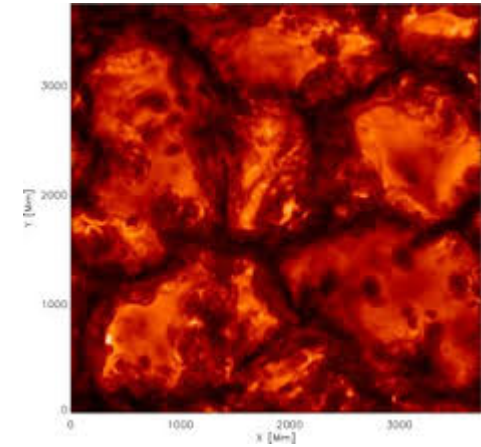
HD 122563 : some conclusions

- **We need more point for testing the scaling relations for metal-poor stars. Relations seems ok whitout strong corrections.**

- **Individual frequencies requested to better constrain the age**

  That star and its physics is now under control by :

  Photometry, spectrometry, astrometry, interferometry and asteroseismology

  for

  cosmology: to constrain epochs in the Halo phase of the Milky-Way