Testing the Milky Way's AMR, AVDR and the low-mass star age-rotation-activity relation using white dwarfs

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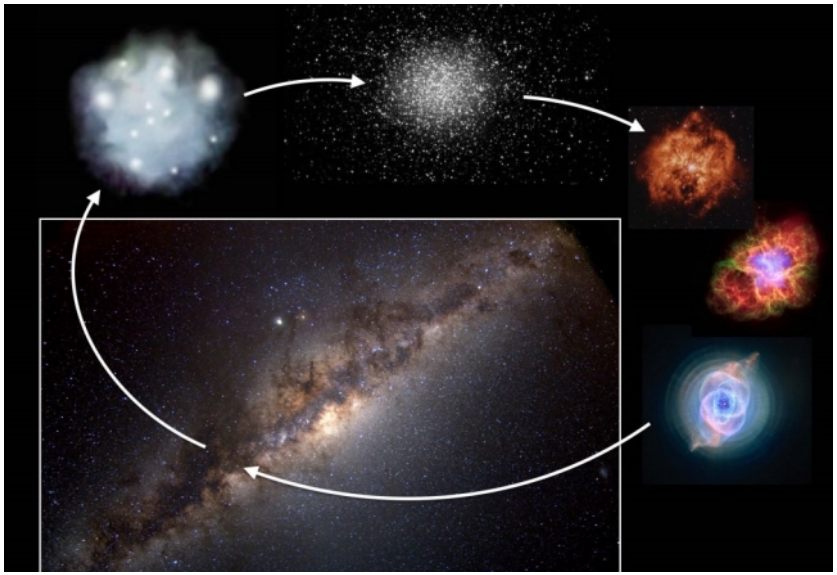
The importance of deriving ages

Understanding the Milky Way‘s evolution and that of its constituents requires obtaining precise ages of stars

Stellar ages are difficult to obtain



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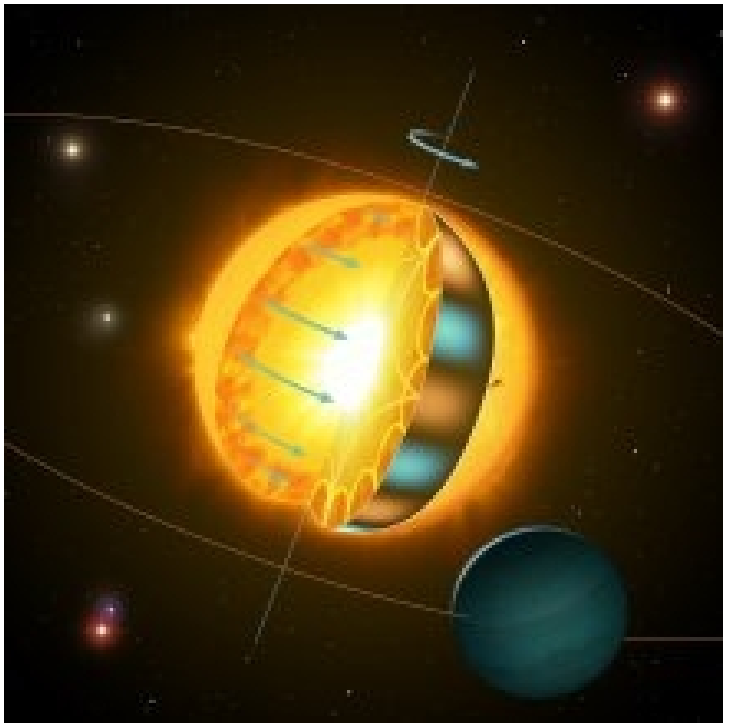

M. Garlick

The importance of deriving ages

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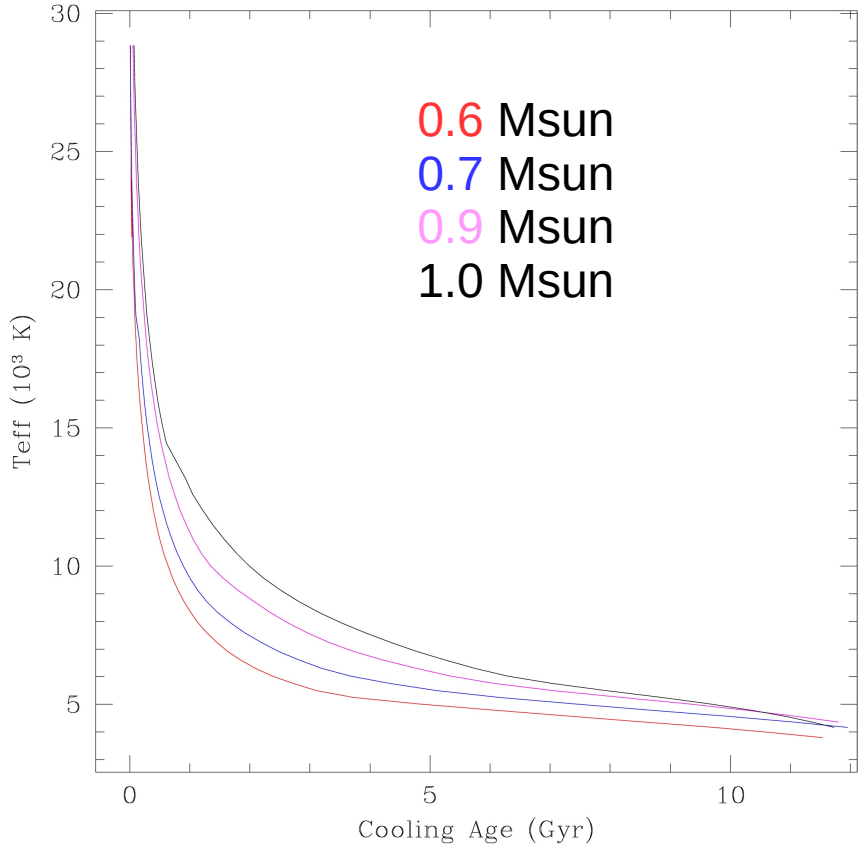
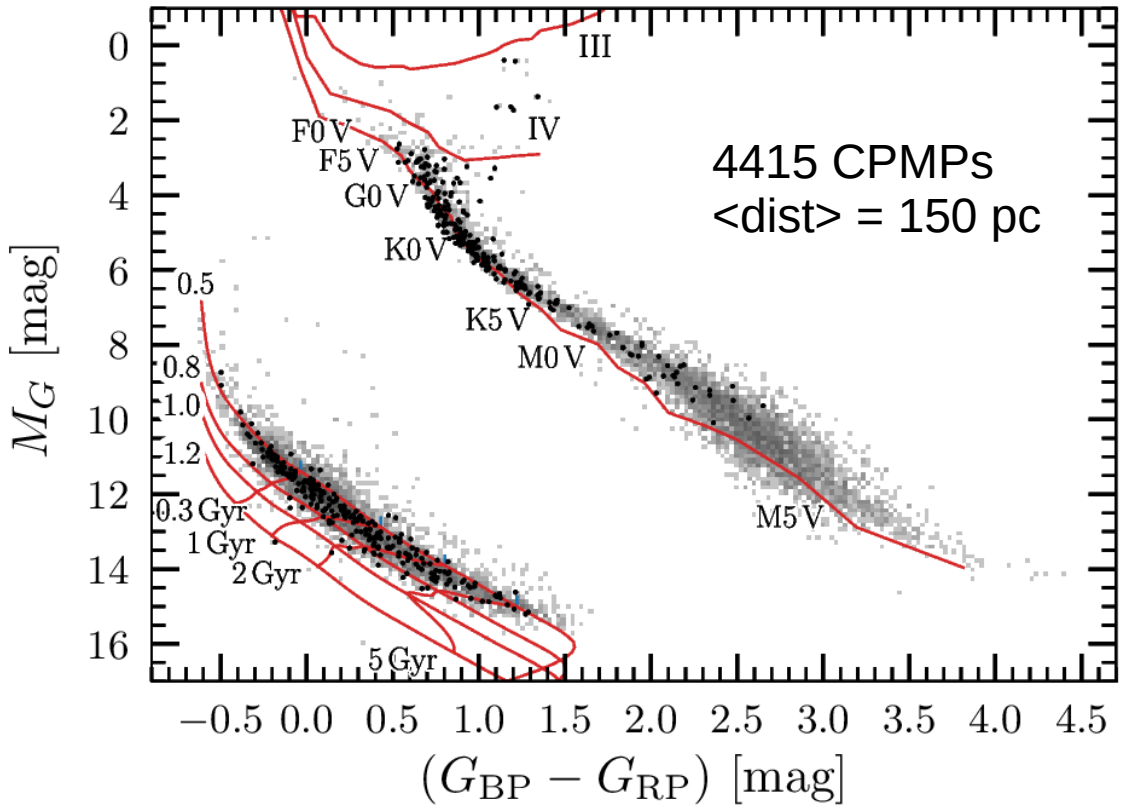
White dwarfs can be used as cosmochronometers



Camisassa et al. (2016)

The white dwarf-main sequence sample

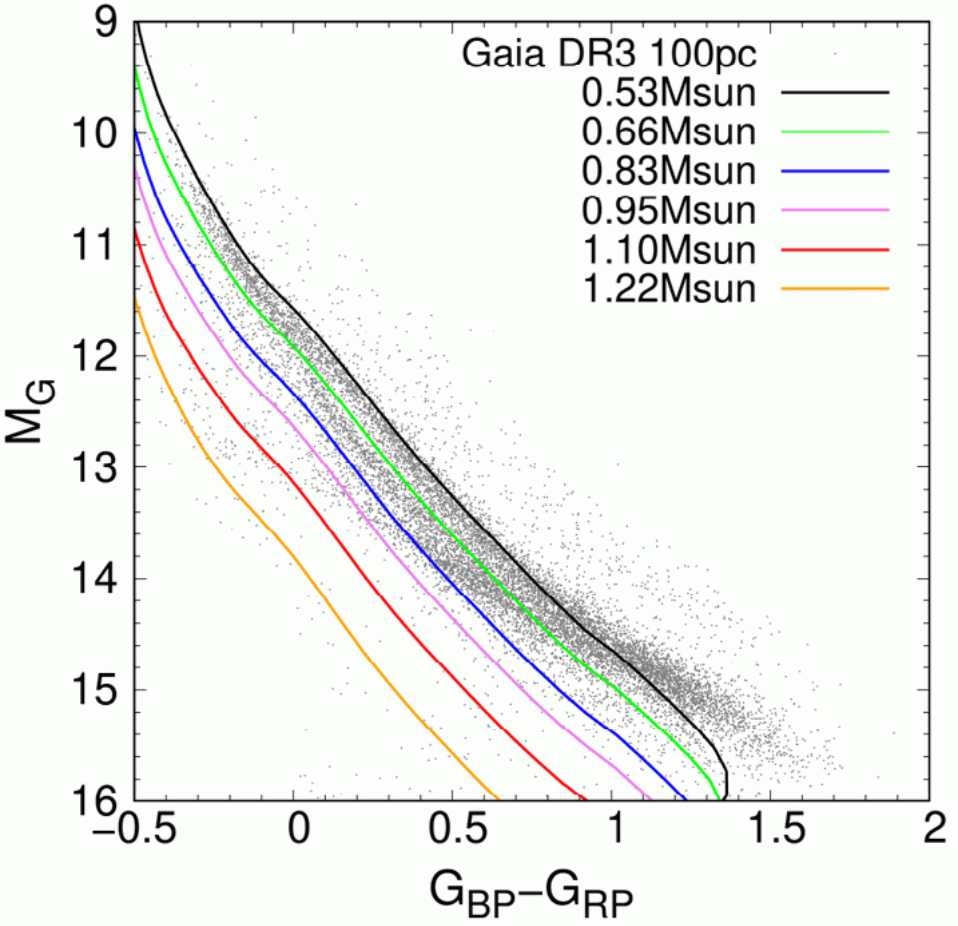
White dwarfs and main sequence companions with consistent parallaxes and proper motions



Rebassa-Mansergas et al. (2021)

White dwarf ages

La Plata cooling sequences are used to interpolate the Gaia Gabs and Bp-Rp colours to derive the age



Age = T_{WD_prog} + Cooling Age

Camisassa et al. (2016)

Main sequence star parameters

– 189 [Fe/H] abundances from follow-up high-resolution spectra (HARPS, HERMES, Xinglong) (TGVIT code; Maldonado et al. 2015)

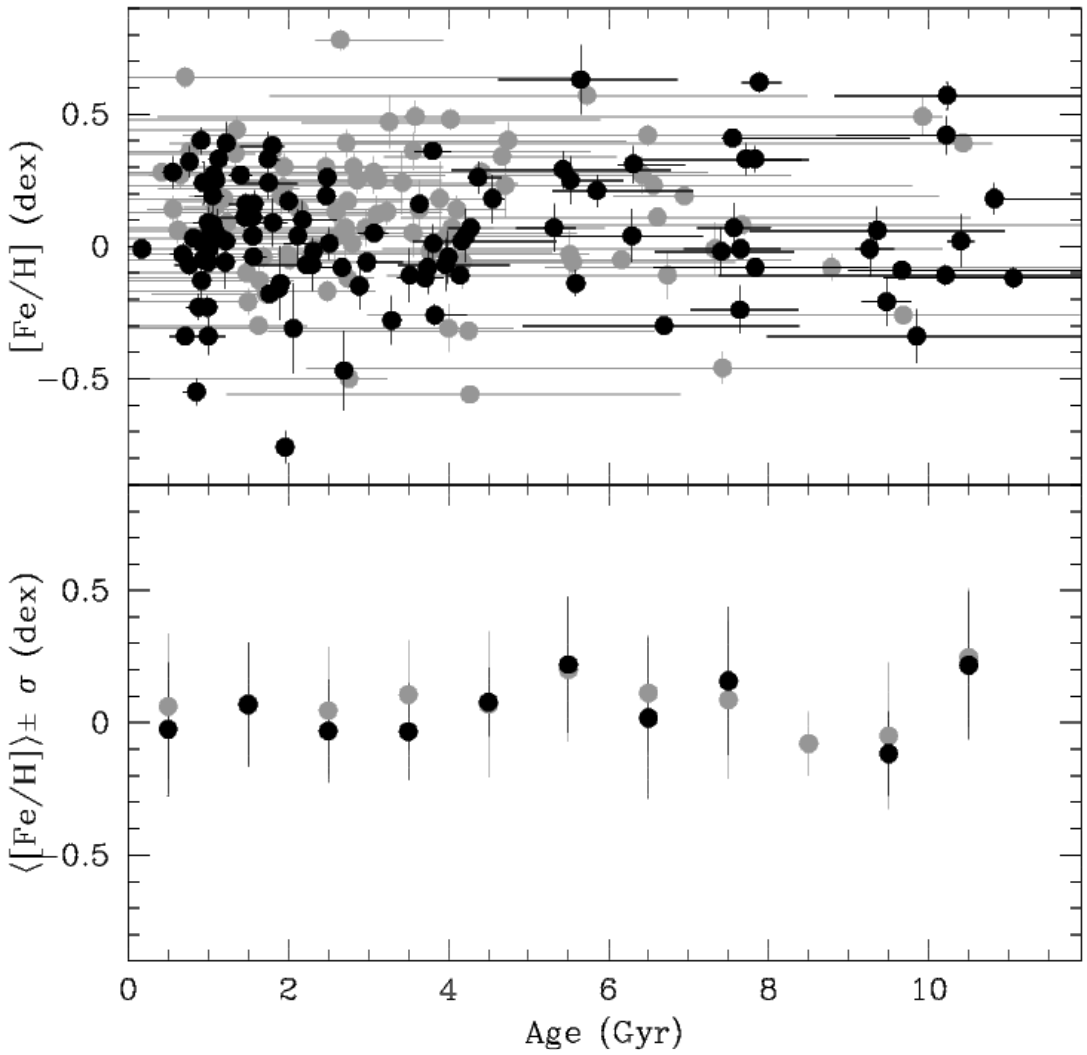
– 102 Rotational velocities from high-resolution spectra (Maldonado et al. 2022)

– 1092 Radial velocities from Gaia (976), LAMOST (68), RAVE (113), APOGEE (37), GALAH (41) and high-resolution spectra (23)

– 340 Hα equivalent widths, hence log(LHα/Lbol), from high resolution spectra plus LAMOST-MRS/LRS

– 111 Shk, hence R‘hk, indexes from HARPS and LAMOST-LRS

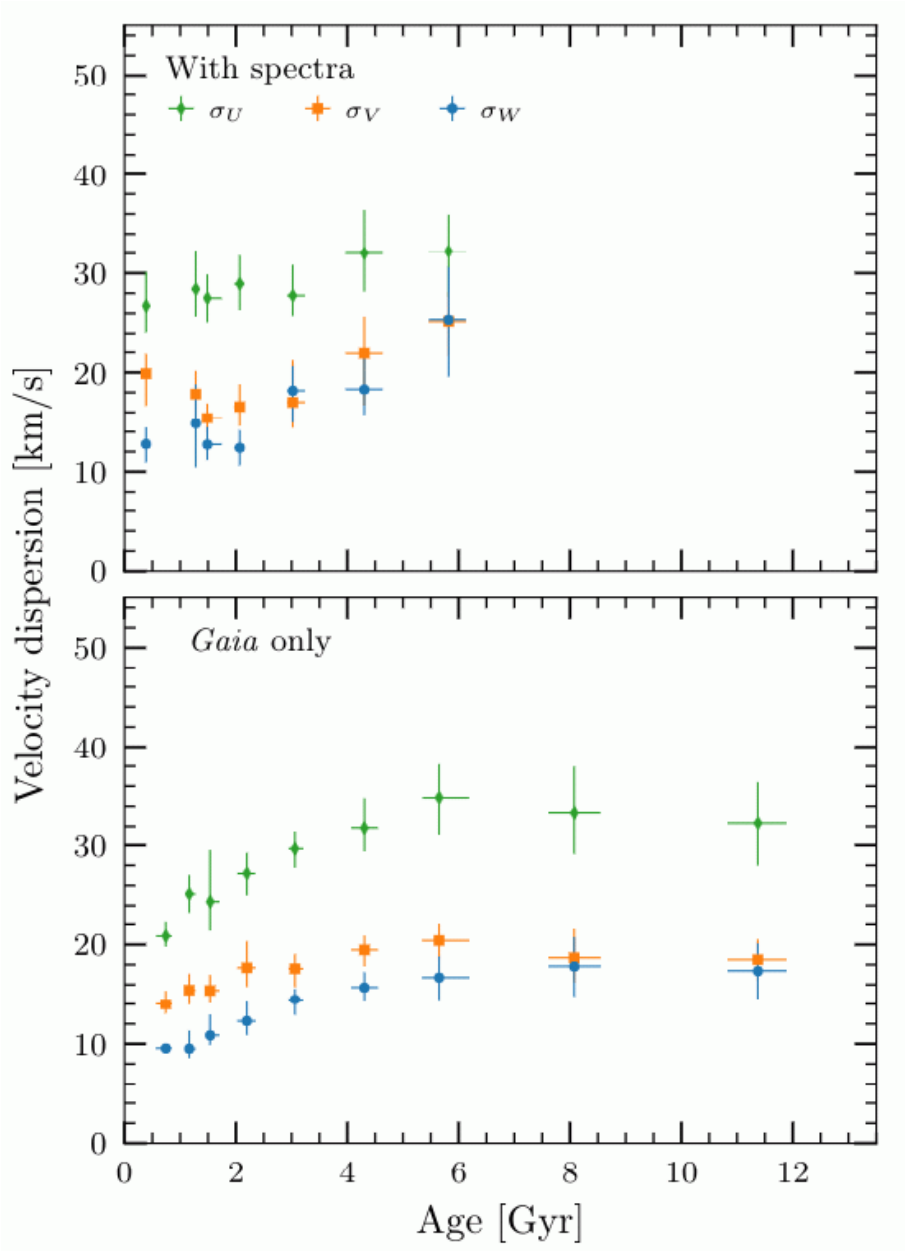
The MW age-metallicity relation



189 stars

Rebassa-Mansergas et al. (2021)

The MW age-velocity dispersion relation

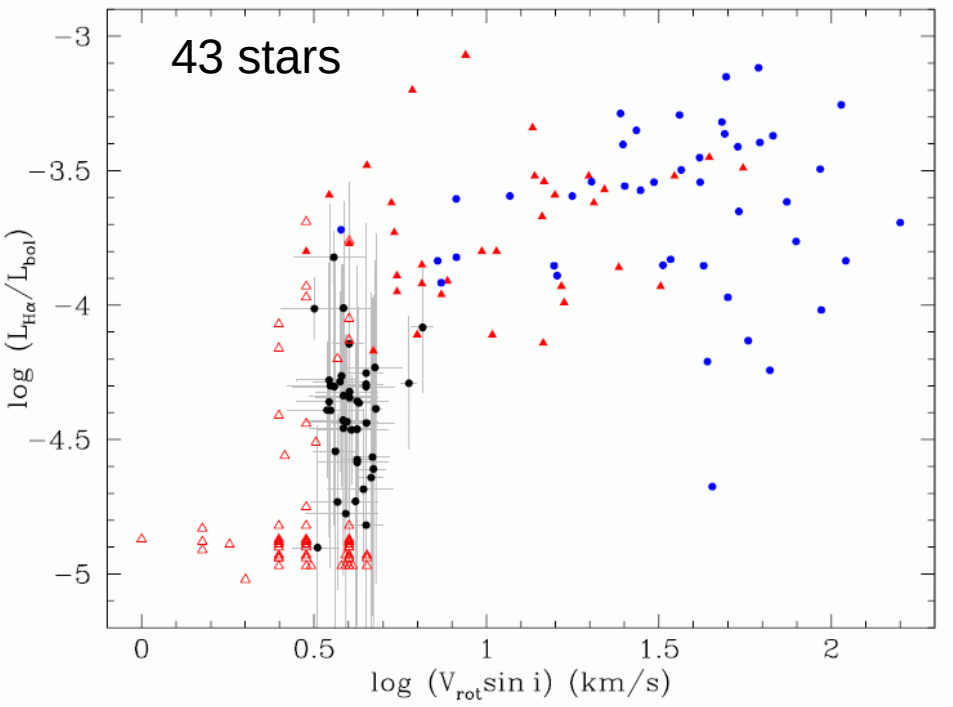


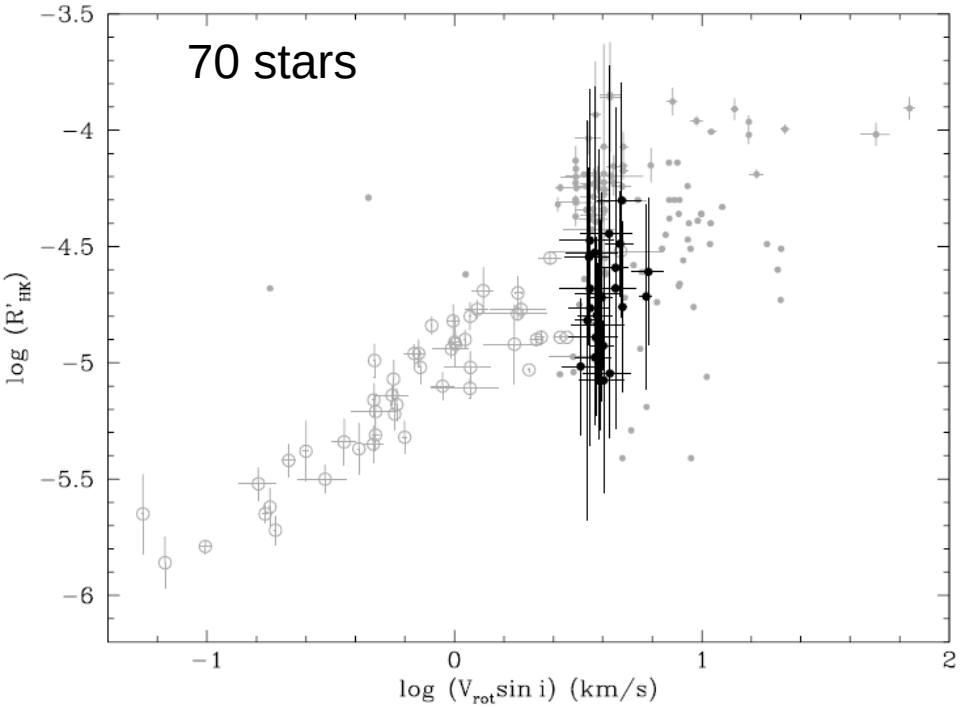
269 stars

976 stars

Raddi et al. (2022)

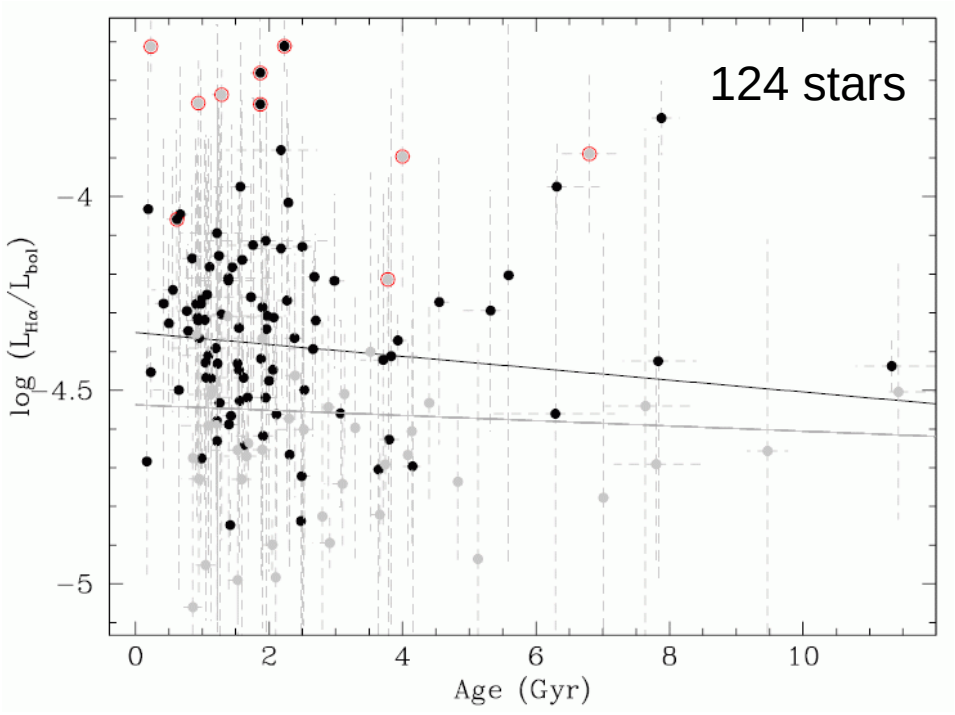
The low-mass MS activity-rotation relation

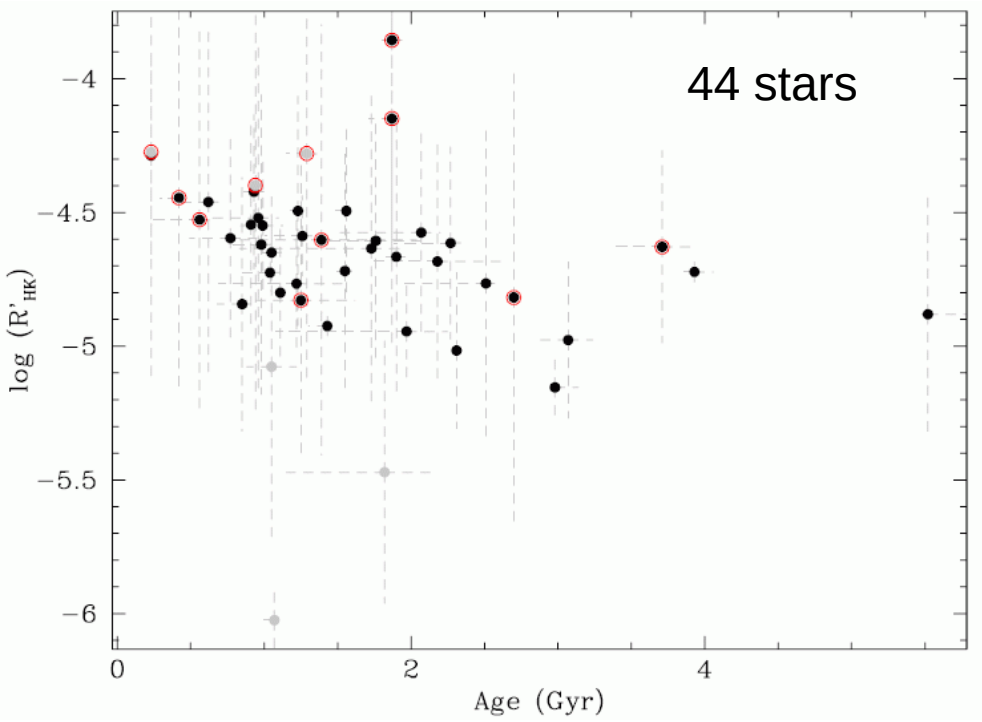




Rebassa-Mansergas et al. (2023)

The low-mass MS activity-age relation





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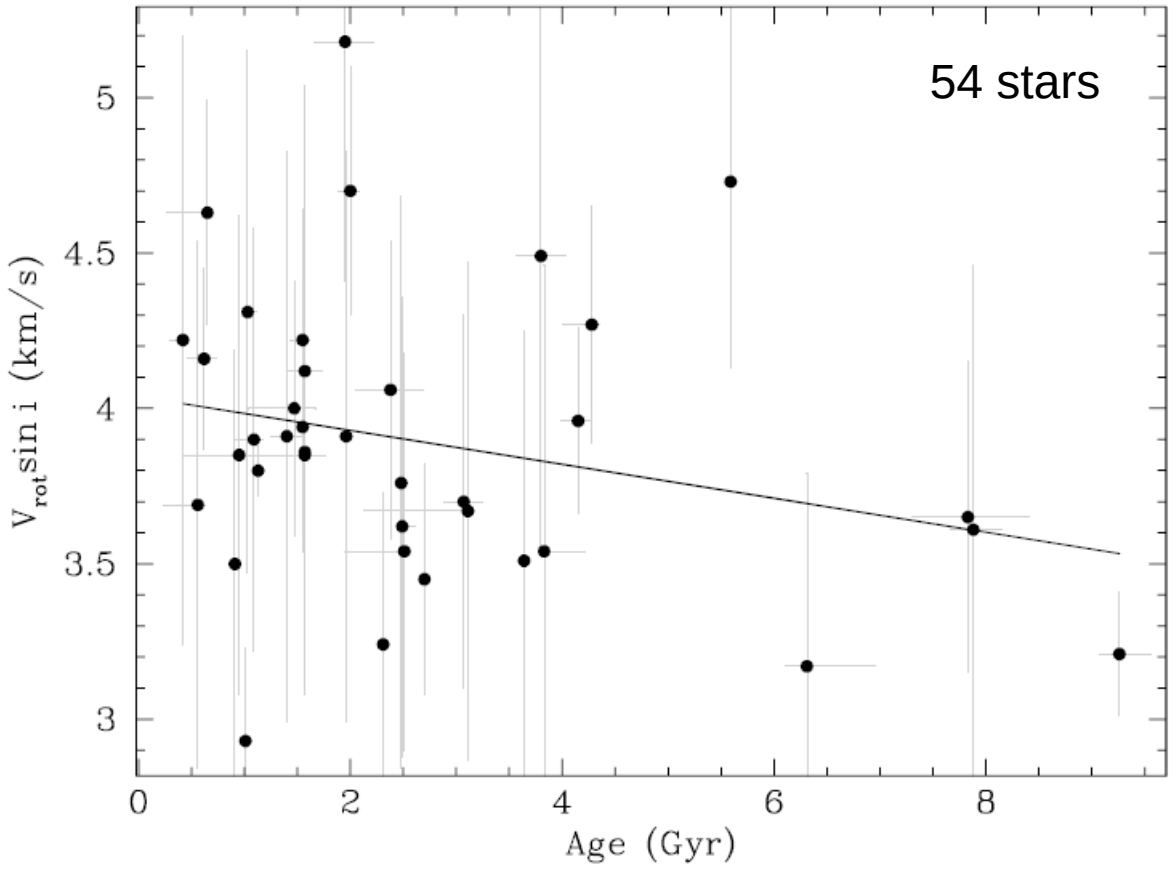
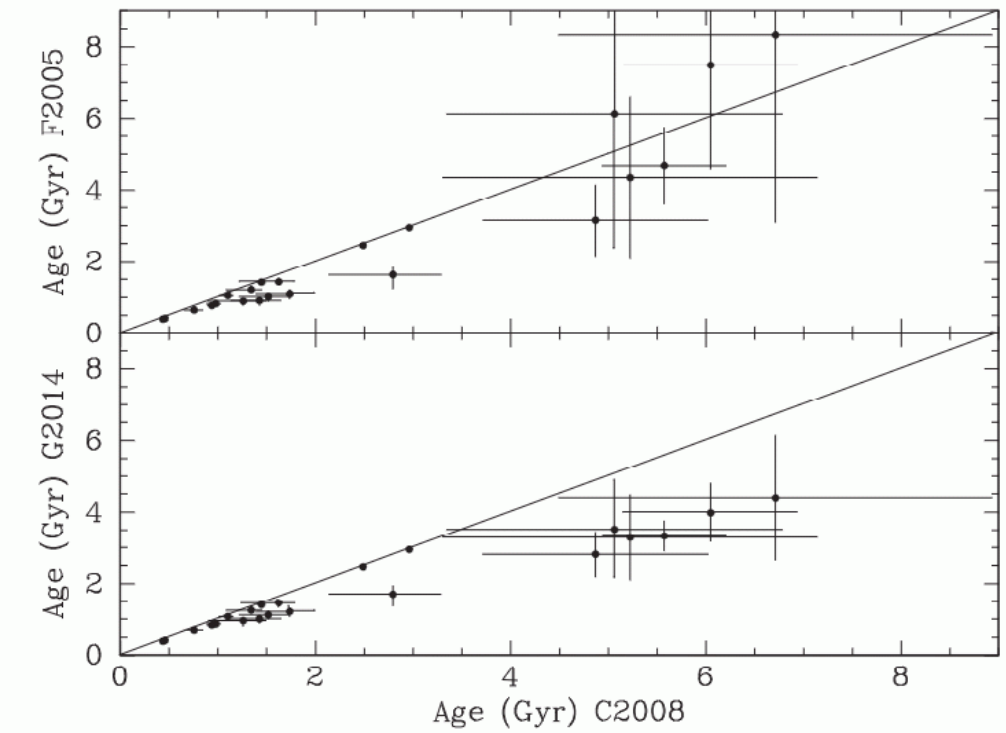
The low-mass MS age-rotation relation



Rebassa-Mansergas et al. (2023)

Potential issues

– Initial-to-final mass relation is not well constrained by observations



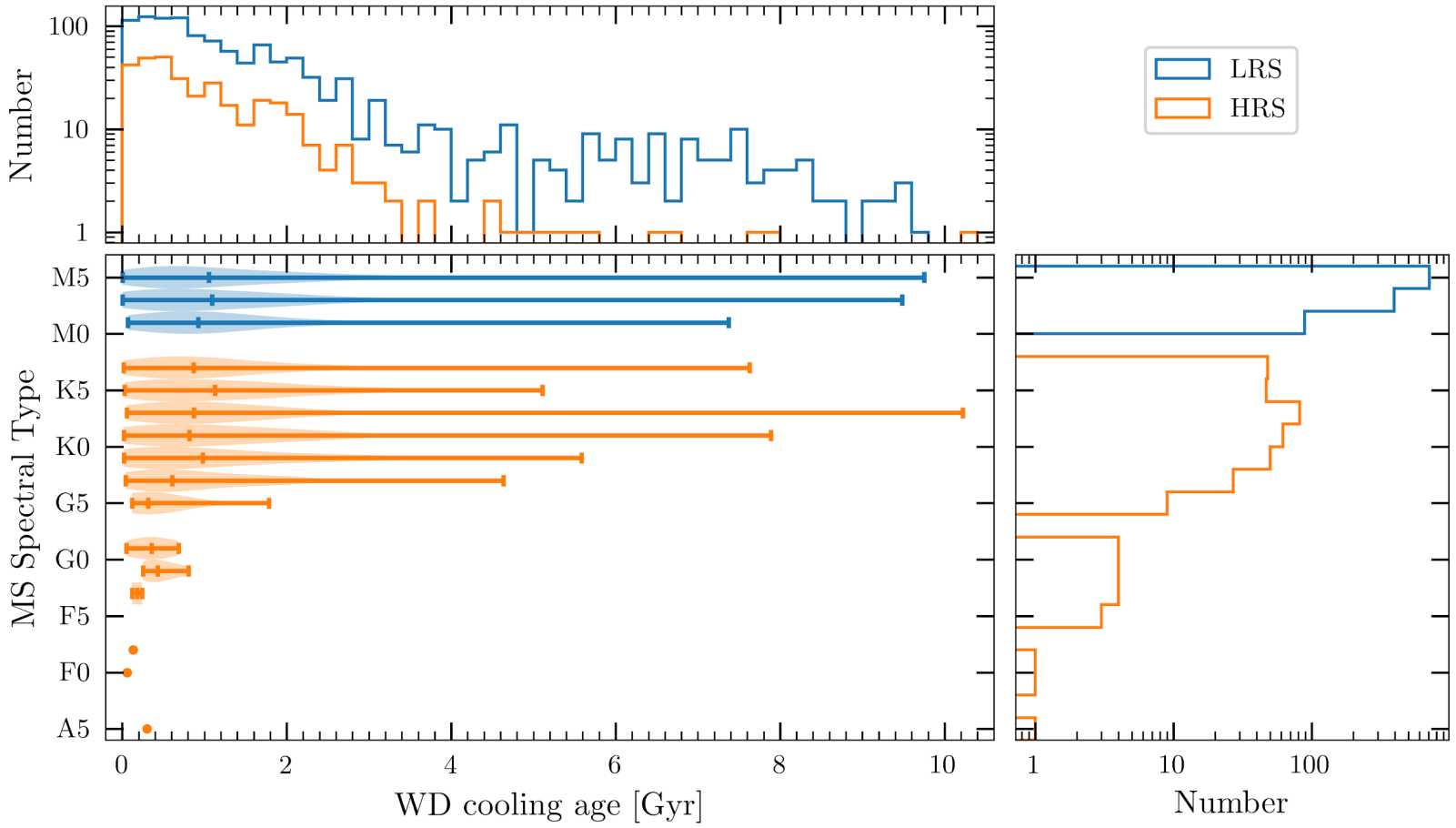
Rebassa-Mansergas et al. (2016)

– White dwarf spectral types

– Lack of all parameters for all stars (homogeneous sample)

The 4MOST white dwarf binary survey

WDB survey is 1 of the 18 surveys of 4MOST and targets WDMS CPMPs in the south (~3500 objects)



Conclusions

- White dwarfs are excellent tools to analyse/test relations between age and other parameters
- The results so far agree with previous works and theoretical expectations
- 4MOST will provide an homogenous and considerably larger sample of white dwarf-main sequence common proper motion pairs with ages and stellar parameters