Gaia-ESO Survey Second Science Meeting, 10–13 November 2014, Porto

Gaia-ESO Survey data to constrain stellar evolutionary models

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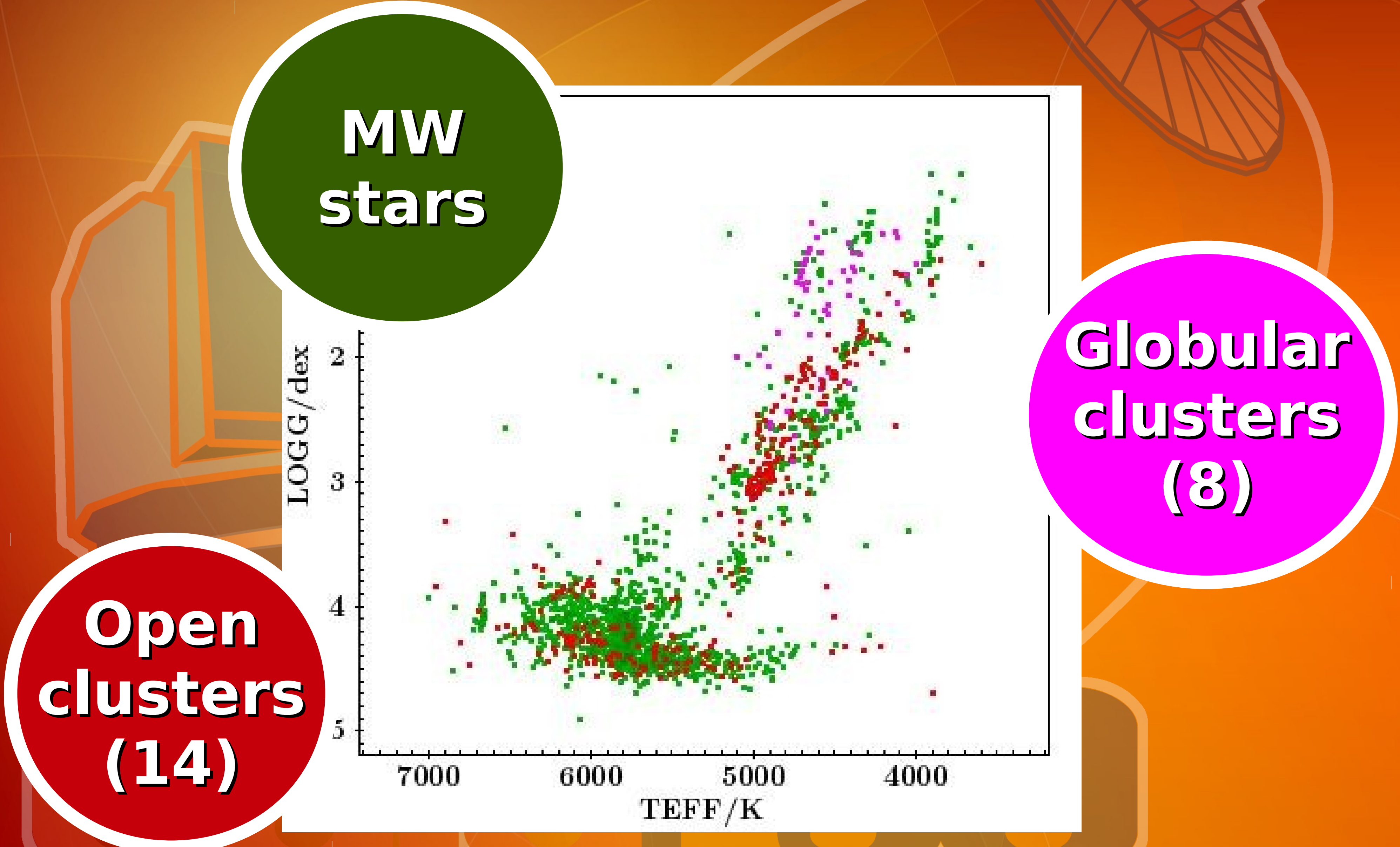
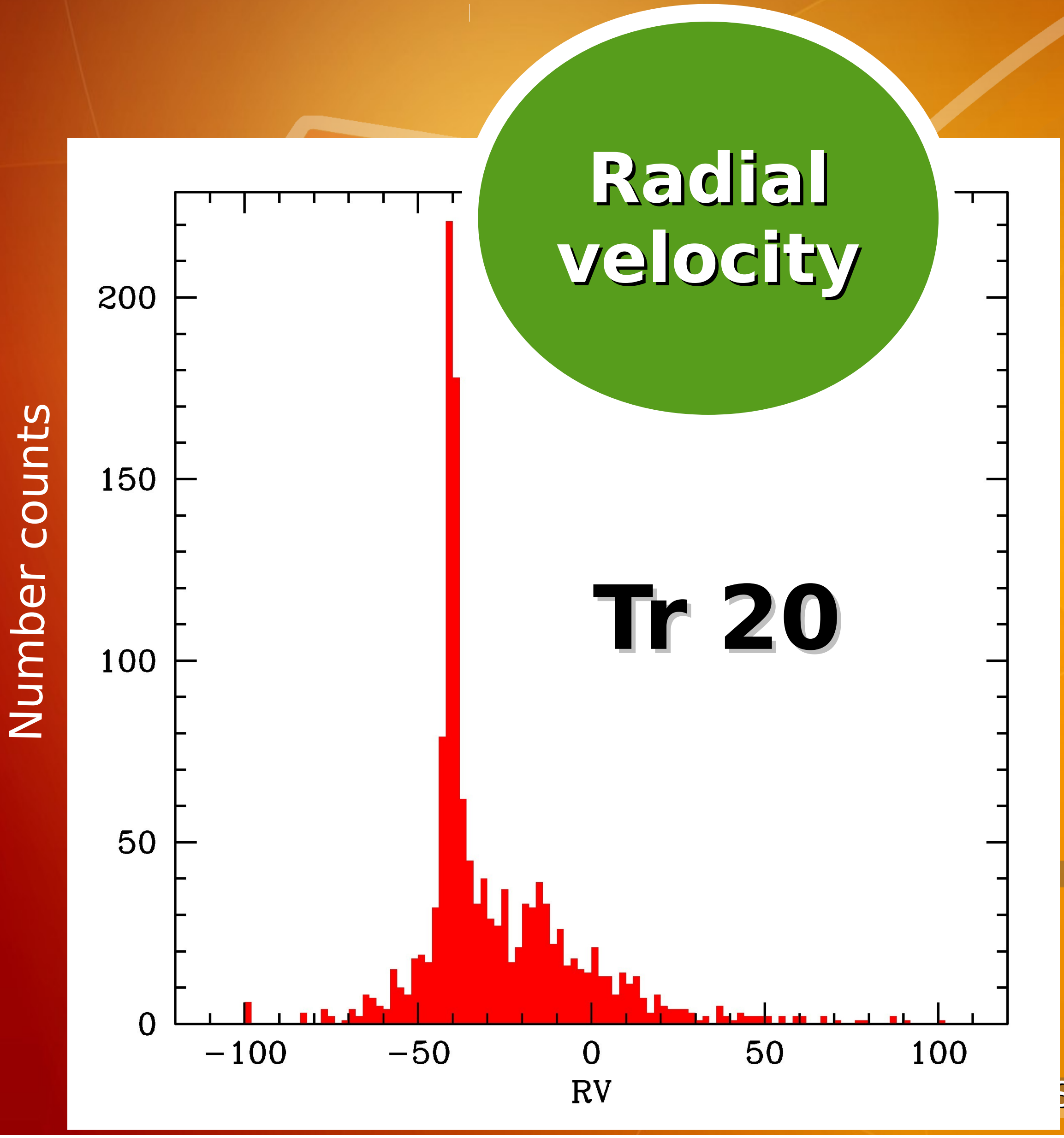
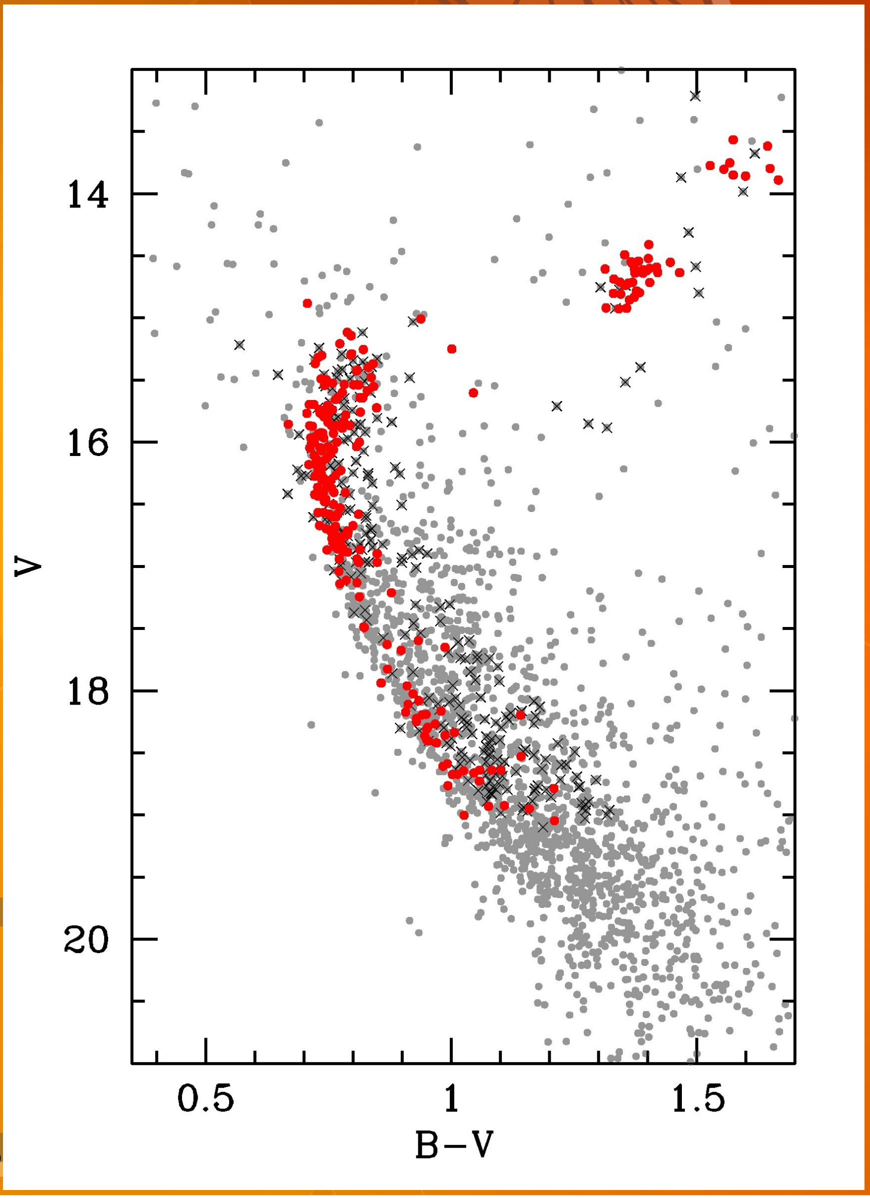
GES and stellar evo: iDR2



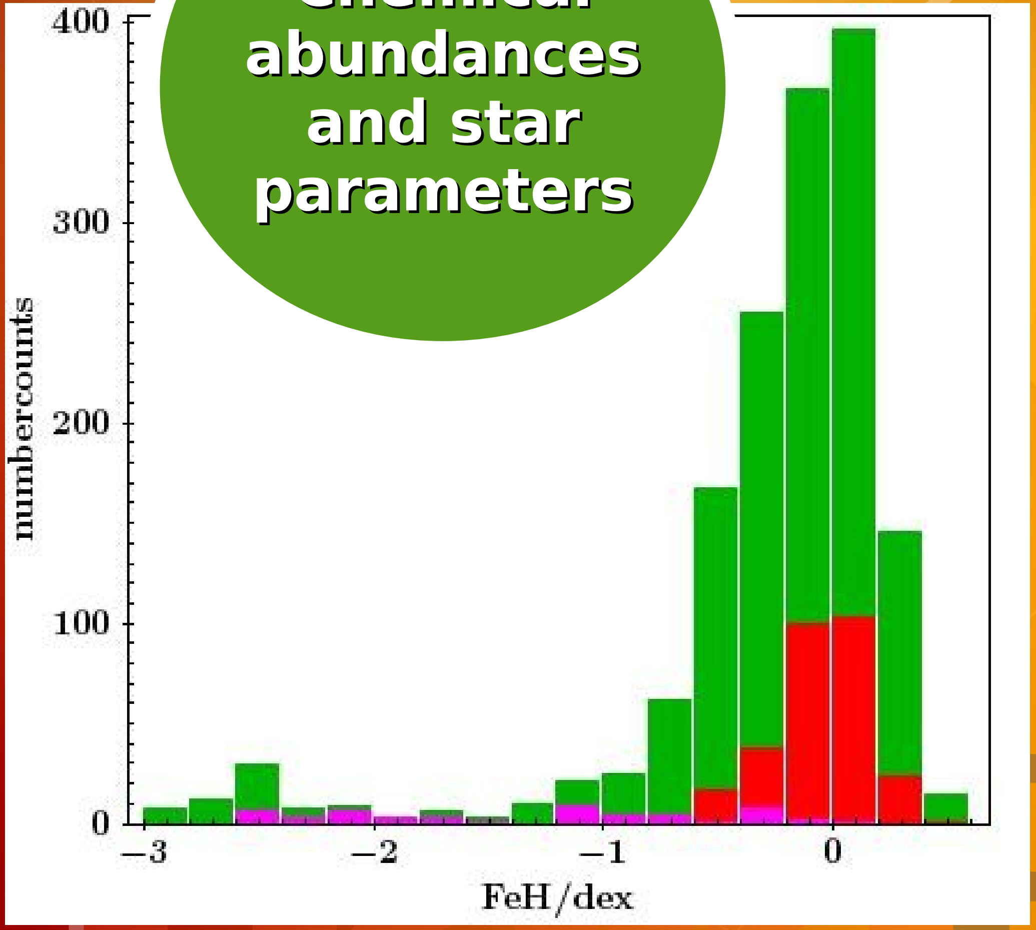
Kinematic and Chemistry to understand stellar evolution

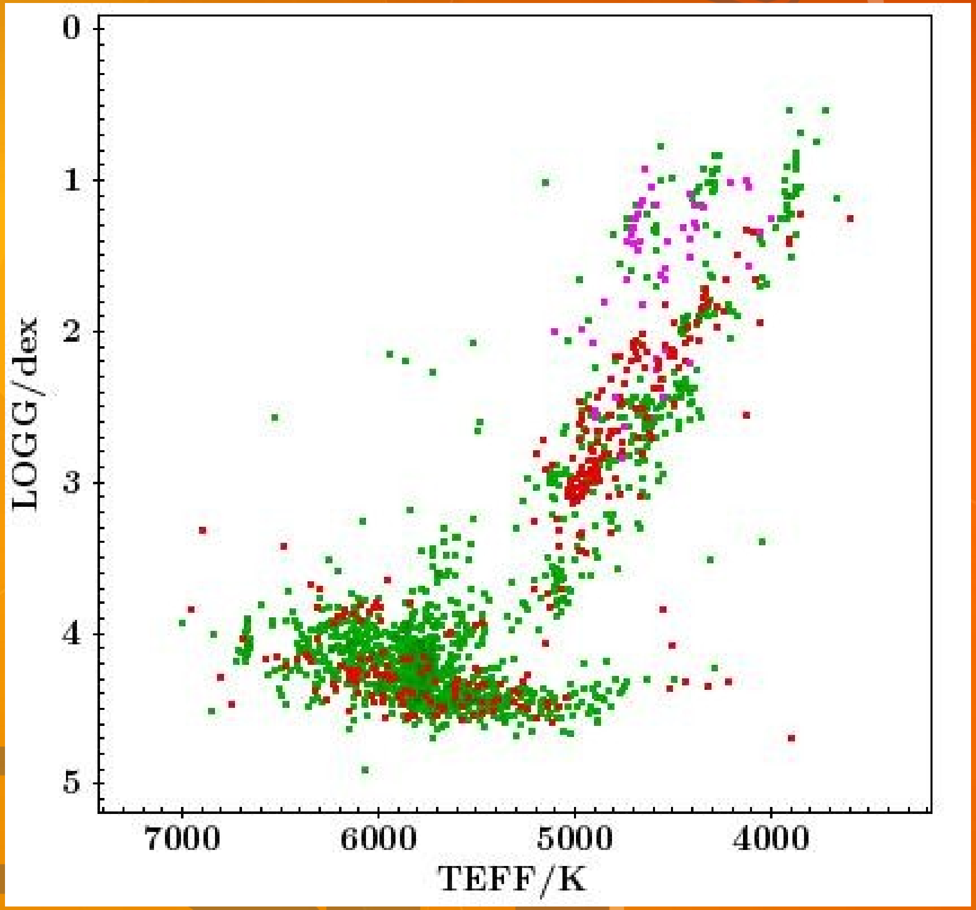




Kinematic and Chemistry to understand stellar evolution

Chemical abundances and star parameters





GES: calibration of stellar models

Shape of IMF and its universality

Timescale of SF and SF history

Improved basis for field star age determination

Initial to final mass relation in WD

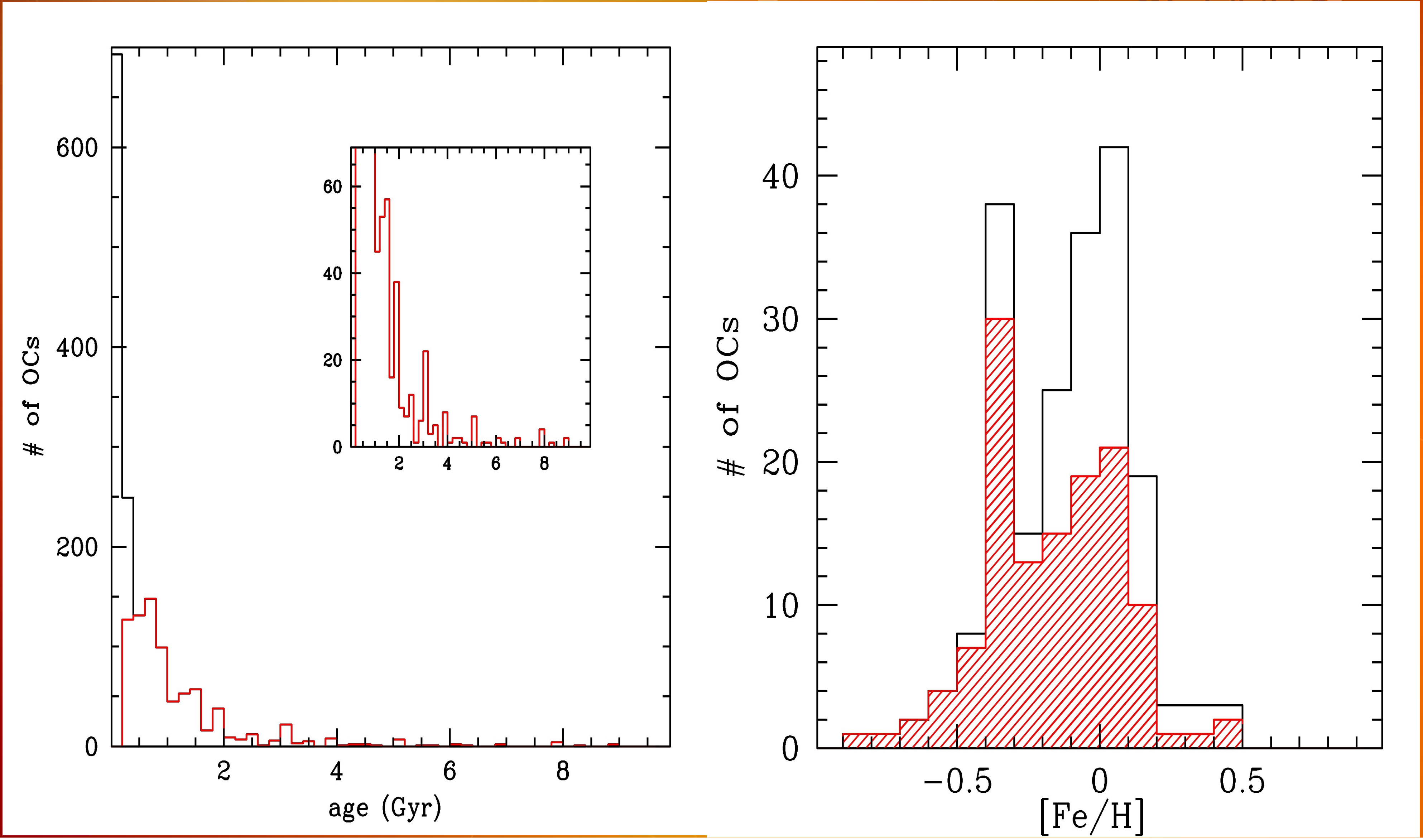
Calibration of HR diagram from Milky Way open clusters

GES core science: to use OCs to test stellar evolutionary models

http://great.ast.cam.ac.uk/GESwiki/Gesproj

The Open Clusters as ideal testbeds for stellar evolution

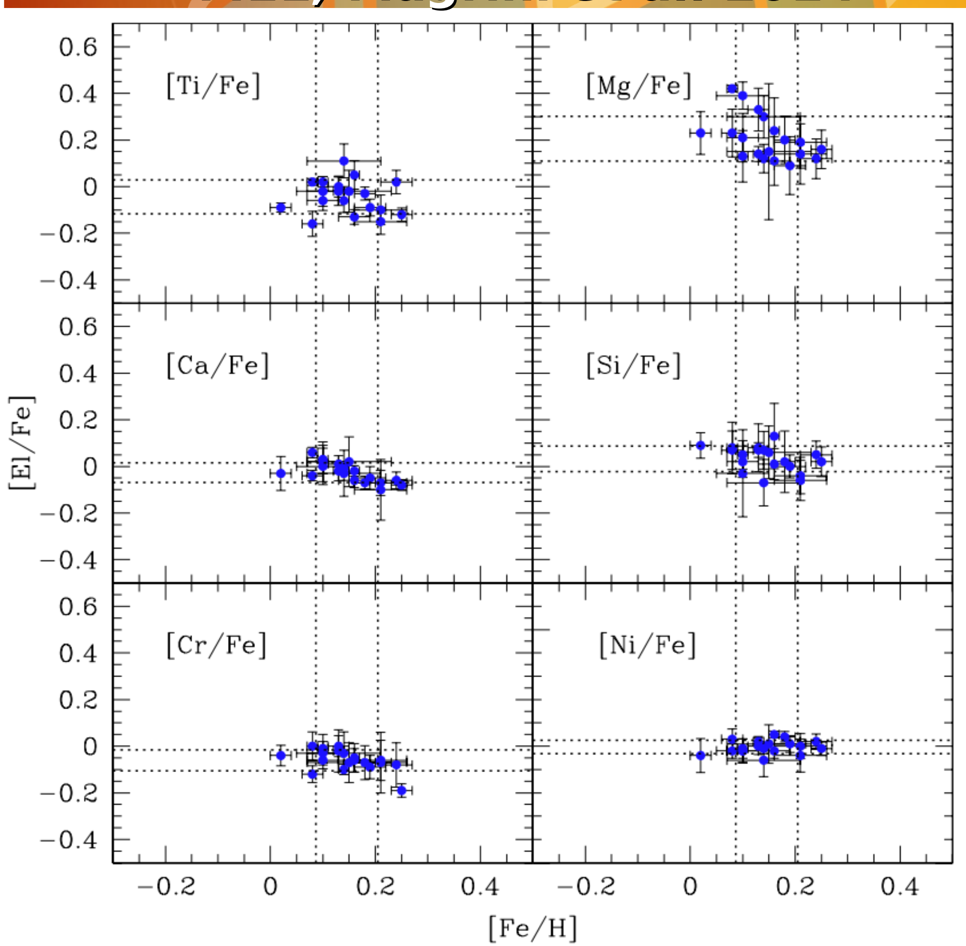
DAML catalogue, Dias et al. 2002



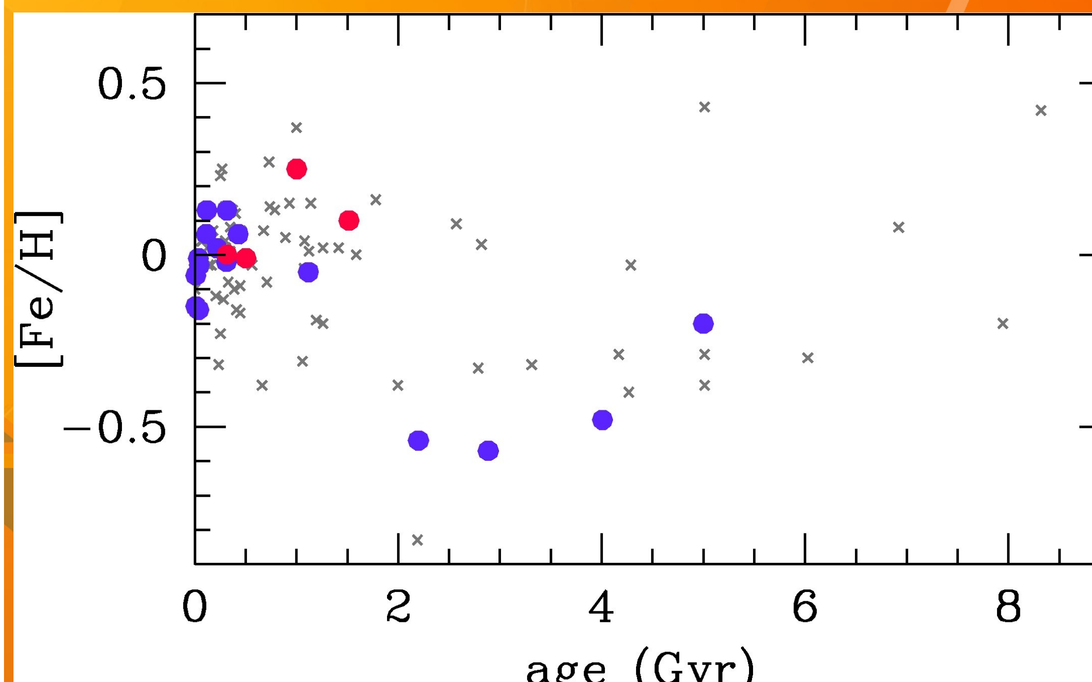
OCs ~ SSPs

Open clusters are aggregates of coeval and chemically homogeneous stars. They are the best approximation of simple stellar populations (SSPs) we have in nature

M11, Magrini et al. 2014

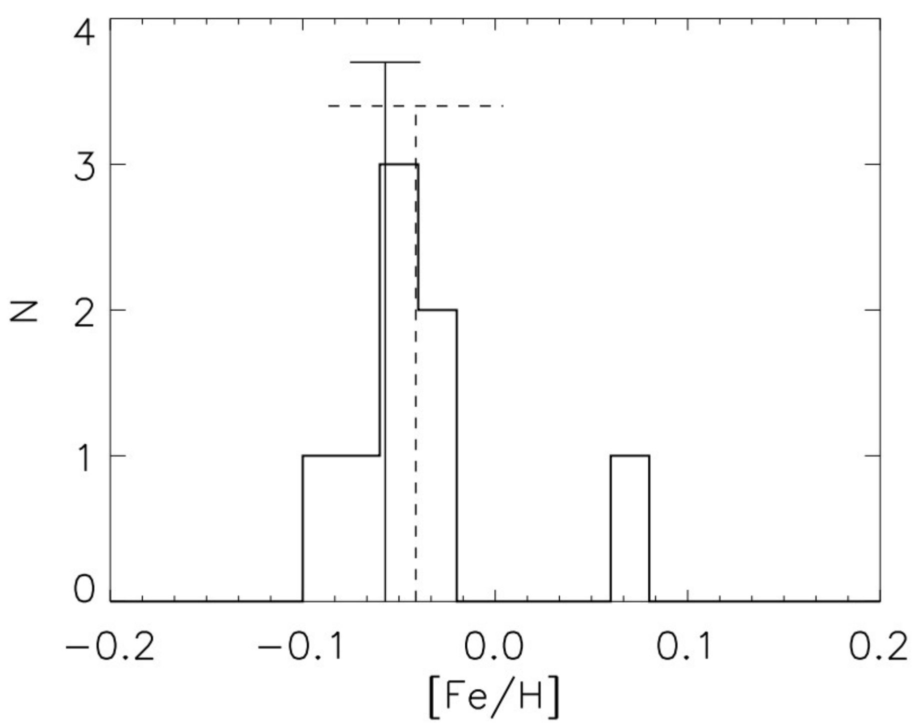


Heiter et al. 2014 and GES



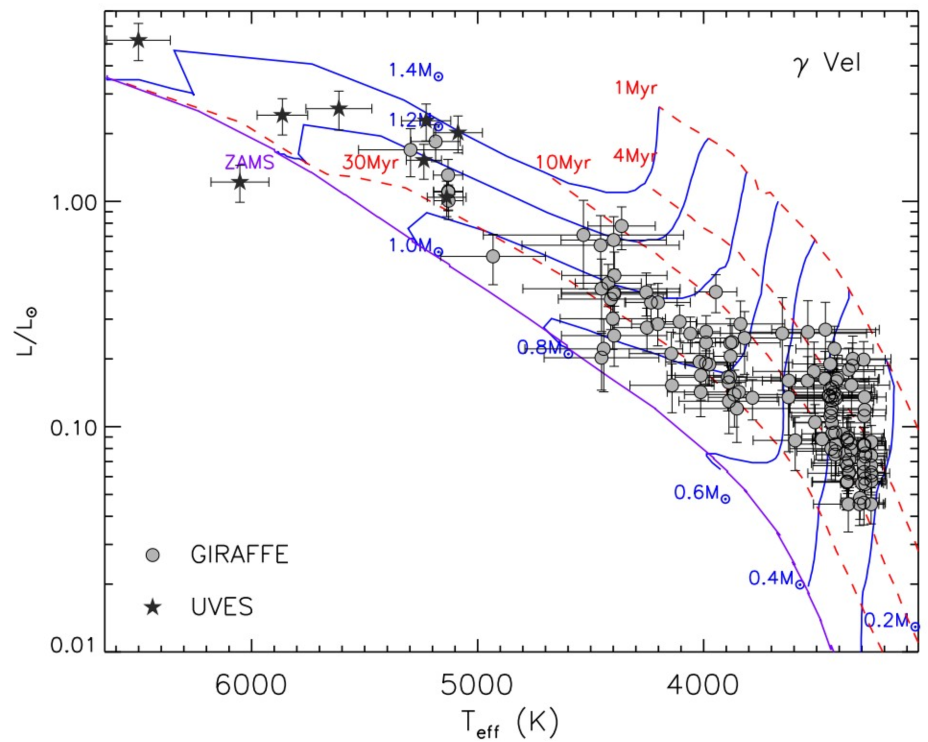
The Young Open clusters perspective

Chemical properties

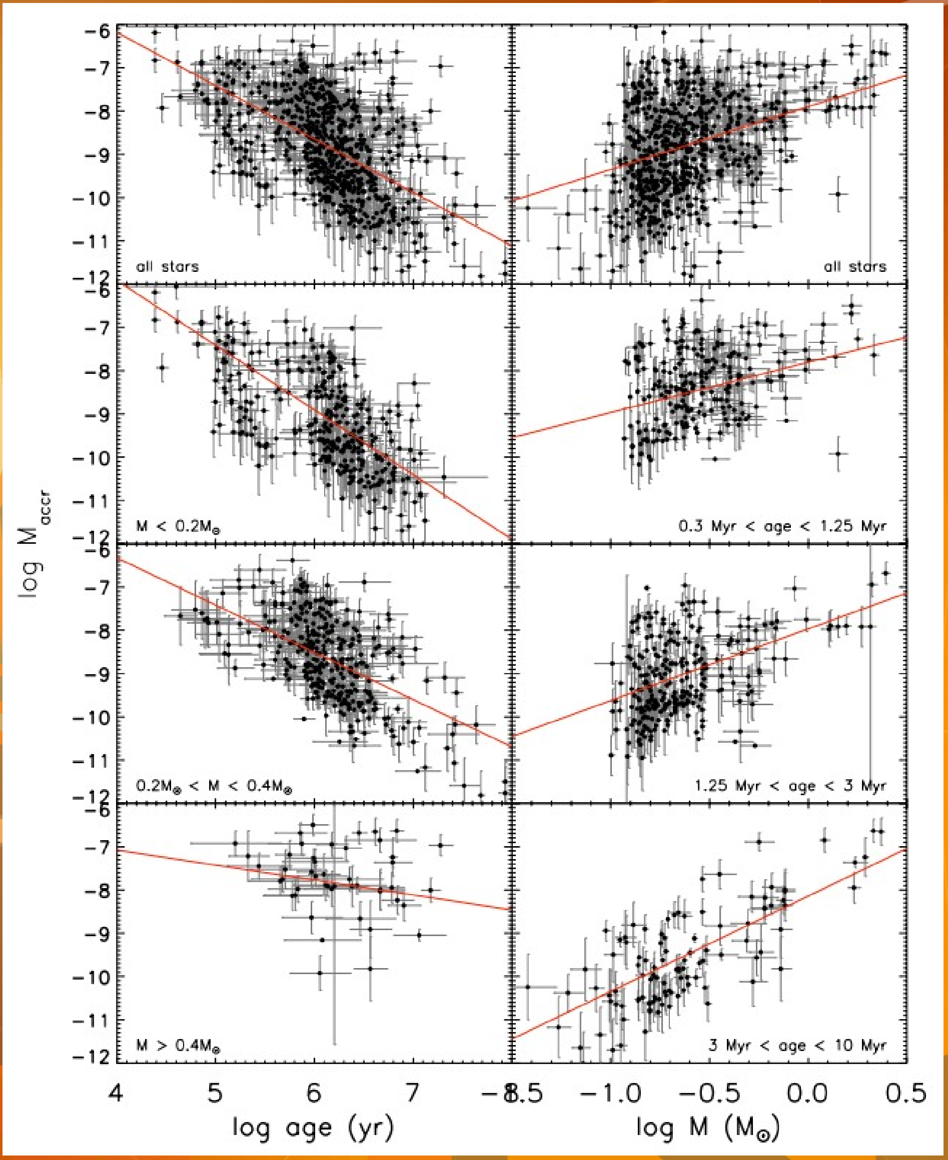


GannaVel, Spina et al. 2014

Pre-Main Sequence stars
(see Frasca et al. GES paper 21)

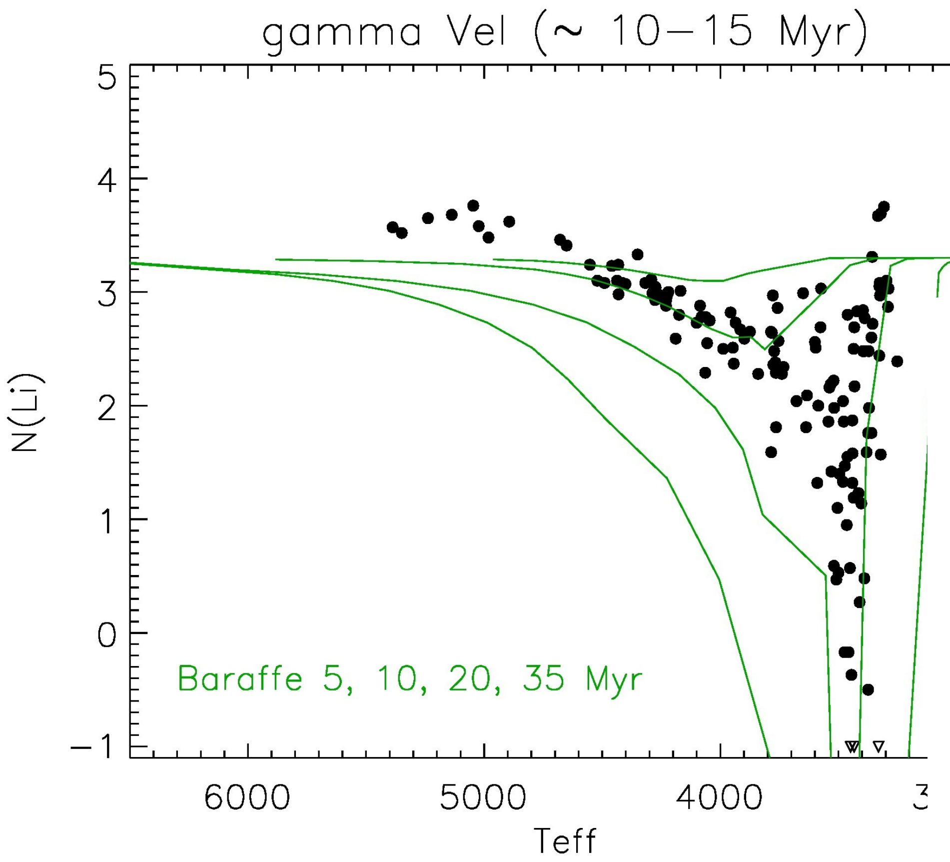


PMS stars and stellar evolution

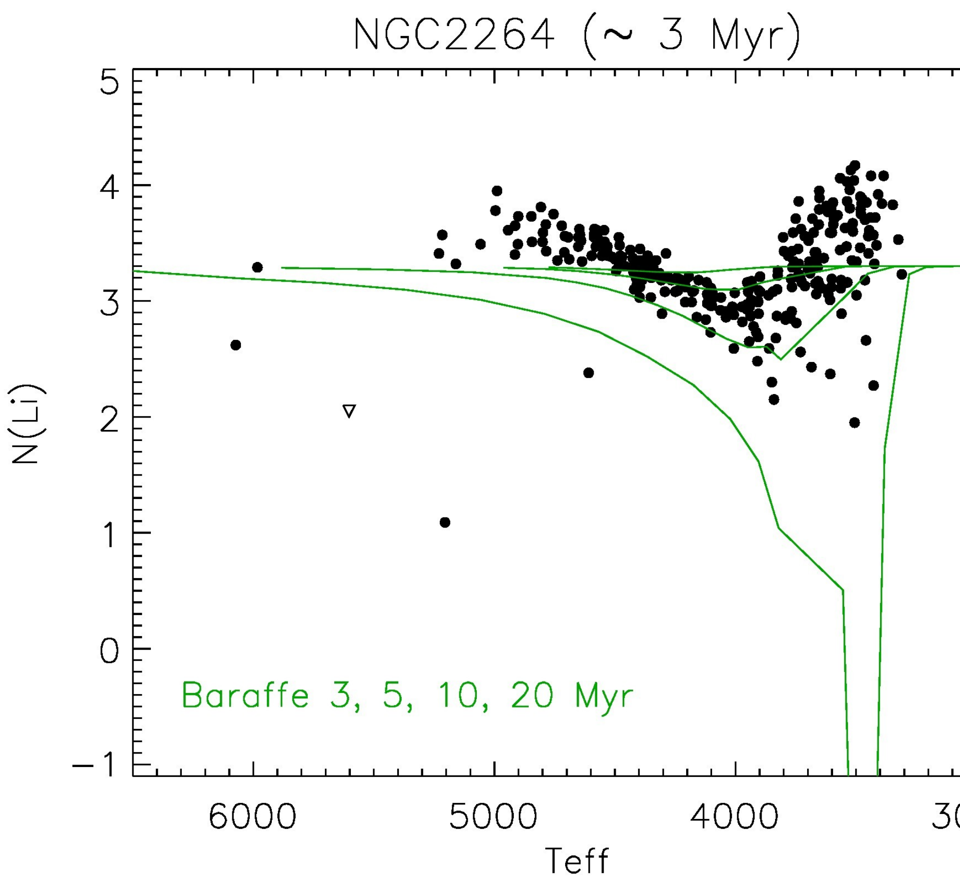


Orion Nebula cluster, Manara et al. 2012

PMS stars and stellar evolution



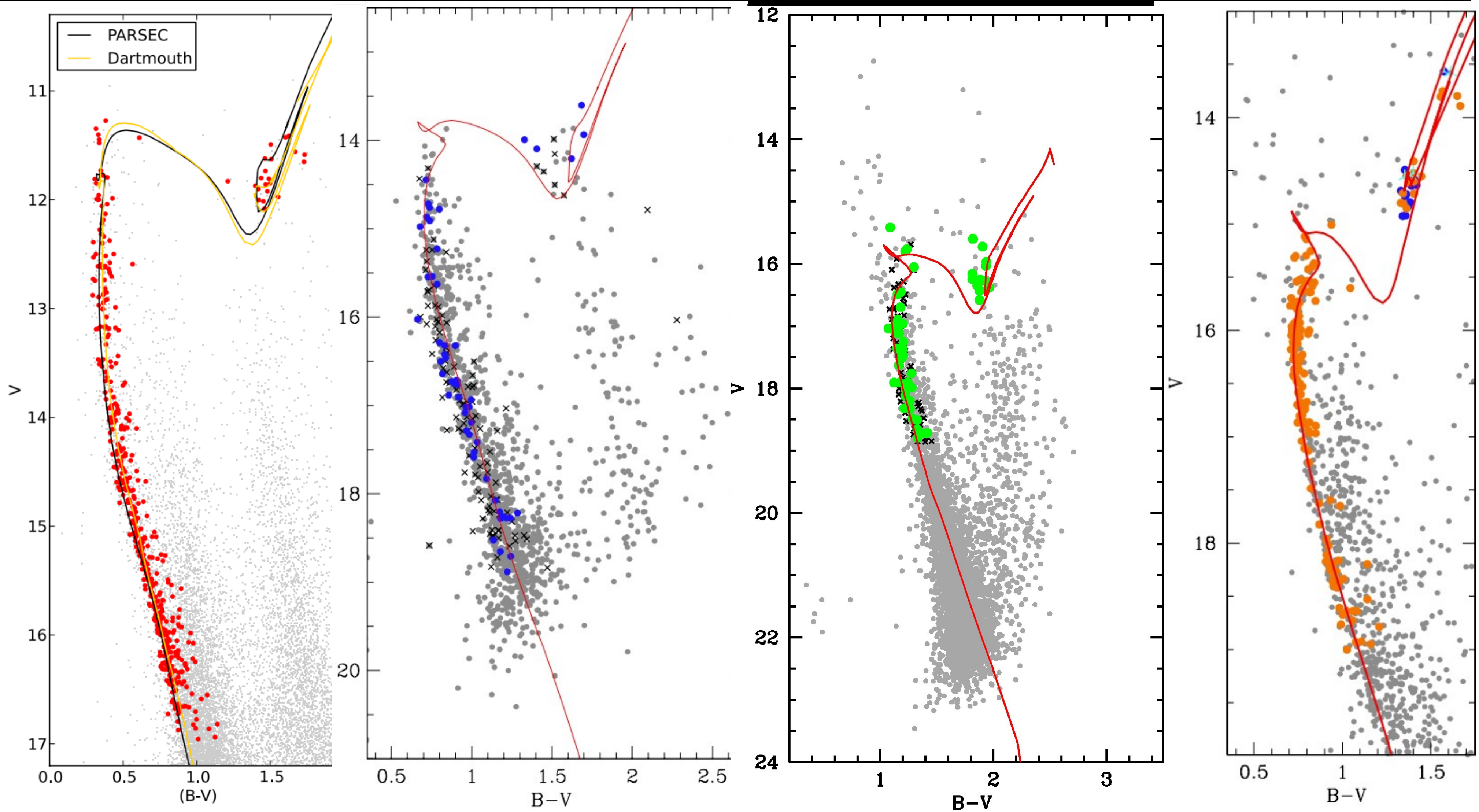
See Franciosini poster



Gravities, rotation, magnetic activity have an important impact on the evolution of PMS stars

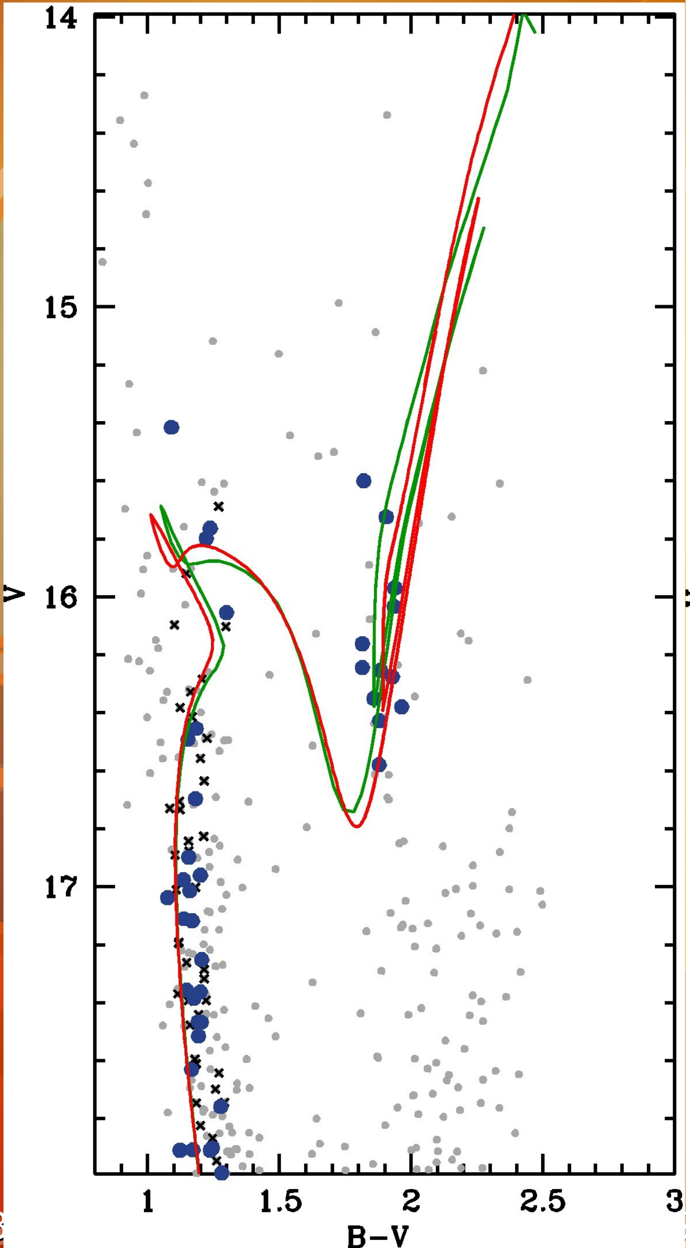
The Old Open clusters perspective

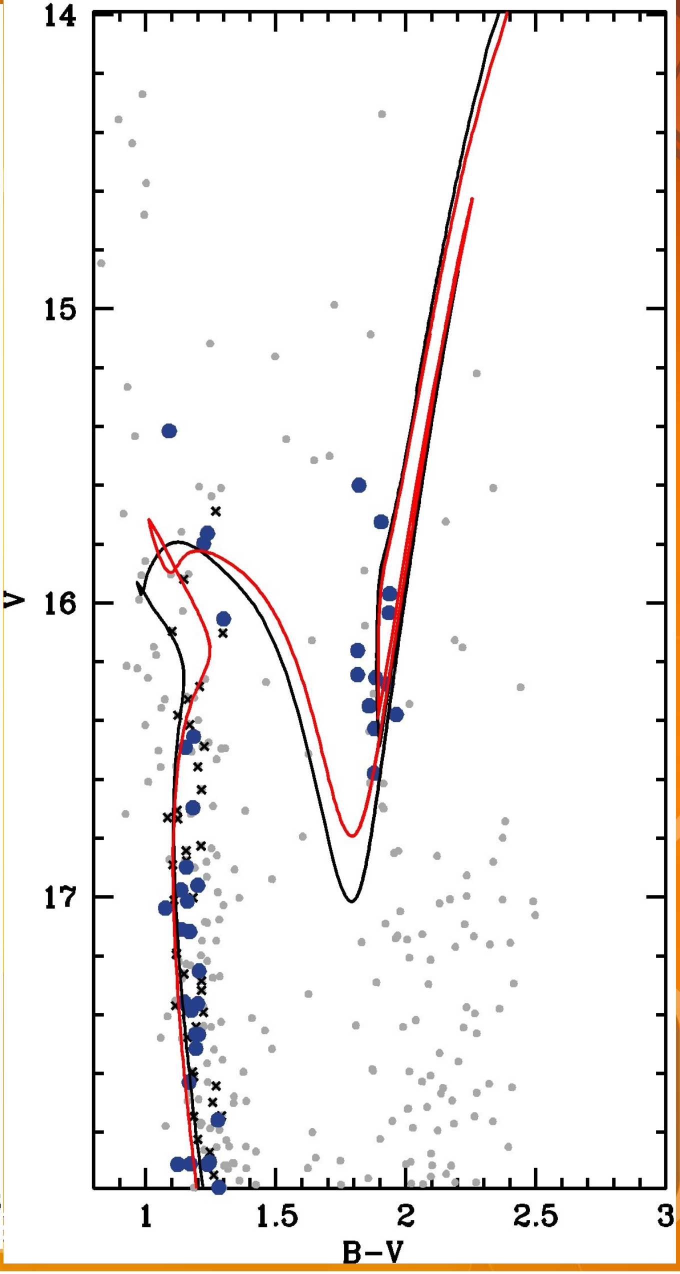
M11	NGC4815	Be81	Tr20
Cantat-Gaudin et al. 2014	Friel et al. 2014	Magrini et al. in prep.	Donati et al. 2014



The Old OCs: Be81

BASTI vs PARSEC isoc



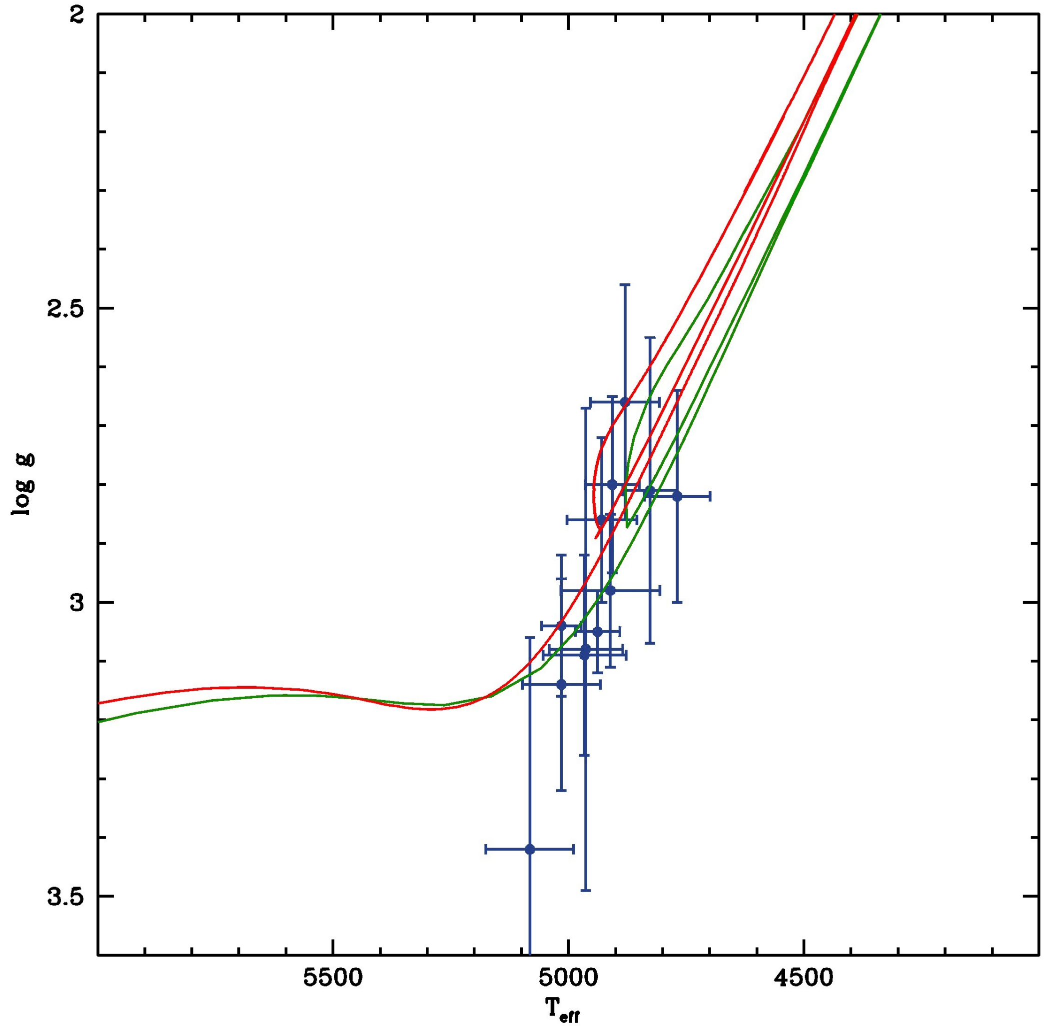


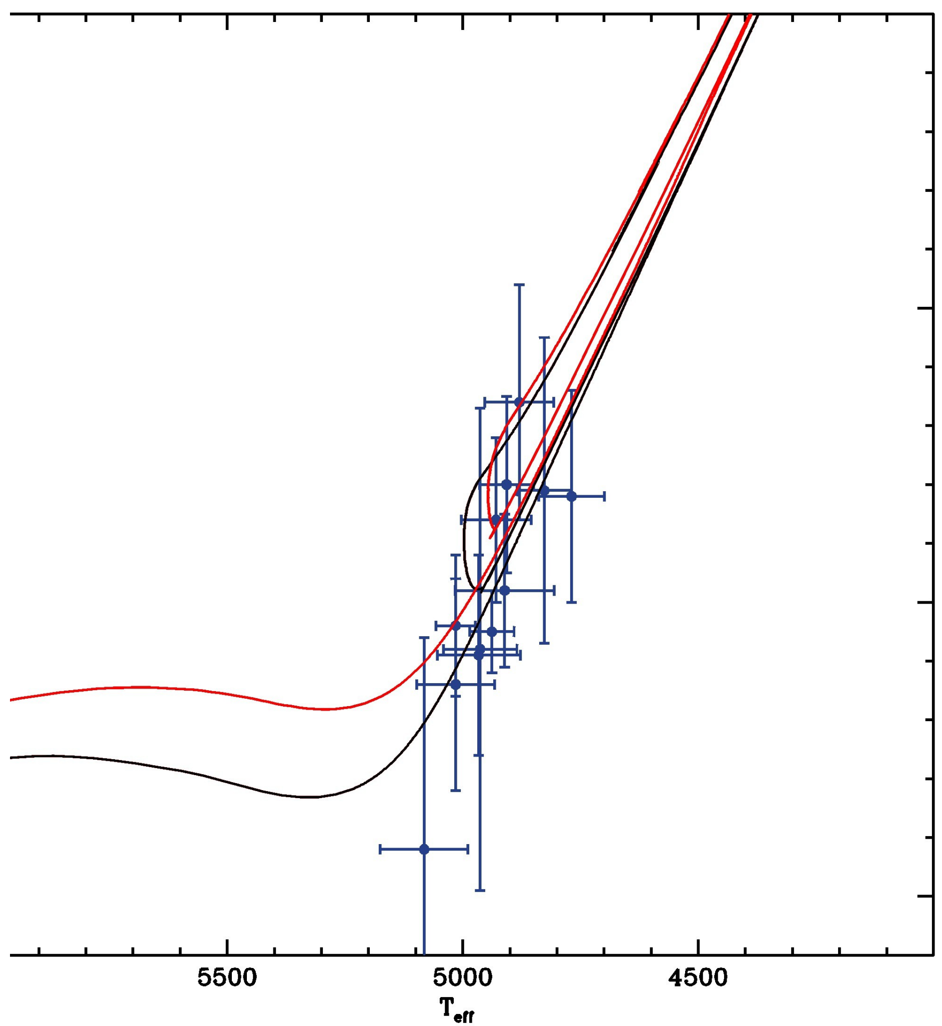
OV vs NO-OV BASTI isoc

The Old OCs: Be81

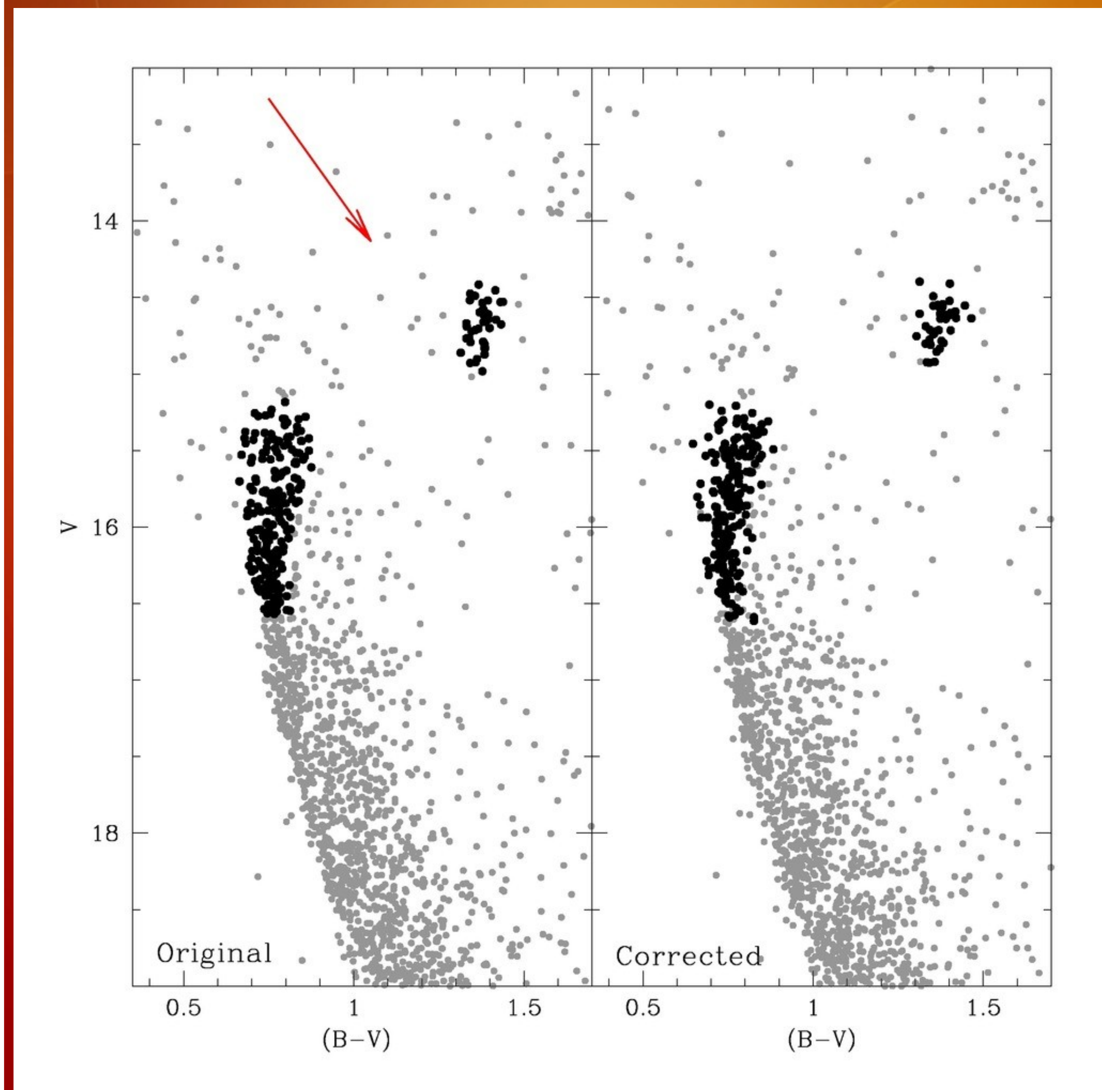
BASTI vs PARSEC isochrones

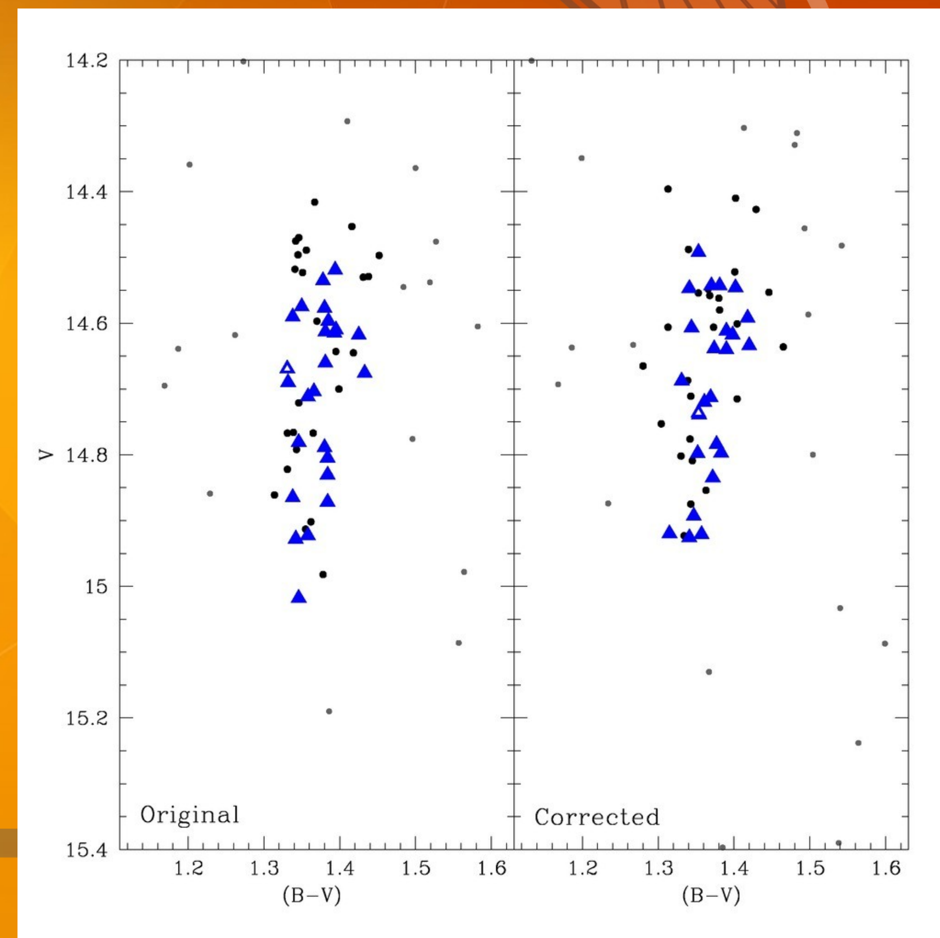
OV vs NO-OV BASTI isochrones





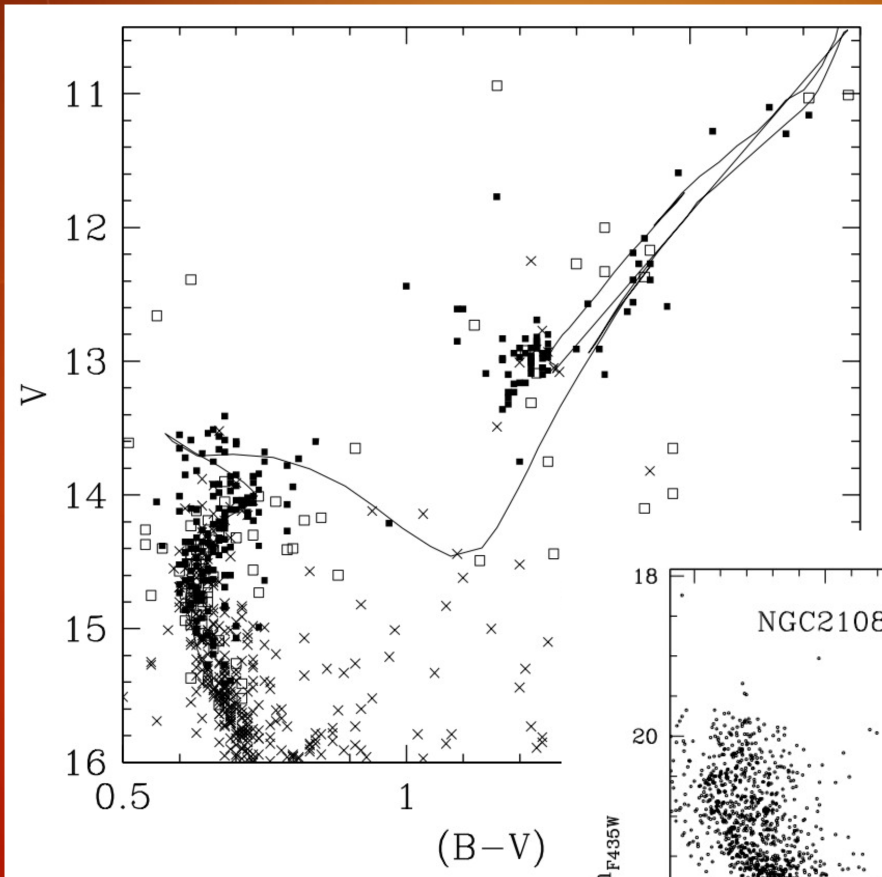
The Old OCs: the RC of Tr20 and its golf-club shaped MSTO





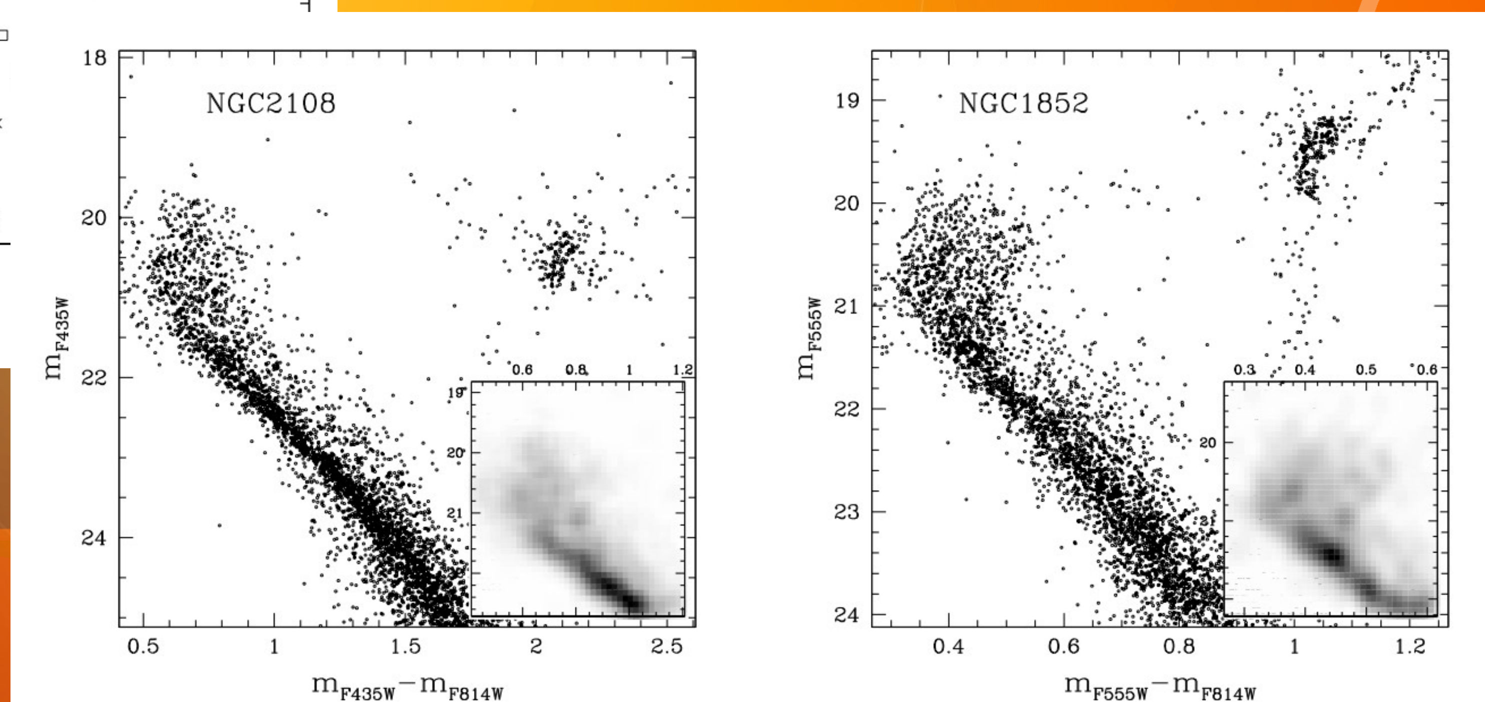
Donati et al. 2014

Other cases not only in the MW



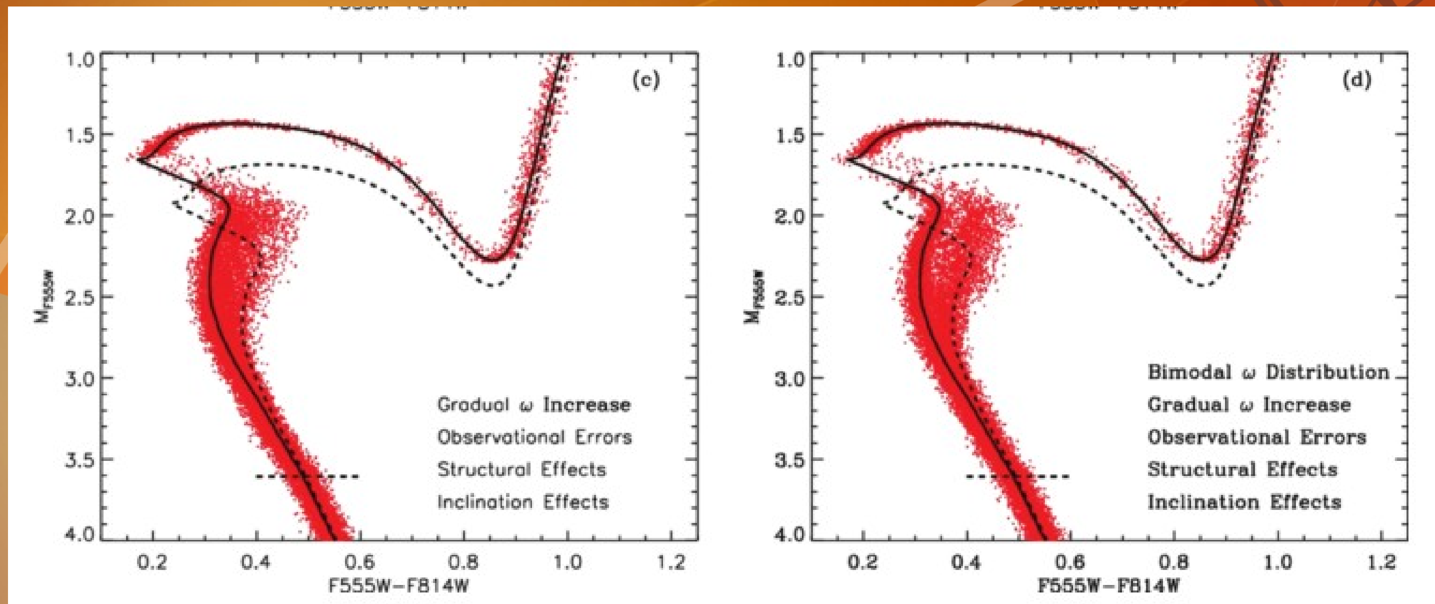
NGC7789
Girardi et al. 2000

Milone et al. 2009

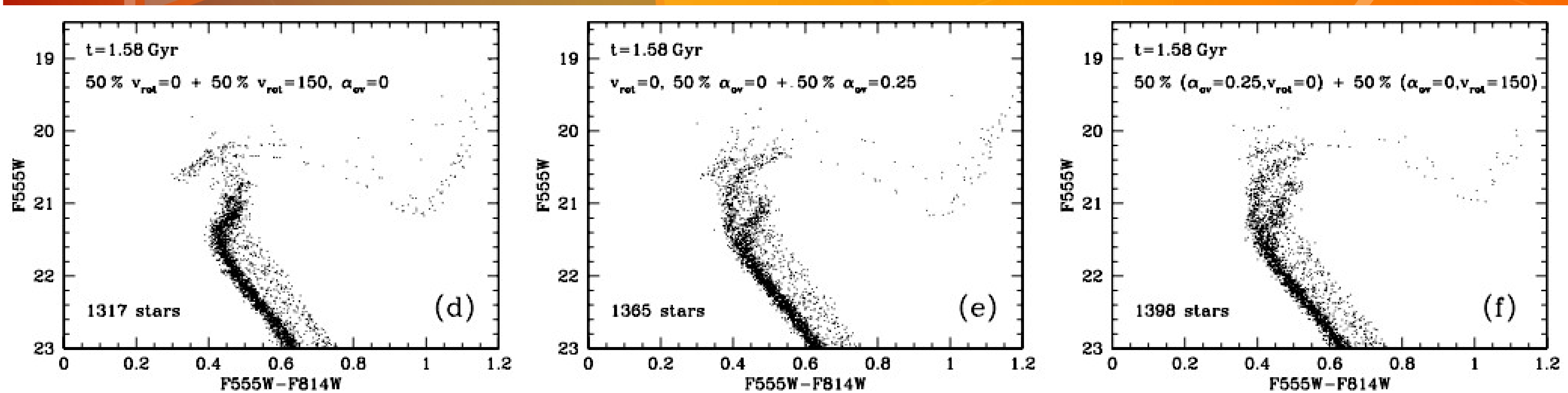


The effect of rotation

Bastian & de Mink 2009



Girardi et al. 2011



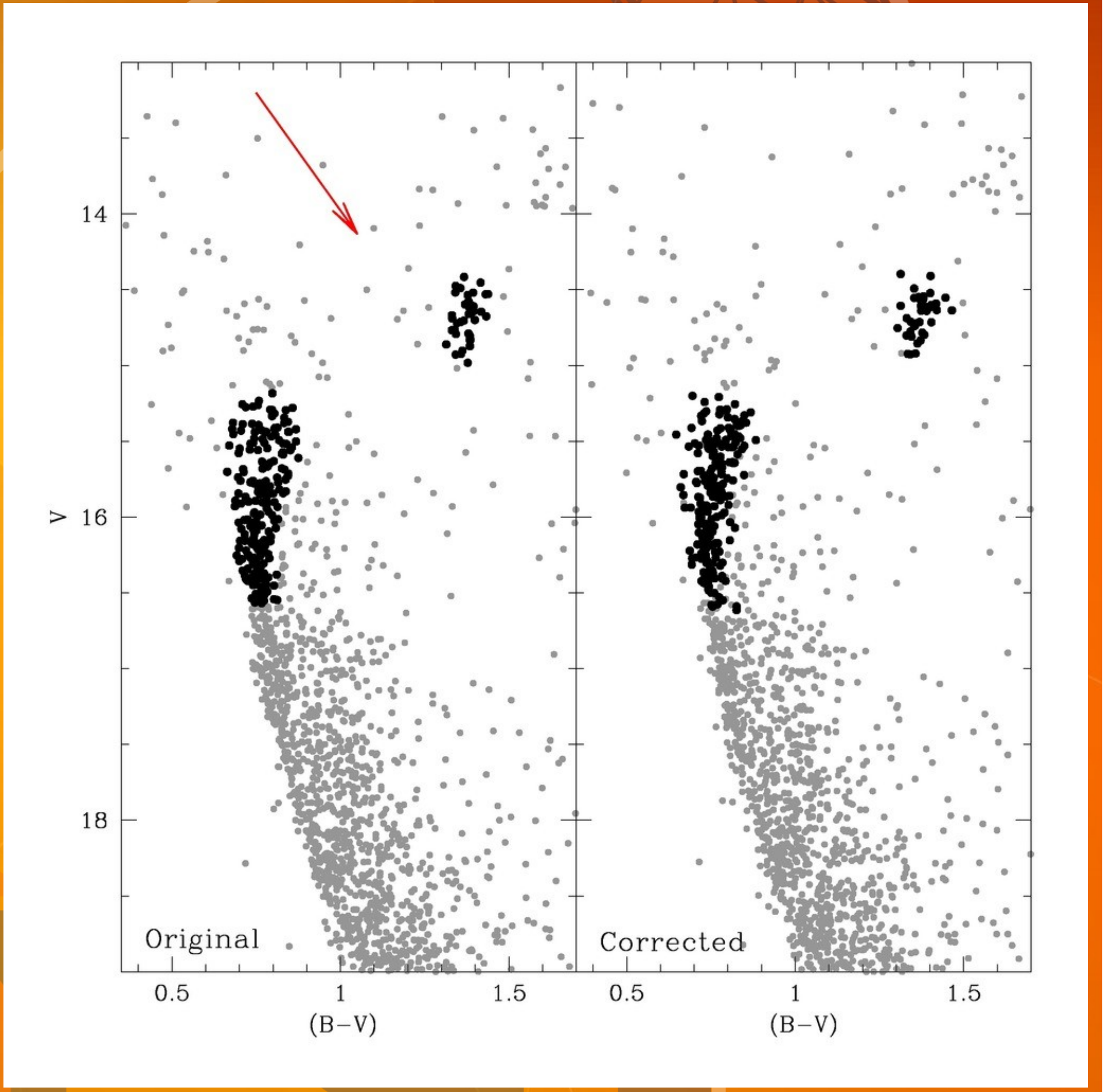
Viable explanations

MSTO/RC

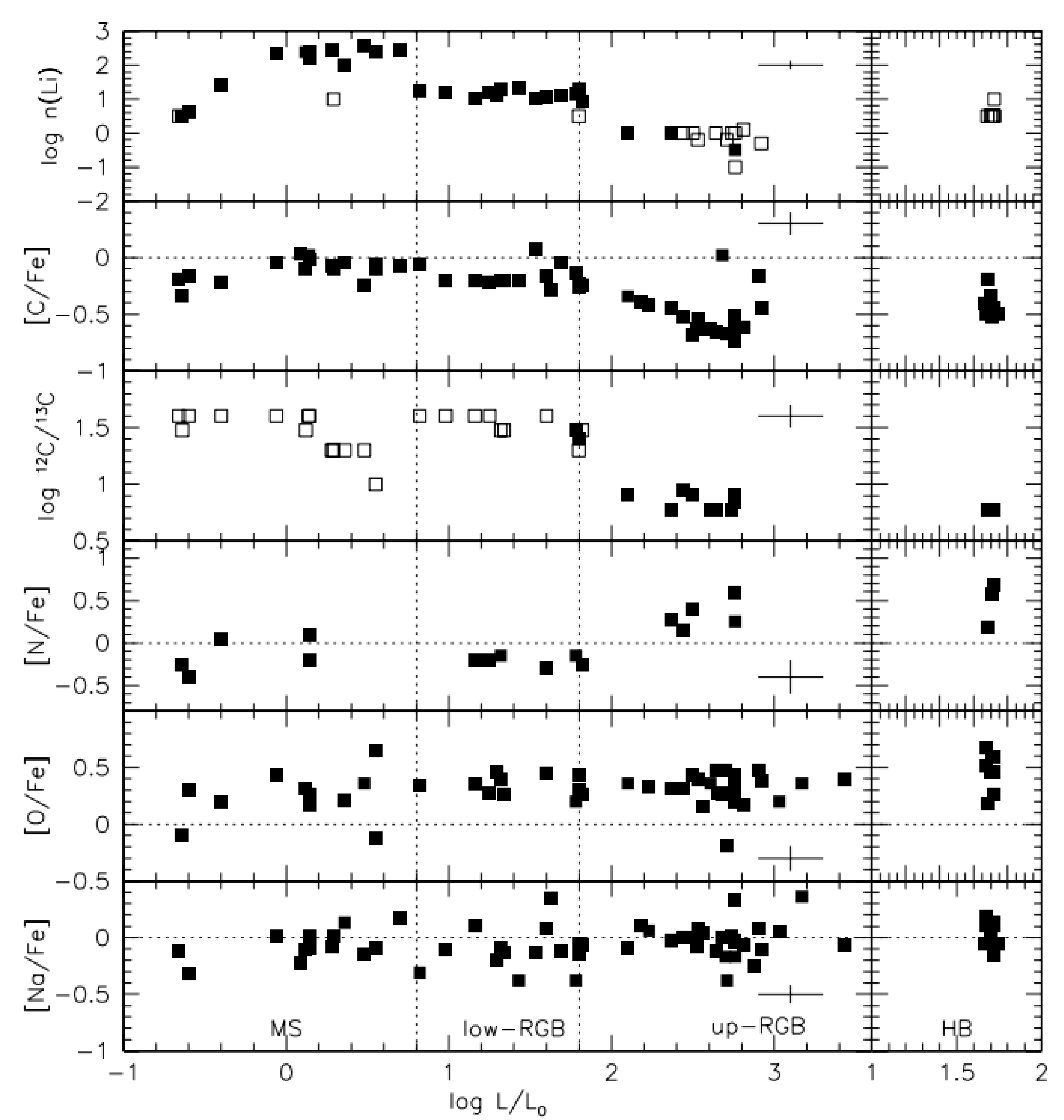
- **Differential reddening?**
- **Different rotation history?**
- **Age spread?**

ONLY RC

- **Transition of the core mass between not degenerate and degenerate?**
- **Dispersion in the overshooting efficiency in the convective core?**



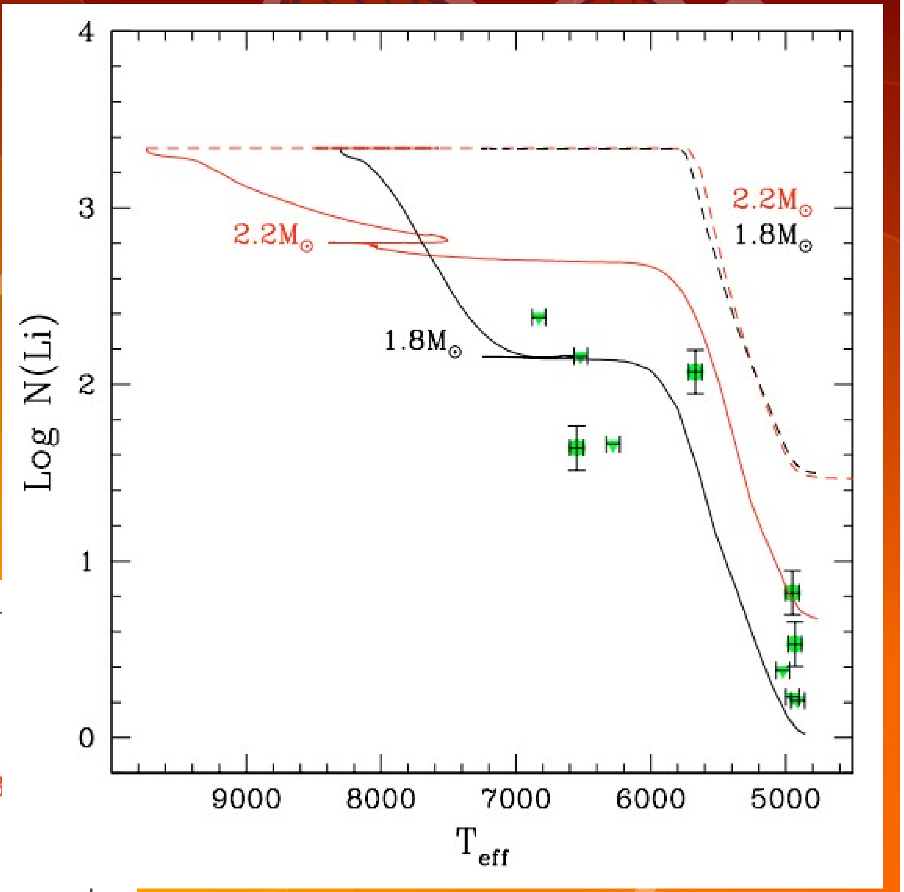
Mixing: observational constraints

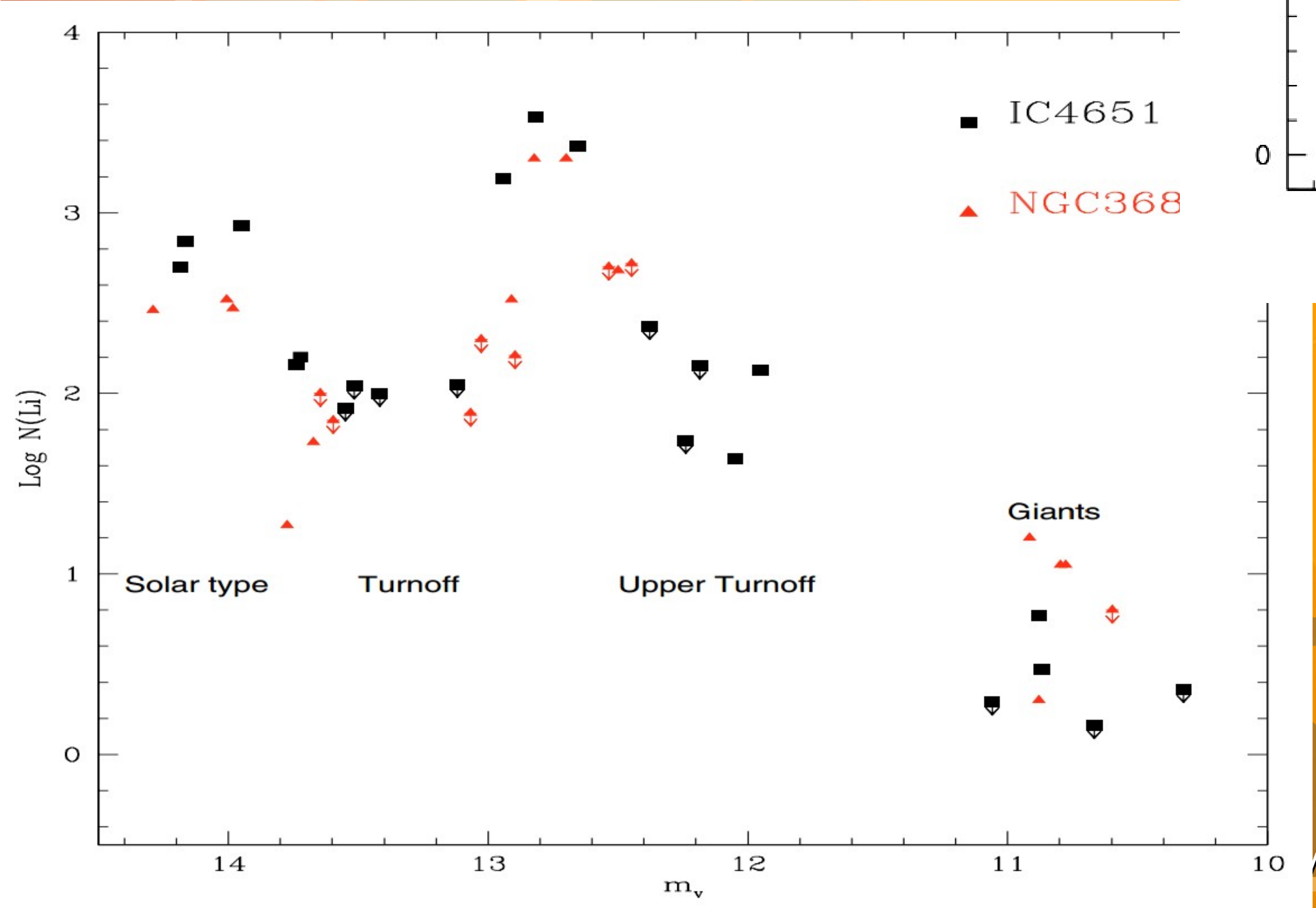


Gratton et al. 2000

Sample of about 100 field stars with well known parallax and luminosity in the metallicity range <u>-2<[Fe/H]<-1</u> and for <u>low masses</u>

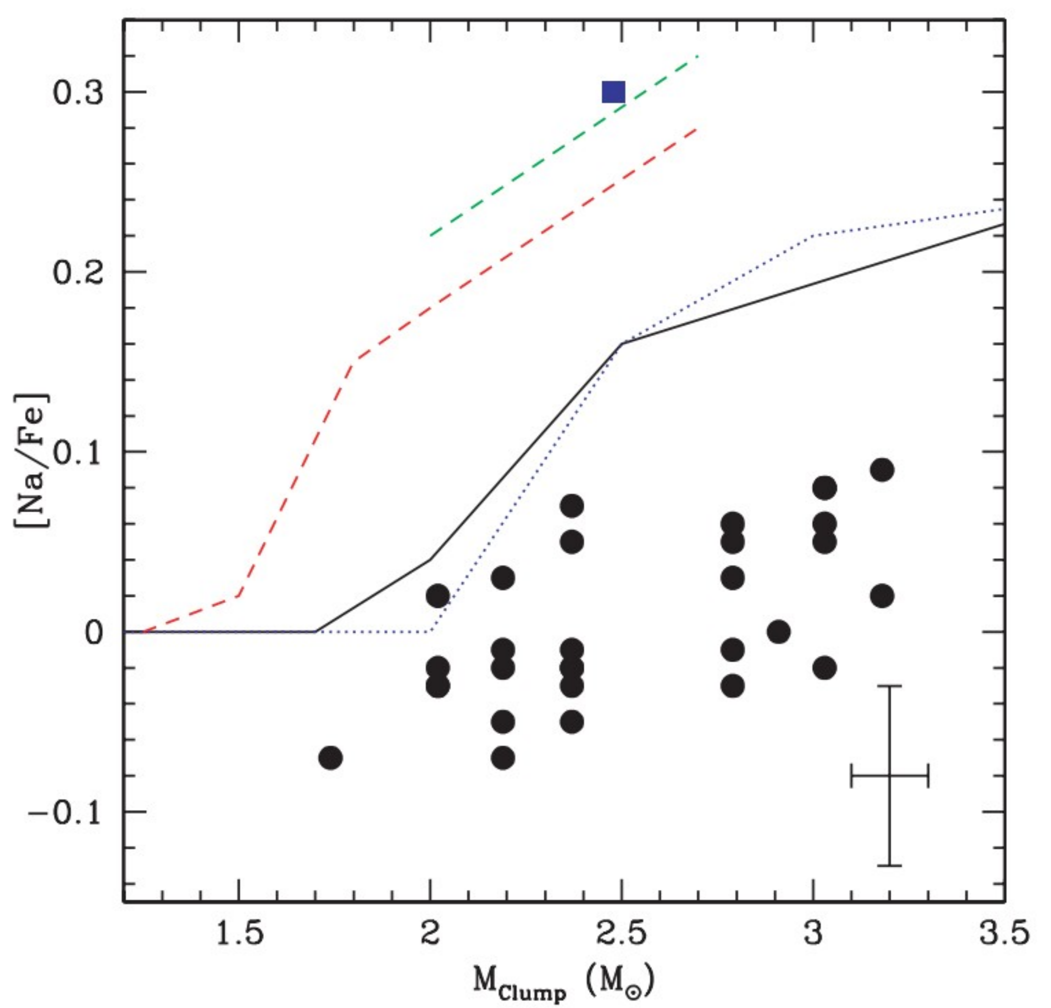
Mixing: observations in OCs

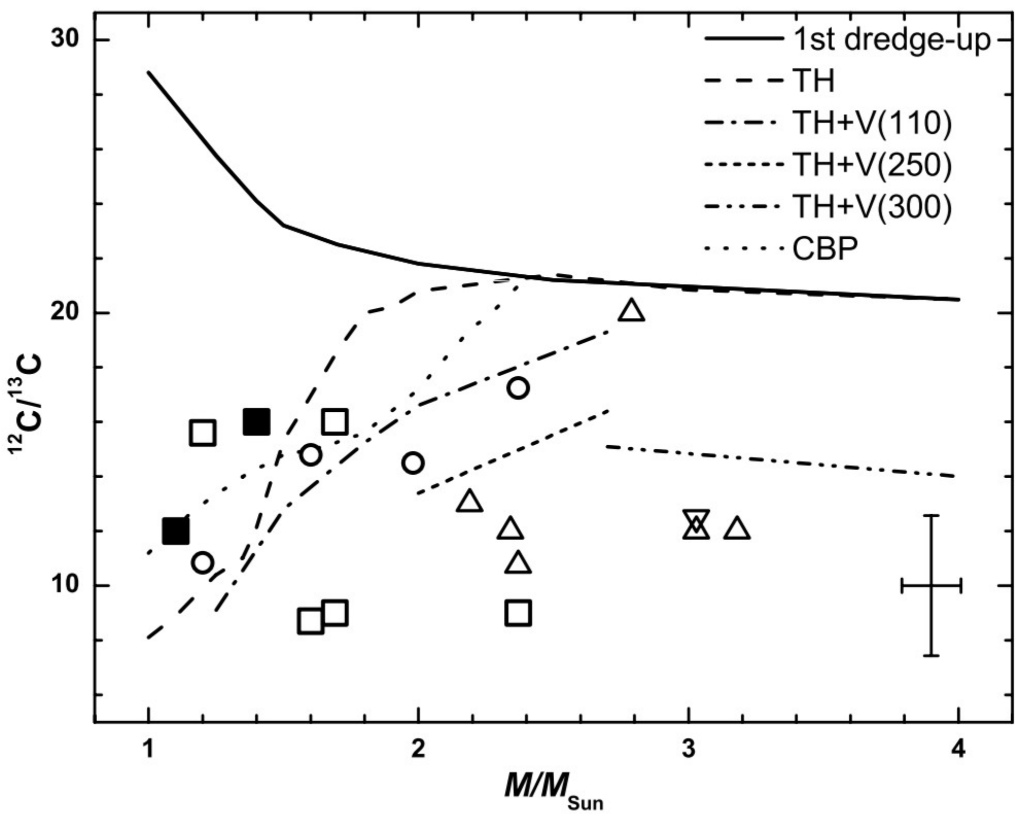




Pasquini et al. 2004

Mixing: observations in OCs





Mikolaitis et al. 2012

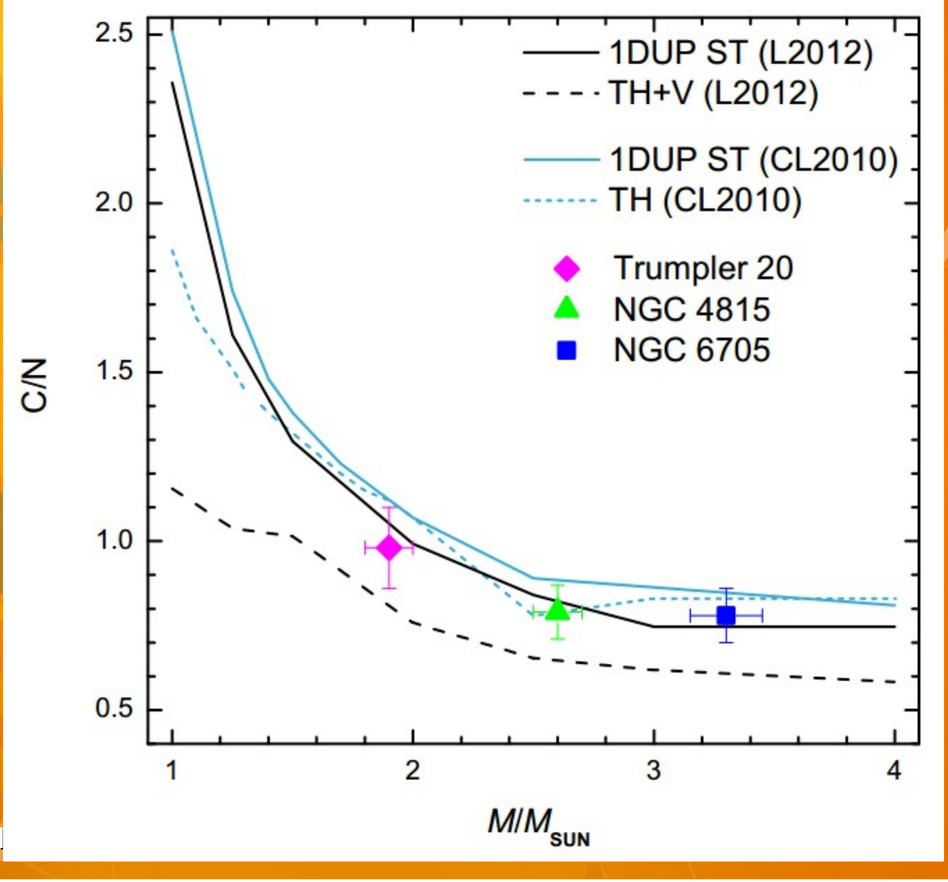
Smiljanic 2012, see talk

Mixing and the GES

The Gaia-ESO Survey: CNO abundances in the open clusters Trumpler 20, NGC 4815, and NGC 6705★

G. Tautvaišienė[1], A. Drazdauskas[1], Š. Mikolaitis[1,2], G. Barisevičius[1], E. Puzeras[1], E. Stonkutė[1], Y. Chorniy[1], L. Magrini[3], D. Romano[4], R. Smiljanic[5,6], A. Bragaglia[4], G. Carraro[7], E. Friel[8], T. Morel[9], E. Pancino[4,10], P. Donati[4], F. Jiménez-Esteban[11], G. Gilmore[12], S. Randich[3], R. D. Jeffries[13], A. Vallenari[14], T. Bensby[15], E. Flaccomio[16], A. Recio-Blanco[2], M. T. Costado[17], V. Hill[2], P. Jofré[12], C. Largo[4], P. de Laverny[2], T. Masseron[12], L. Moribelli[3], S. G. Sousa[18], S. Zaggia[4]

See Tautvaišienė talk

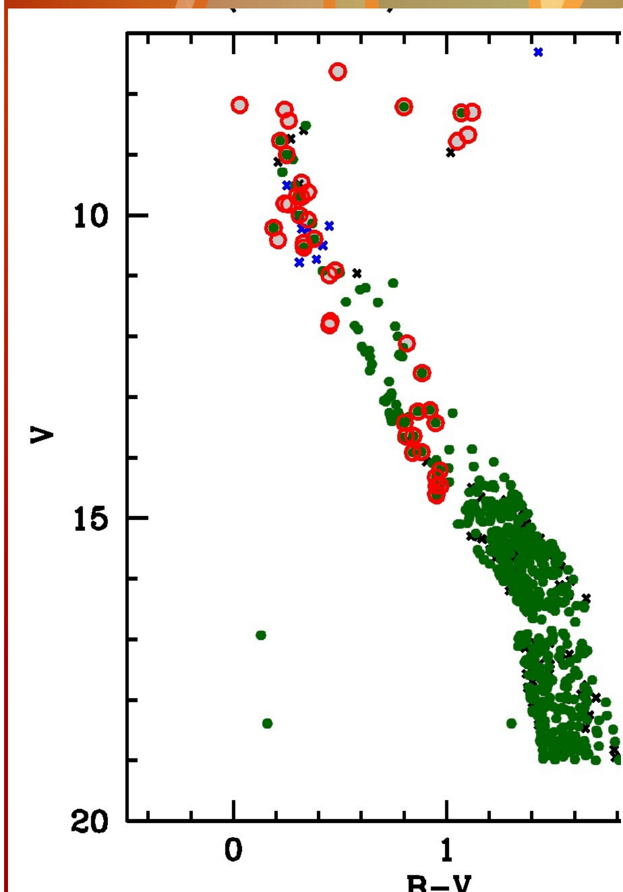


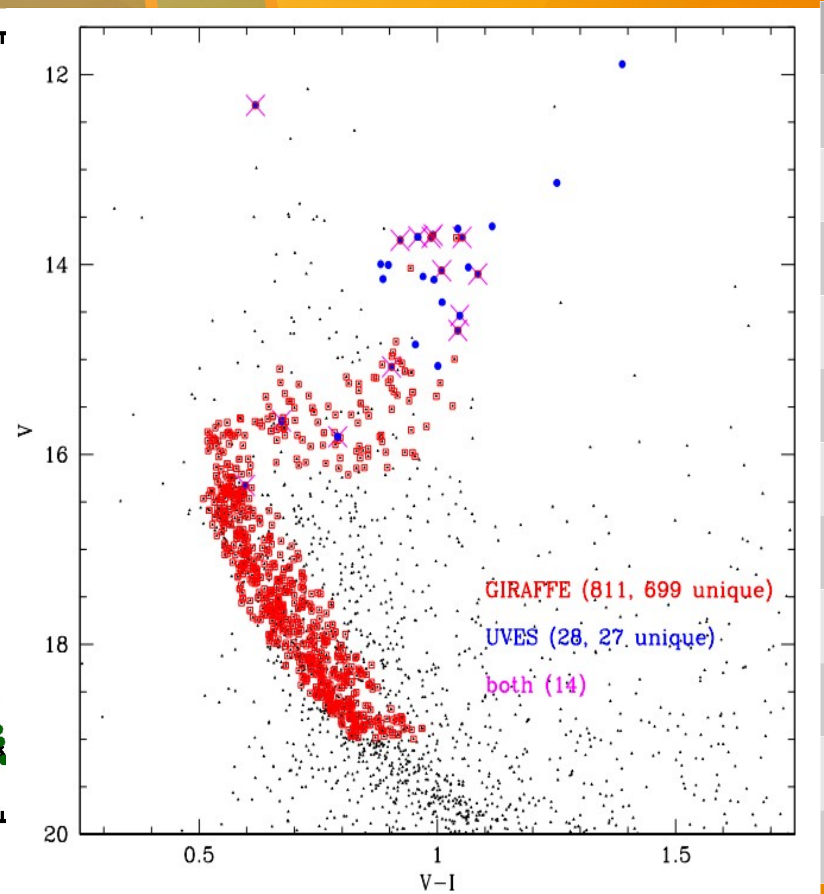
GES OCs

[Fe/H]~±0.4

~1Msun ⟷ ~7Msun

NGC6633 and NGC2243





Old OCs in iDR1-4

Trumpler20	1.6 Msun
NGC 4815	2.5 Msun
NGC 6705	3.3 Msun
Berkeley 81	2.2 Msun
Berkeley 25	1.4 Msun
NGC 2243	1.4 Msun
Berkeley 44	1.9 Msun
NGC 6005	2.1 Msun
Trumpler 23	2.1 Msun
Pismis 18	2.1 Msun
NGC 6802	2.4 Msun
NGC 6633	3.0 Msun

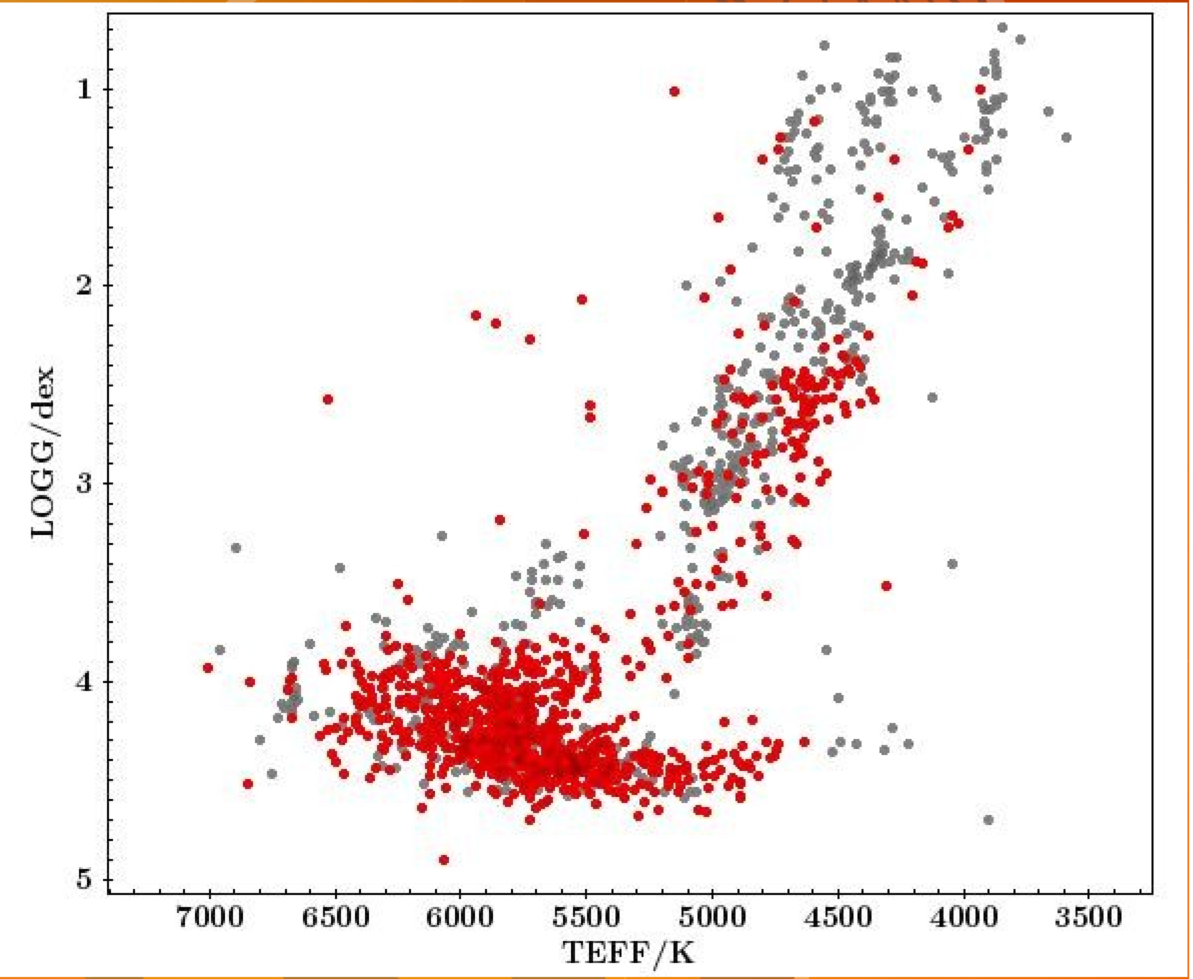
What about MW stars?

MAIN FOCUS

Chemical properties of the Galactic disc and bulge

CoRoT stars will benefit of accurate gravities

***Gaia* mission will provide accurate distances with an enormous impact on stellar evolution studies**



To sum up

OCs

PMS:
- mass accretion
- rotation
- light elements

Test of:
- evolutionary models for different ages and metallicities
- the effect of rotation
- the effect of mixing

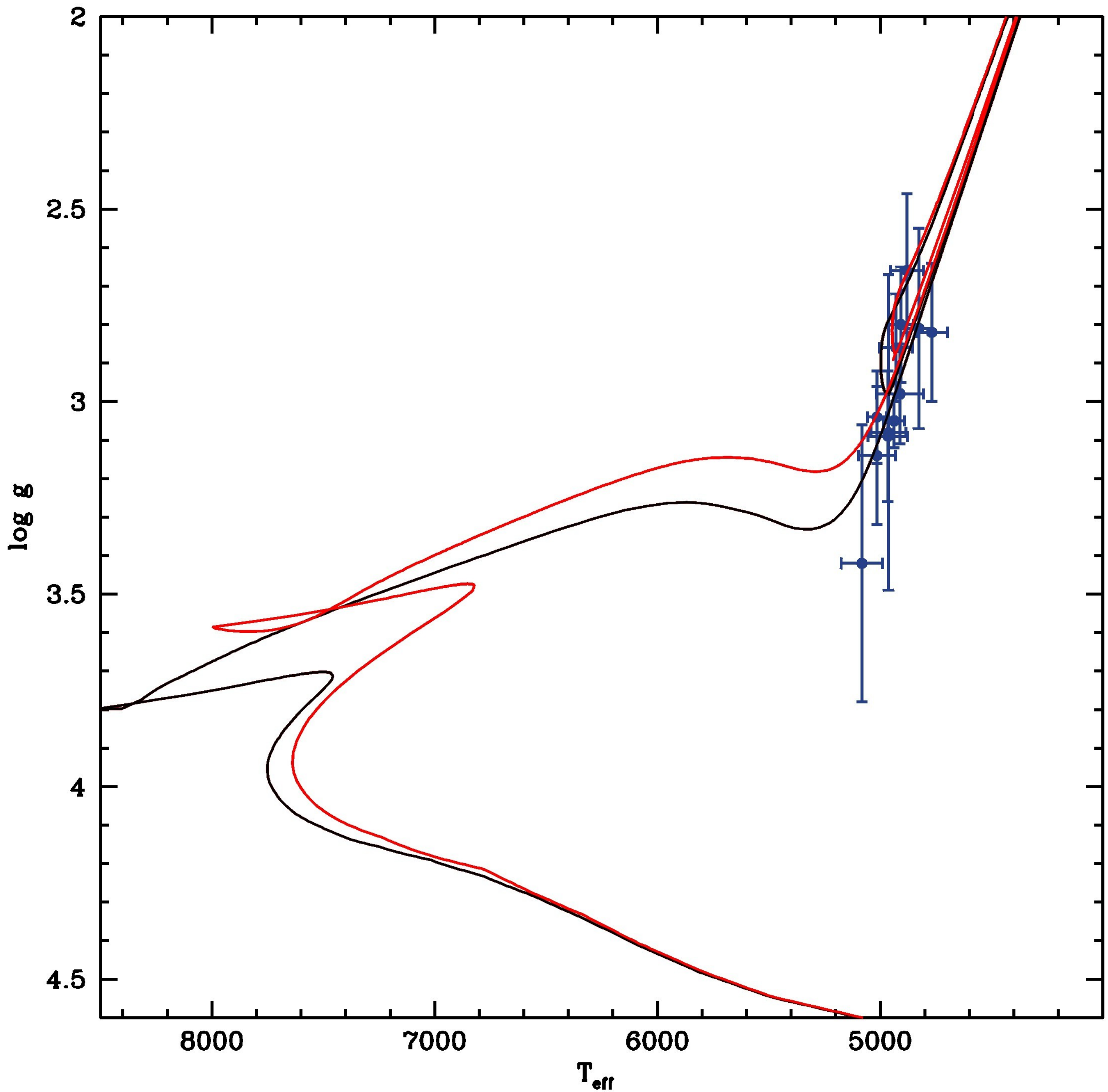
MW stars

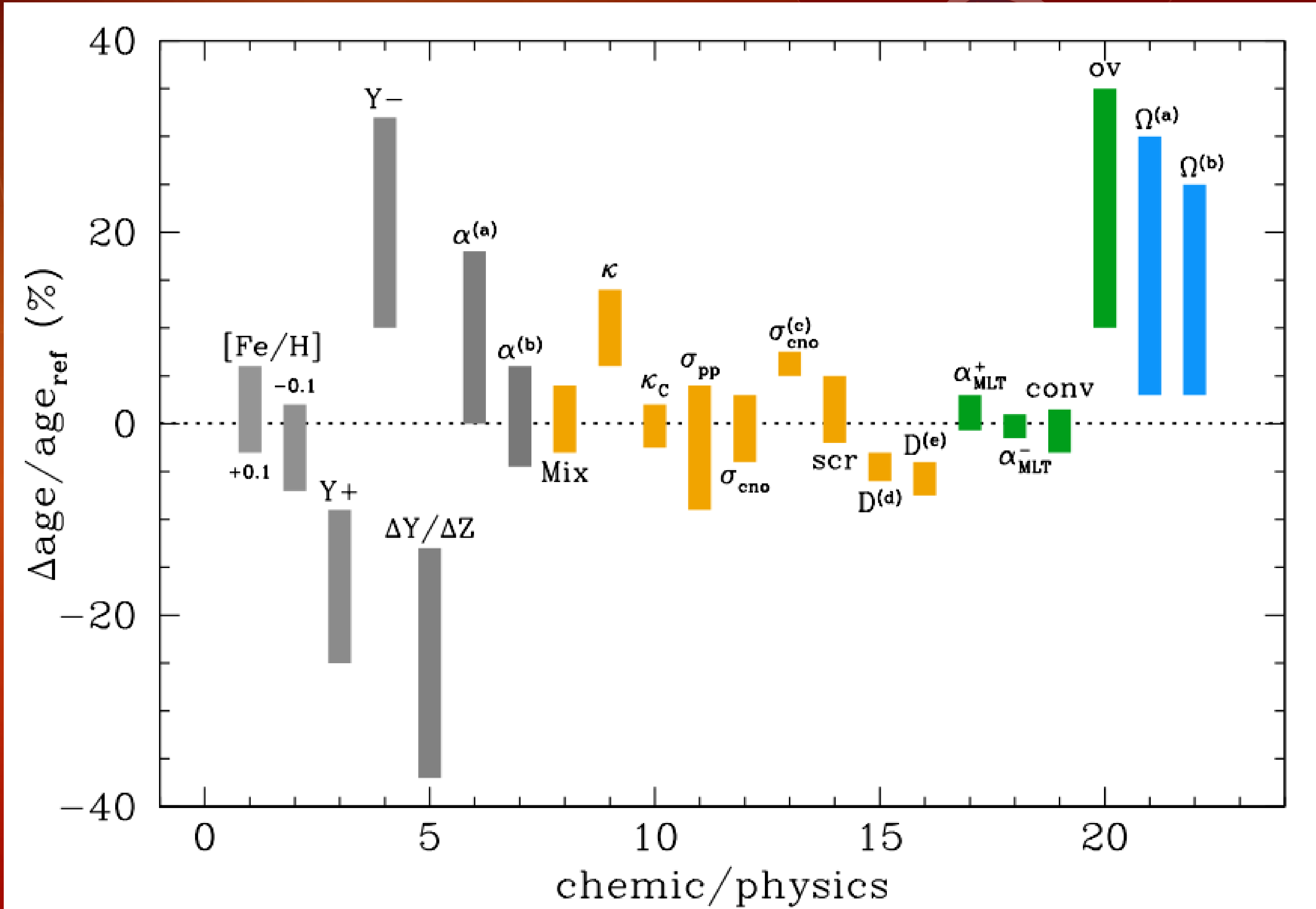
Largest homogeneous dataset of field stars, un unprecedented legacy for stellar evolution when *Gaia* distances will be available

PS: GCs

MAIN FOCUS: Calibrators
They can be used to study mixing but they should be used with care.

Thank you!

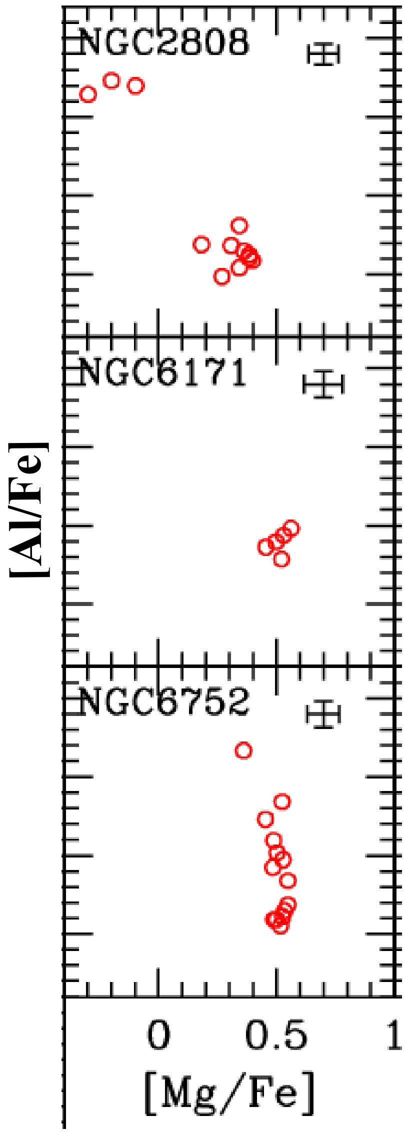

2
2.5
3
3.5
4
4.5
log g
8000
7000
6000
5000
T_{eff}



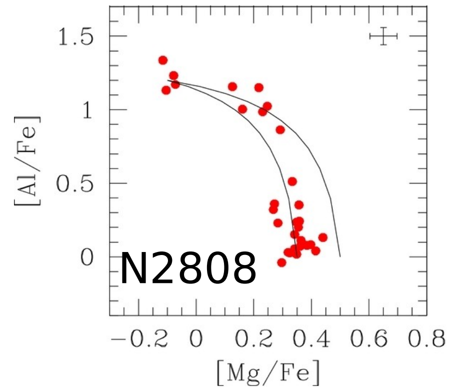
Lebreton et al. 2014

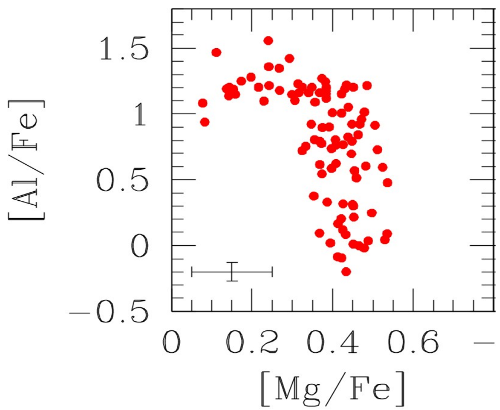
The GC status

Carretta+2009



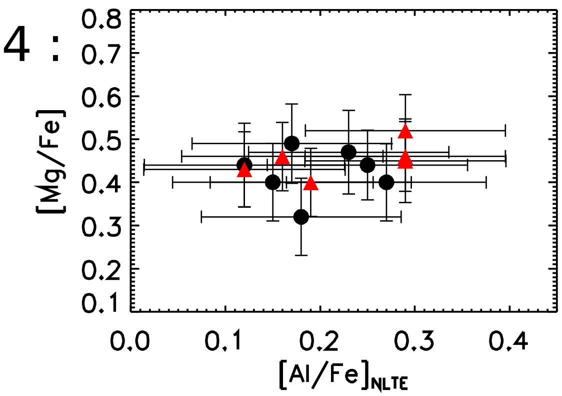
Carretta 2014

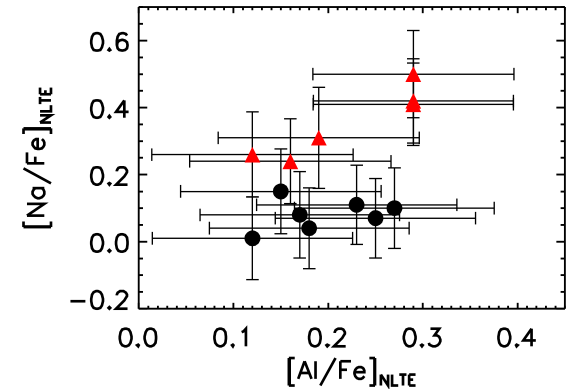




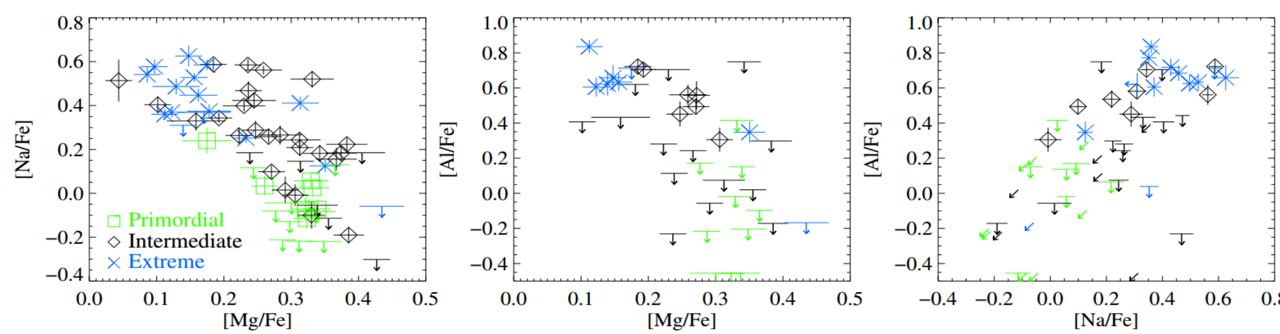
Carretta+2012:
NGC6752
(Al: HR21)

Thygesen+2014 :
47Tuc



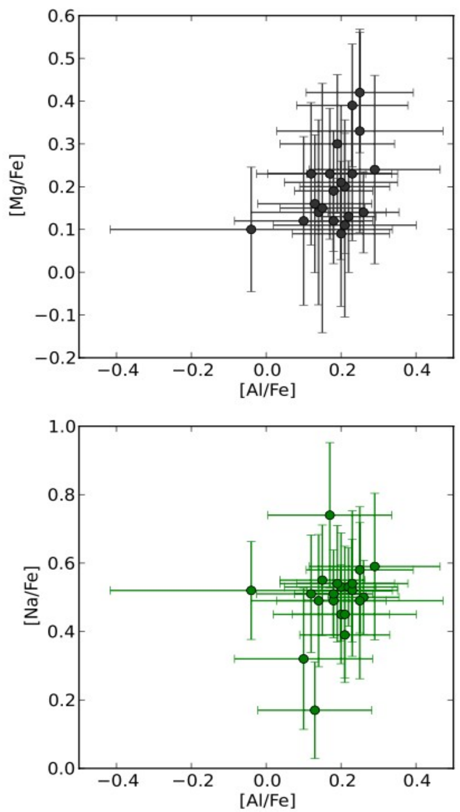


Gruyters+2014 : NGC6752

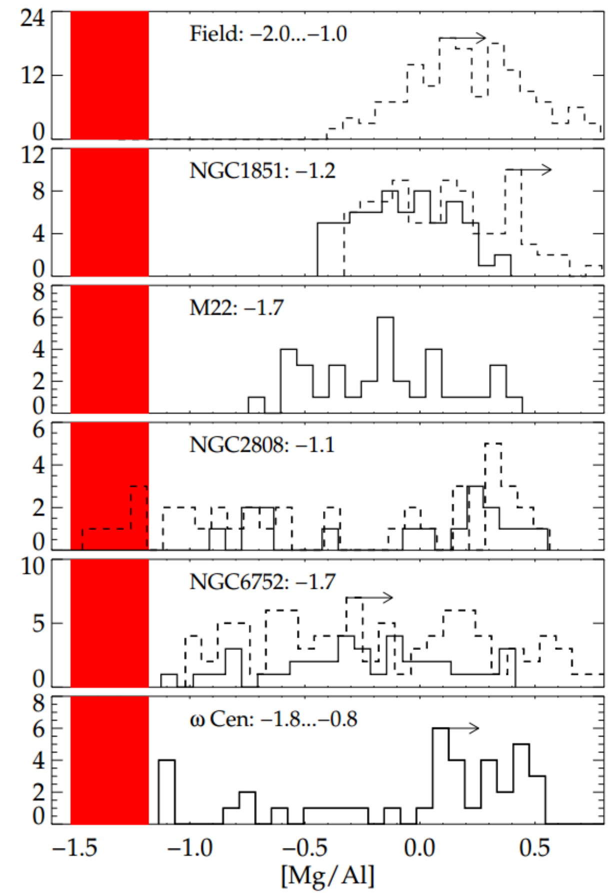


The GC status

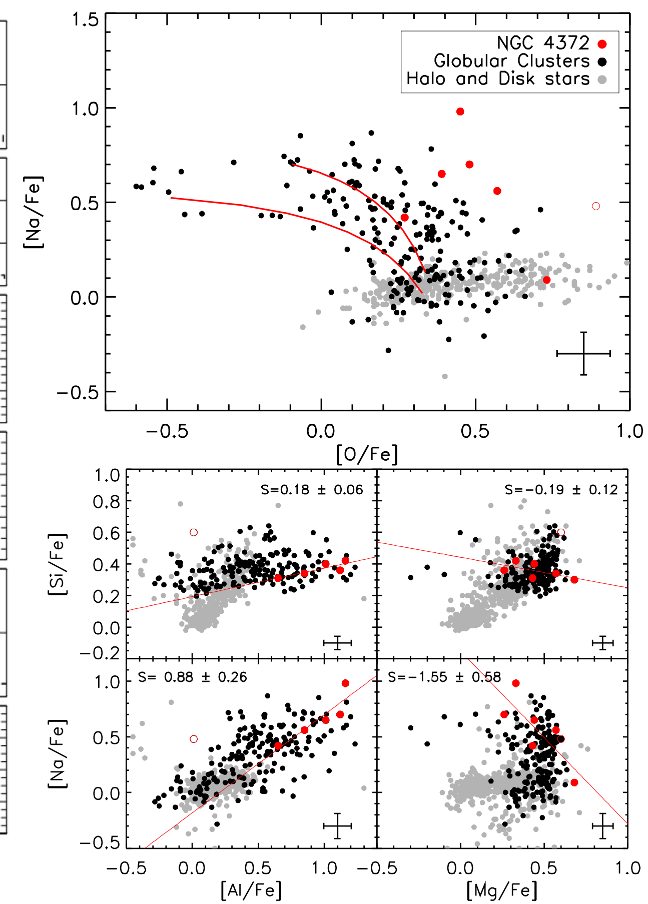
Cantat-Gaudin+2014



Lind+ in prep



San Roman+ in prep



M11

NGC1851, NGC2808, NGC6752

NGC4372

GES data