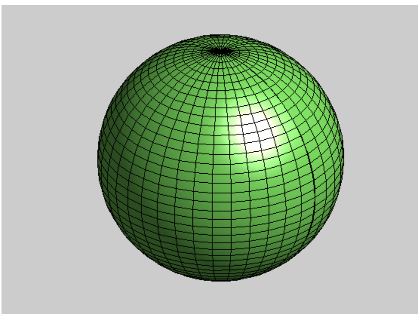
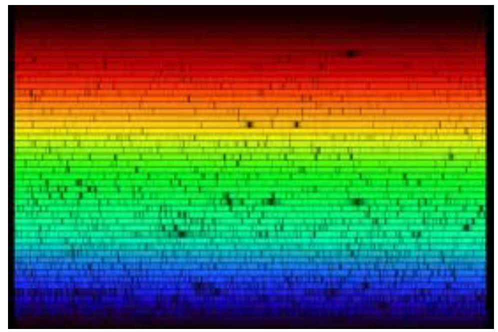
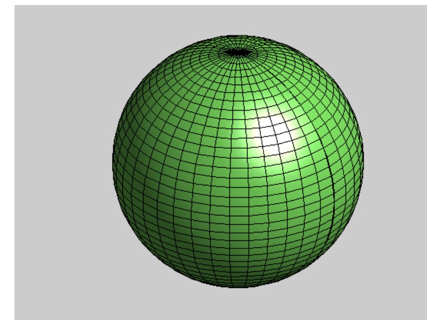
GALAH + CoRoT

where high resolution spectra meet asteroseismology







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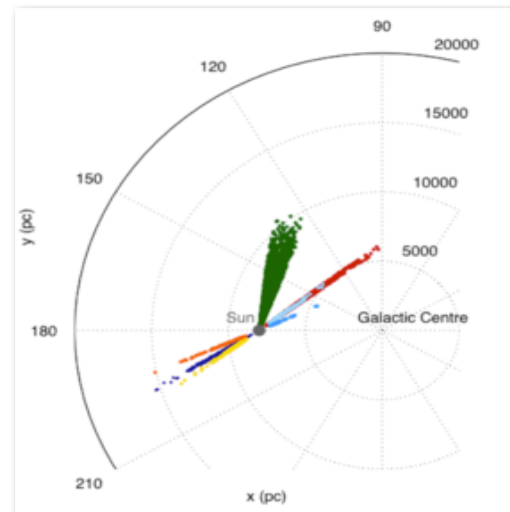
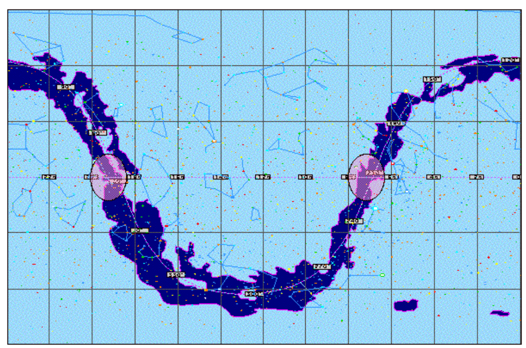
Asteroseismology with CoRoT

New insights on **stellar evolution** and **stellar interiors** physics are being made possible by asteroseismology, the study of stars by the observation of **natural, resonant oscillations**.

- CoRoT perfoms asteroseismology by measuring **solar-like oscillations** (convection in the outer layers) in stars.

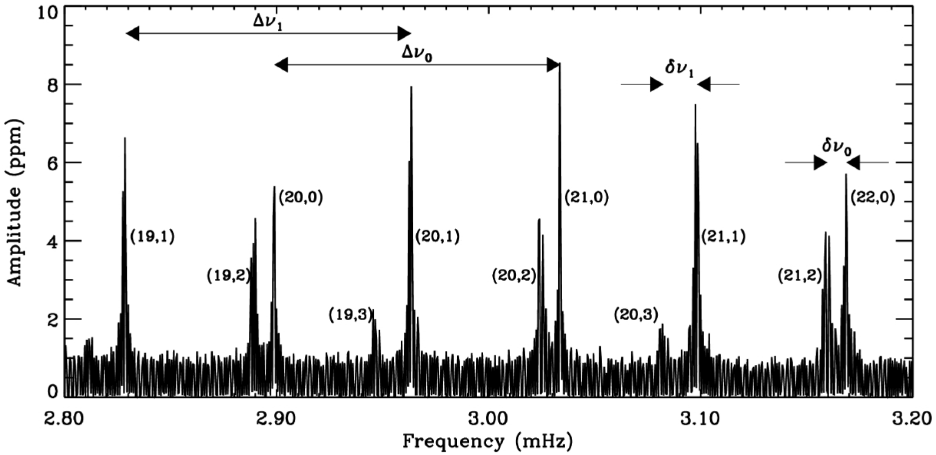


The CoRoT eyes: Centre and Anti-centre



153,000 stars 10 < R < 16, > 30,000 RG up to 10 kpc

Asteroseismic scaling relations



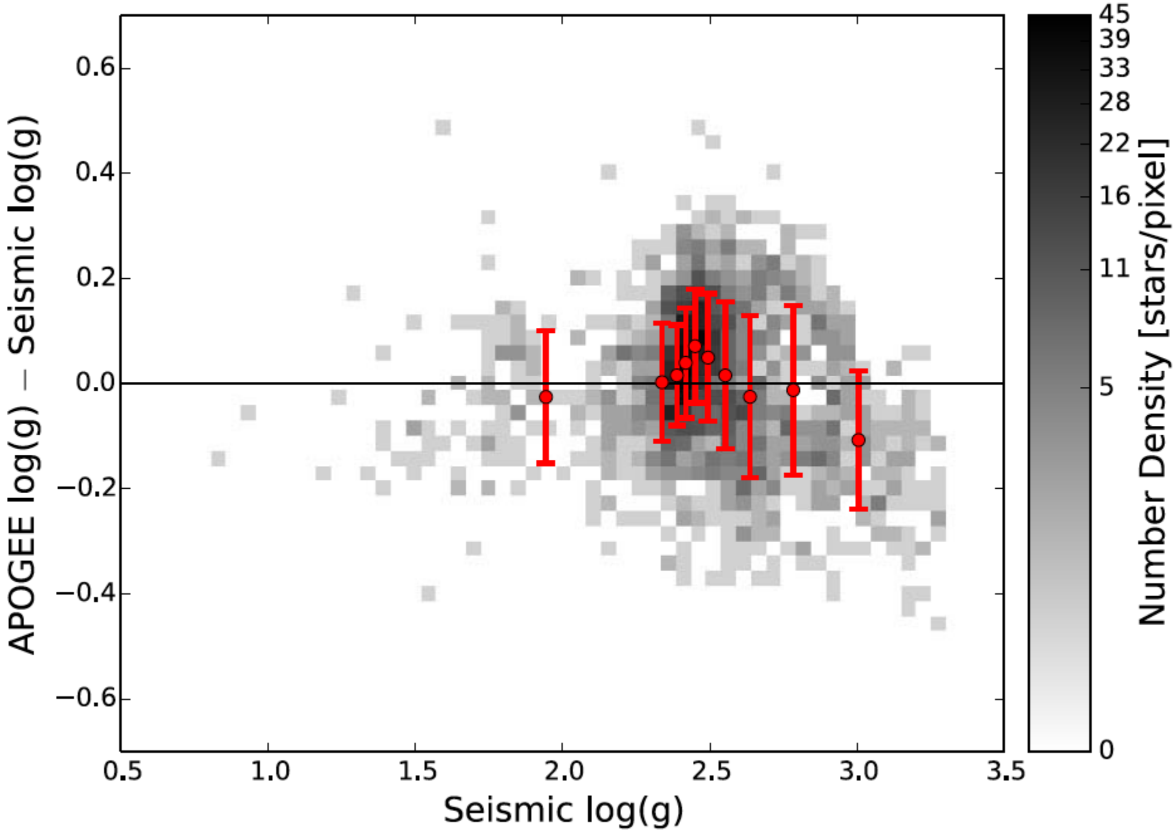
$$\frac{R_{\rm obs}}{R_\odot} = \left(\frac{\nu_{\max}}{\nu_{\max,\odot}}\right)\left(\frac{\Delta\nu_{\rm obs}}{\Delta\nu_\odot}\right)^{-2}\left(\frac{T_{\rm eff}}{T_\odot}\right)^{1/2}, \qquad (25)$$

$$\frac{M_{\rm obs}}{M_\odot} = \left(\frac{\nu_{\max}}{\nu_{\max,\odot}}\right)^{3}\left(\frac{\Delta\nu_{\rm obs}}{\Delta\nu_\odot}\right)^{-4}\left(\frac{T_{\rm eff}}{T_\odot}\right)^{3/2}. \qquad (26)$$

Asteroseismology provides independent estimates of stellar masses and radius for red giants accurate to about 5 to 10% → gravities

Surface gravities (σ < 0.02 dex)

The dependence of scaling relation on Teff is rather mild, and errors in masses and radii are positively correlated, thus leading to very small errors in gravities (e.g. Gai et al. 2011, Chaplin et al. 2014).



APOGEE/Kepler found agreement between their mean values.

Pinsonneault et al. 2014

Benchmark stars from Asteroseismology ?

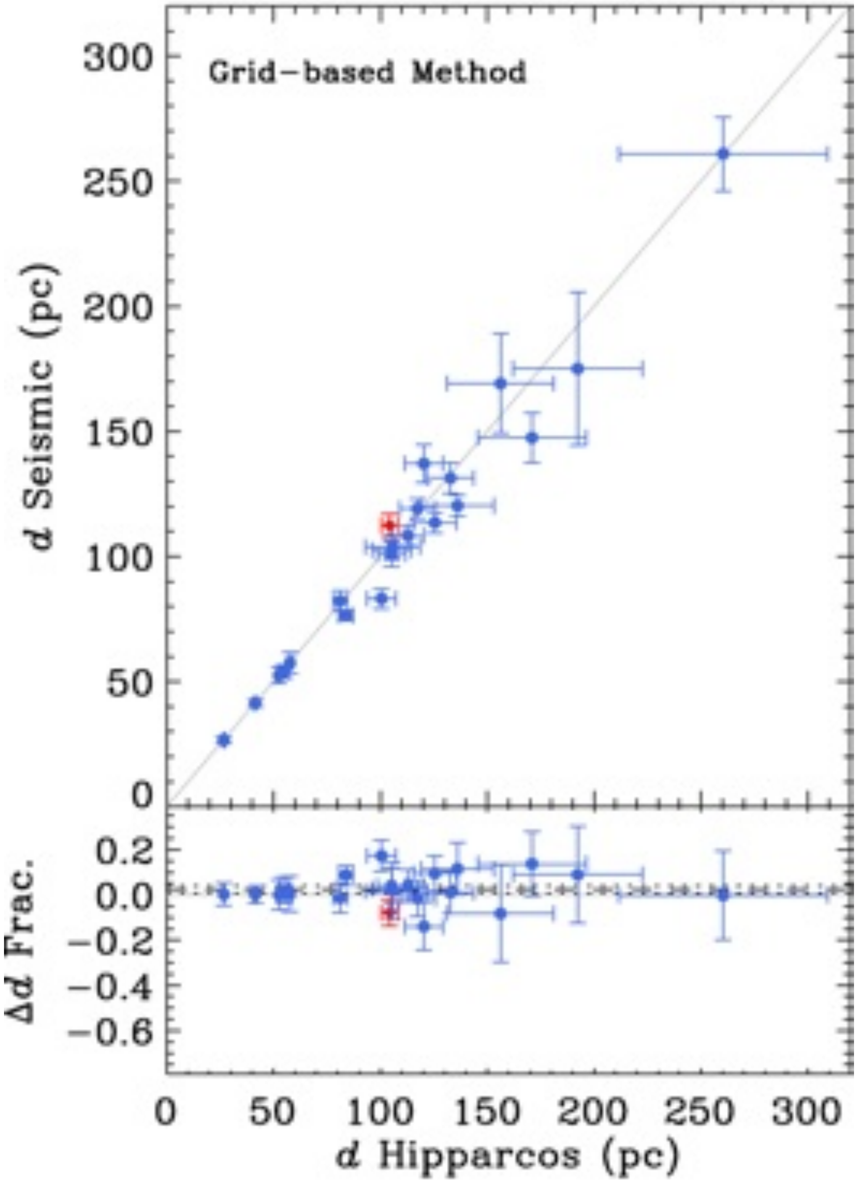
1) Rough **photometric temperature** estimate is enough to start with.

2) The **asteroseismic gravities** derived could **greatly help the spectroscopic analysis**, which can subsequently be used to derive spectroscopic metallicities and Teff.

3) The latter can be folded again into the scaling relation to converge in log g.

4) A good deal of effort is currently invested to whether scaling relations have any dependence on other parameters such as e.g., metallicity (e.g., White et al. 2011).

and distances…

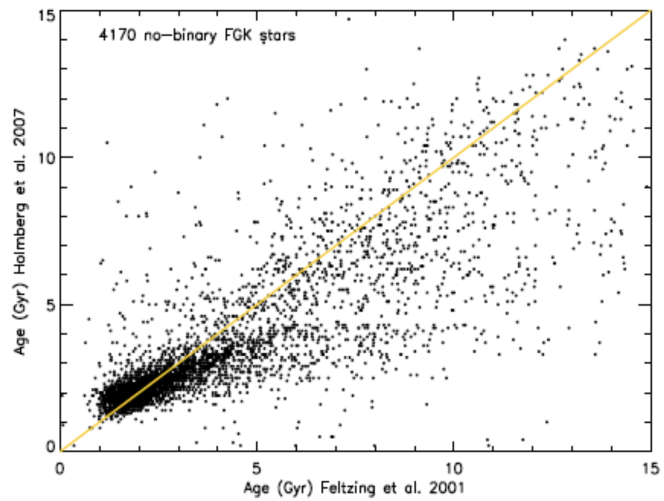


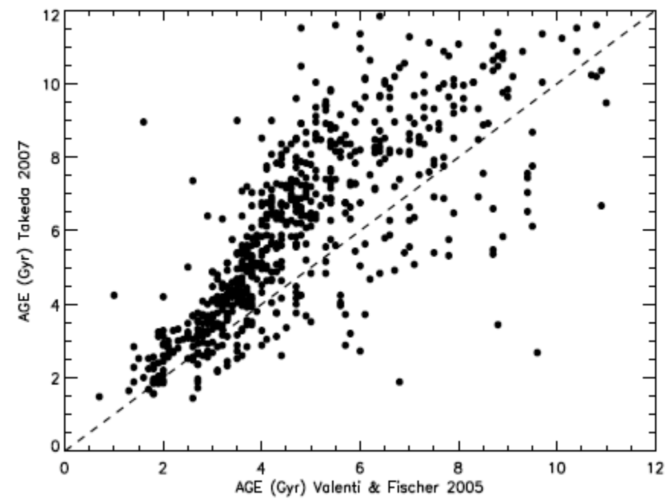
Silva-Aguirre,
Casagrande 2012

Why Galactic astronomers are interested in Asteroseismology ?

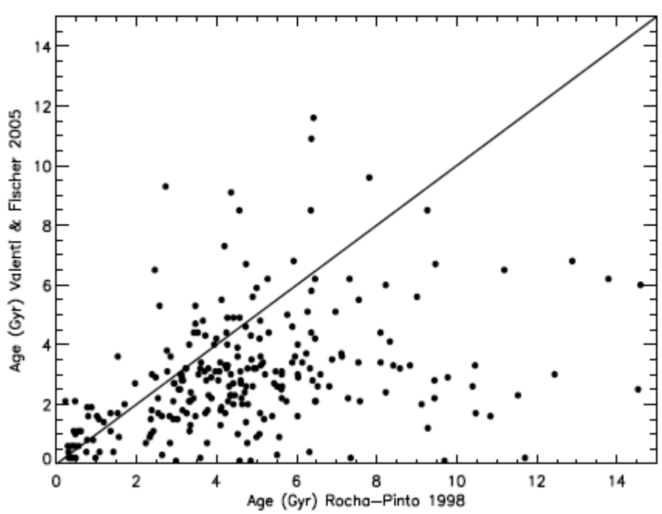
-- The age of stars --

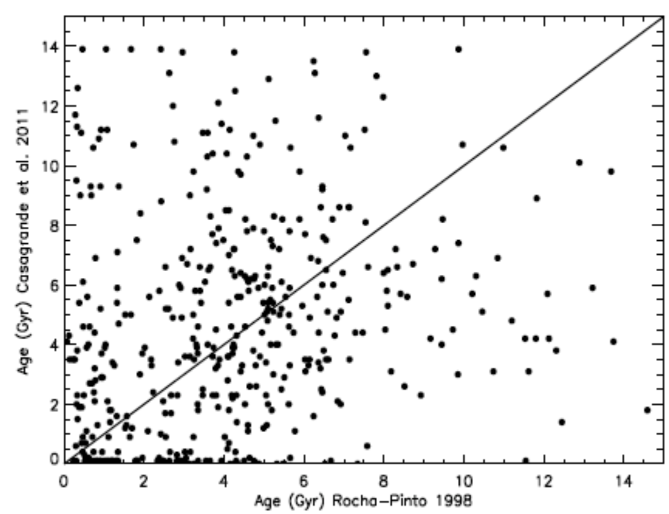
The determination of the age for field stars is difficult and imprecise



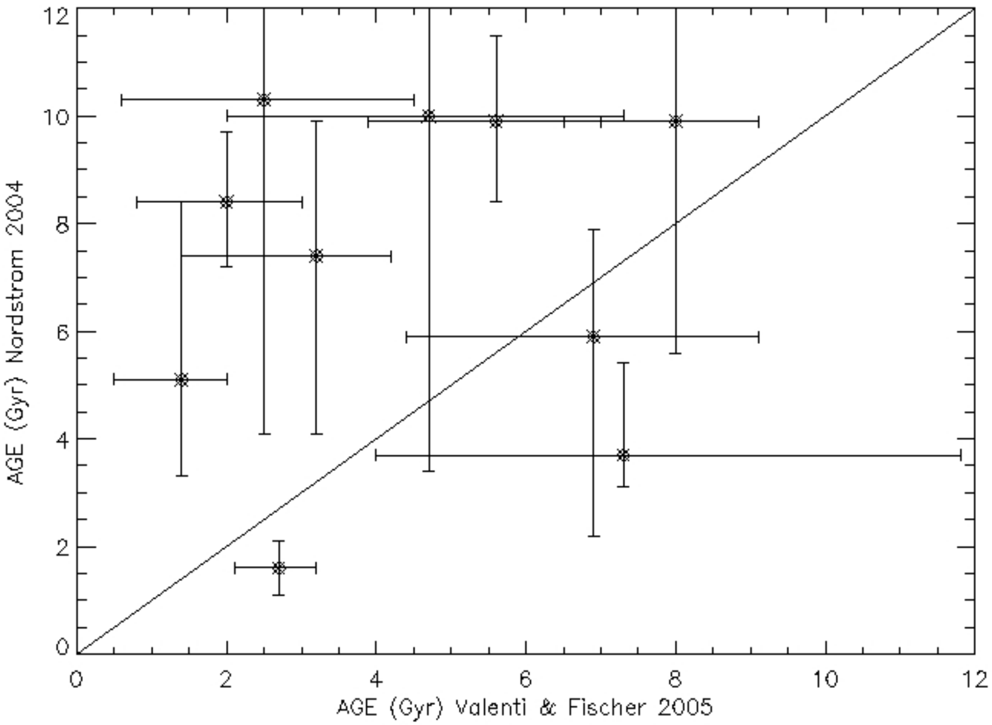


Age vs Age for common field stars





Large errors in age estimations.



Age-metallicity-velocity relation

1) Intrinsic scatter in AMR or observational errors ?

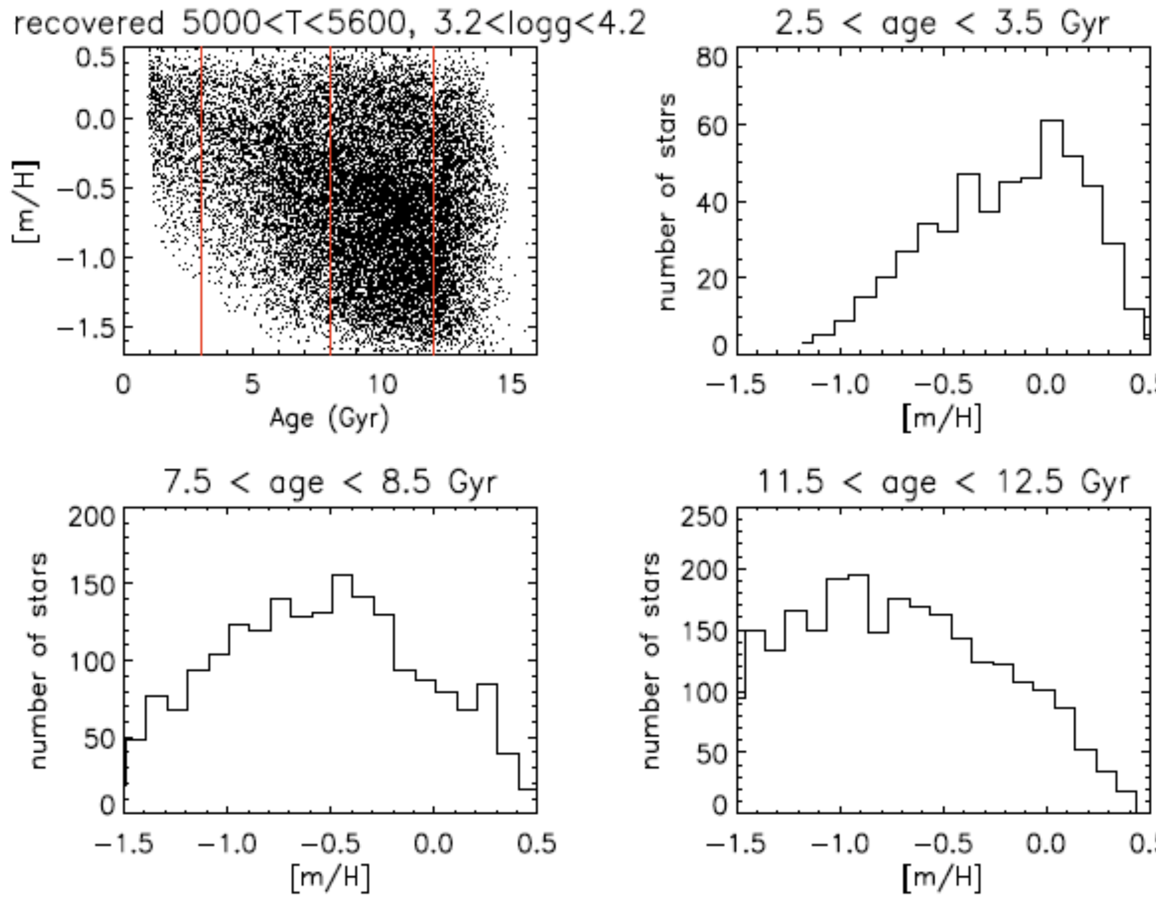
(Twarog 1980, Meusinger et al. 1991, Rocha-Pinto et al. 2000a, Feltzing et al. 2001, Edvardsson et al. 1993, Nordstrom et al. 2004, Soubiran et al. 2008, Casagrande et al. 2011, Bensby et al. 2013…)

2) **Saturation in the velocity dispersion in the temporal diagram for thin disk stars or continuos heating ?**

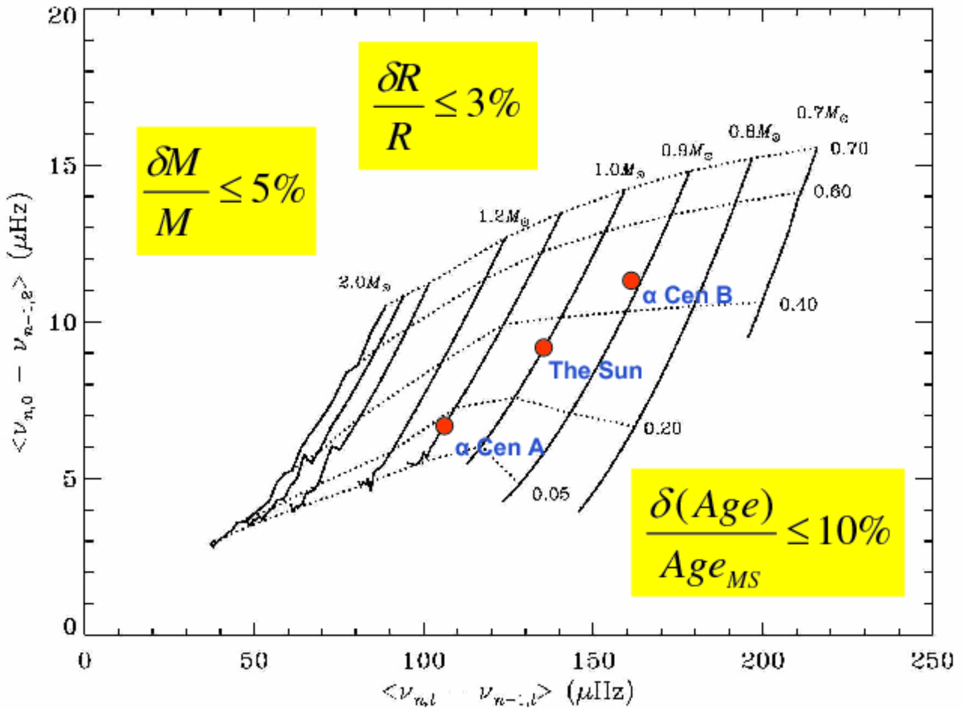
(Strongrem 1987, Quillen & Garnet 2001, Nordstrom et al. 2004, Soubiran et al. 2008, Casagrande et al. 2011…)

More precise ages for field stars will be very welcome to clarify these questions !

Some effects on the MDFs for a given age due to nature of the isochrones and the ML mehtod.

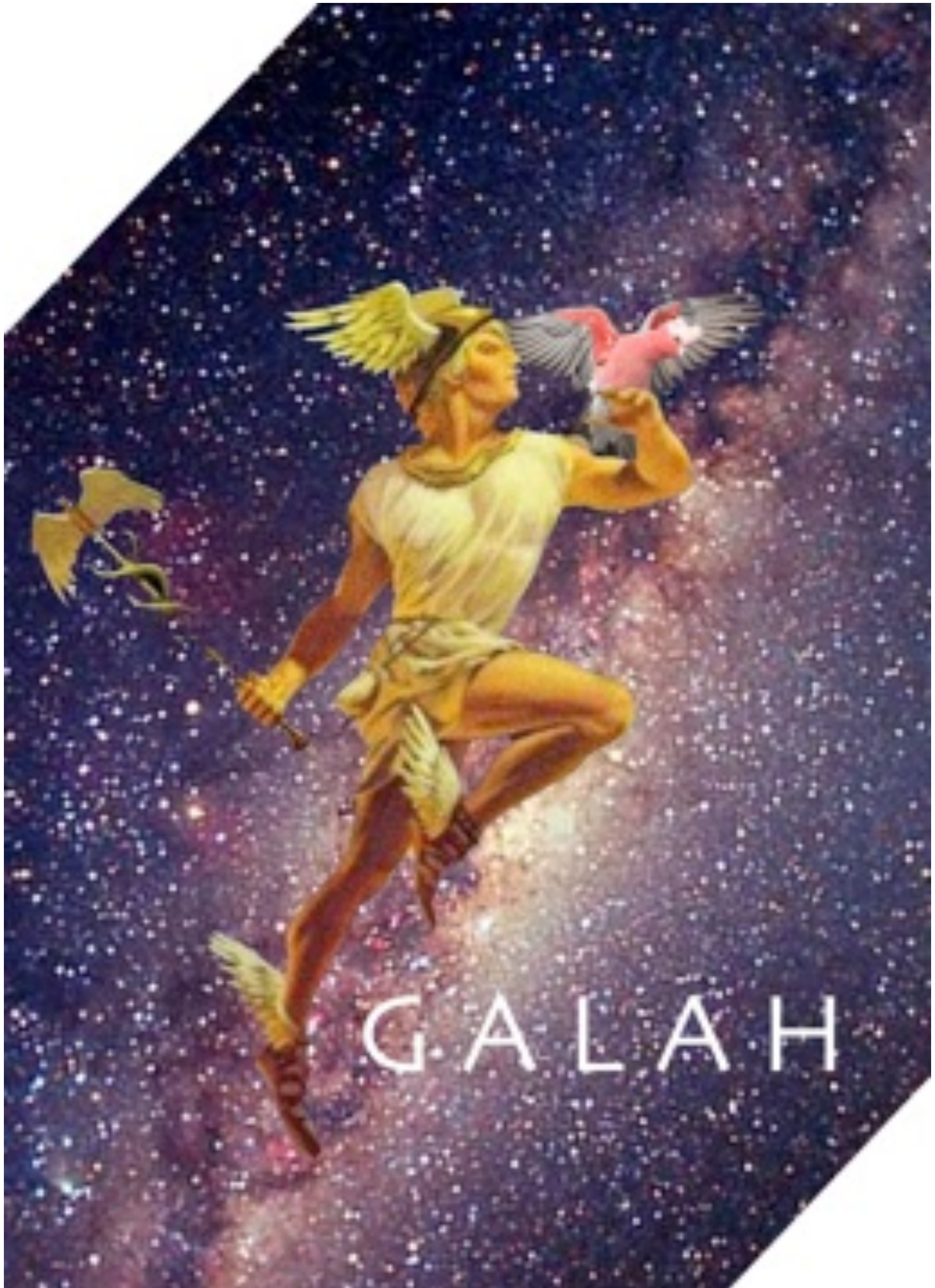


Asteroseismic HR-diagram (Christensen-Dalsgaard 1993)



Asteroseismic community can provide accurate ages to Galactic astronomers using the large and small frequency separations.

The uncertainty of the inferred ages for the CoRoT giants is about 30%. With abundances information, the uncertainty on the ages drops to 20% (Miglio et al. 2013)

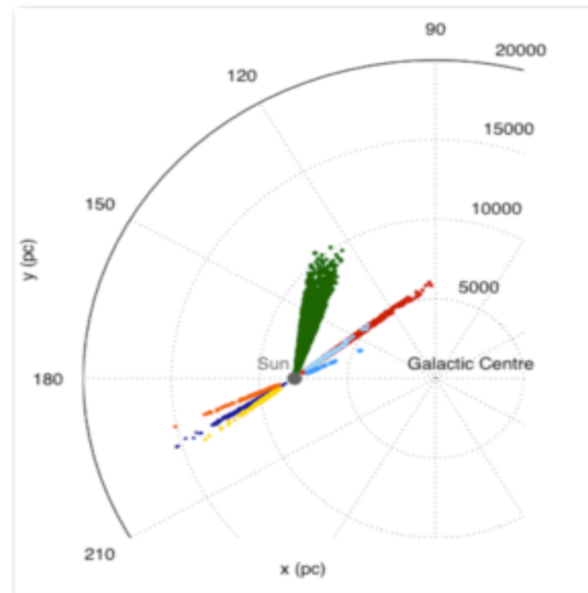

GALAH

CoRoT + GALAH

4 Anticentre CoRoT fields have been observed as part of the pilot survey with HERMES -> 2098 CoRoT stars in total !

12 < V < 14 mag -> S/N ~ 100

- LRa01
- LRa03 -> 100 stars APOGEE
- LRa05
- LRa07



Photometric temperatures using the IRFM (Casagrande et al. 2010). Abundances from GALAH spectra (work in progress)

Gaia-ESO - GALAH

1) GALAH observed CoRoT anticentre fields, LRa01, LRa03, LRa05, LRa07

2) Gaia-ESO observed CoRoT centre fields

Good opportunity of join forces !

Quick science

- Precise age-abundances relations
- Precise age-velocity relations
- Distances from seismic information -> abundance gradients
- Direct test in crucial stellar parameters like gravity
- Chromospheric emission and seismic ages (T. Zwitter)

On high demand

…in parallel

The **K2 Galactic Archaeology Program** (D. Stello + GALAH team)

K2 fields + HERMES