The Gaia-ESO Survey

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Survey Co-PIs: Gerry Gilmore & Sofia Randich
350+ Co-Is (mostly from Europe, but not only)
90++ institutes

www.gaia-eso.eu

CREDIT AND THANKS

1 The Gaia-ESO Survey

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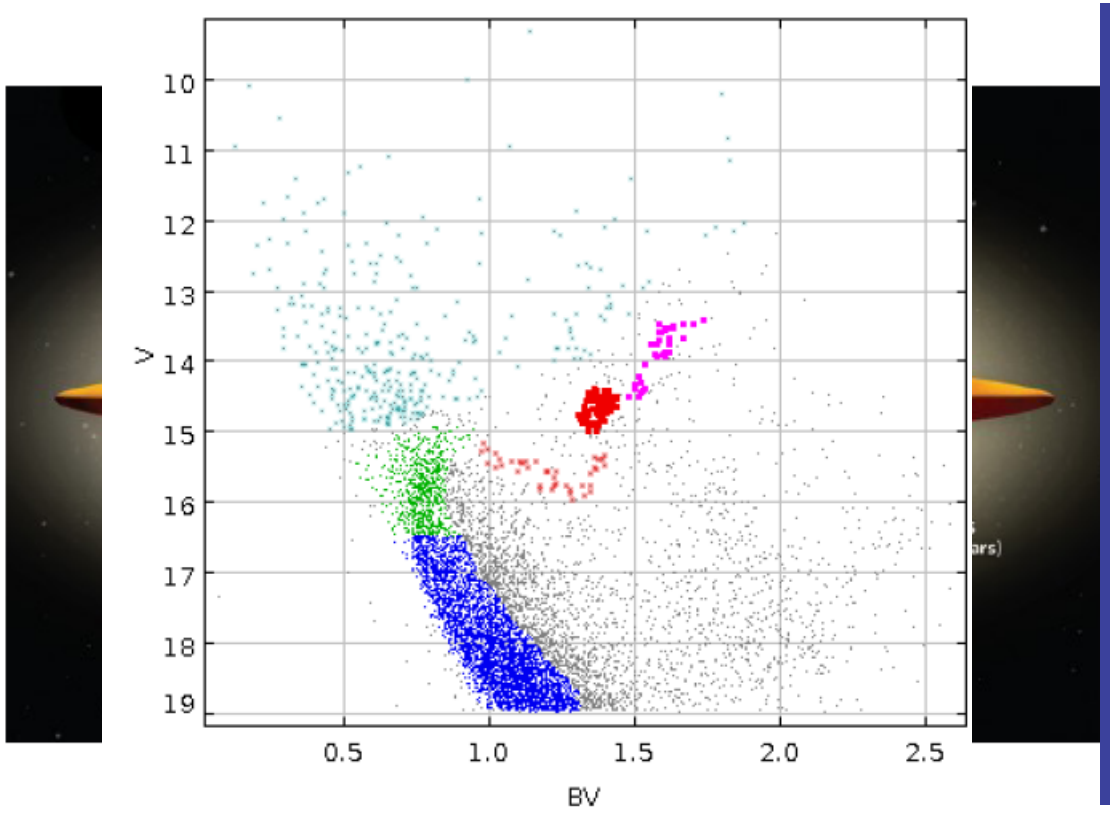
OUTLINE

- Overview
- Core science
- Milestones and current status
- Project organization, data flow, analysis
- Science verification and first results

GAIA-ESO SURVEY IN A NUTSHELL (1/2)

- Large **Public** Spectroscopic Survey – FLAMES
- **300 (240+60) nights** over **5 (4+1) years**; 12/2011 (P88) - 9/2016 (P97)++; VM



10^5 stars

All stellar-types

- O → M
- PMS
- Unevolved MS
- Evolved

→ V=16/19

GAIA-ESO SURVEY IN A NUTSHELL (2/2)

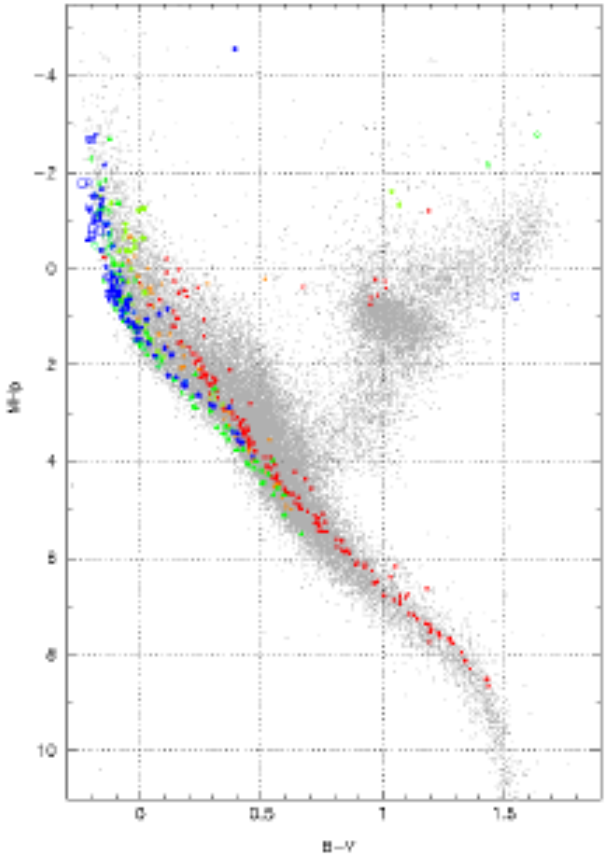
- **Giraffe and UVES spectra →**
  - RVs (0.2-0.3 km/s), and vsini's,
  - APs, [Fe/H], [X/Fe]
  - stellar properties (M_{acc}, $\dot{M}$, etc.)

- **Uniform analysis: → homogeneous overview** of the distributions of **kinematics and element abundances** in the Galaxy

CORE SCIENCE (1/2)

Key open issues in the formation and evolution of the MW and its component stars and stellar pops.

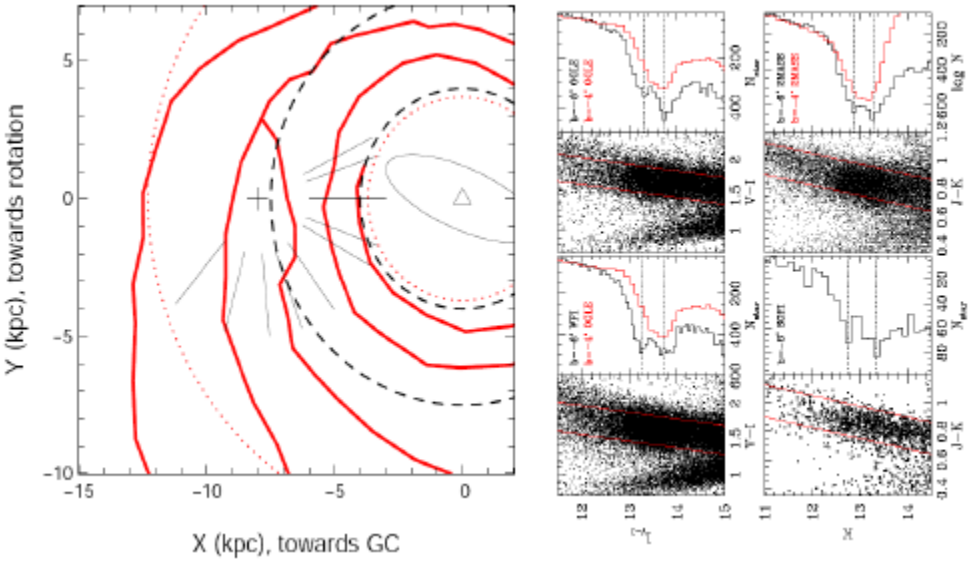
- The (dynamical) evolution of clusters: from birth to disruption into the field
- Stellar evolution (ages, masses)



CORE SCIENCE (3/3)

- Galaxy phase-space substructure
- Formation and evolution of the thin and thick discs
- Halo substructure, Dark Matter
- Formation and nature of the Galactic bulge

Dynamics of spiral arms



Complexity of inner bulge

MILESTONES (AND STATUS)

- **9/2010-11/ 2011:** LoIs, consortium building, proposal approval by PSSP and OPC, SMP
- **New year eve 2011/2012**: observations started
- **2012-2013:** observations, spectrum processing and analysis; several meetings
- **7/2013:** first analysis cycle completed → internal release of APs and abundances
- **8/2013:** first release of spectra to ESO archive (6 month, ~4000 objects)

(MILESTONES AND) **STATUS**

- **20** observing **runs** completed (100+ nights); about 85 % of time useful
- **Large variety of targets** observed, including 20 clusters and several calibration targets (GCs, benchmark stars, COROT, etc.)
- **18 month spectra** along with metadata internally released for the **analysis** (iDR2)
- **Beginning of 2014:** iDR2 APs and abundances internally released
- **July 2014 (?):** next release to ESO

ORGANIZATION, DATA FLOW, ANALYSIS

SPECTRUM ANALYSIS

Gaia-ESO explicitly includes all proven abundance methodologies ➔ systematics
a wide range of techniques is essential
to cover the range of stellar types

Calibration targets: internally consistent
internal and understood external scale

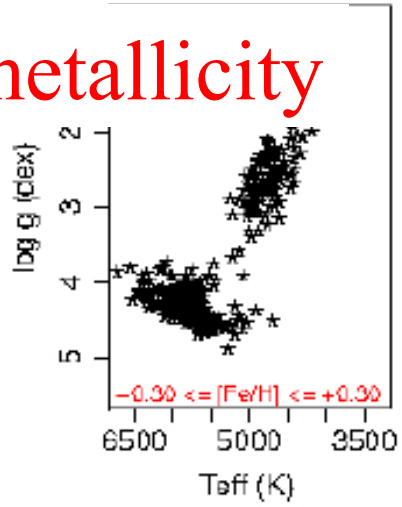
The Gaia-ESO Survey

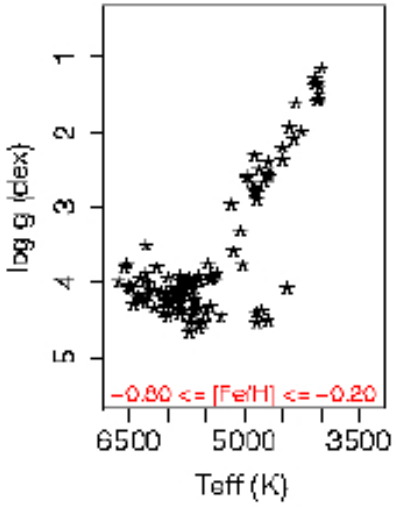
Science verification and results

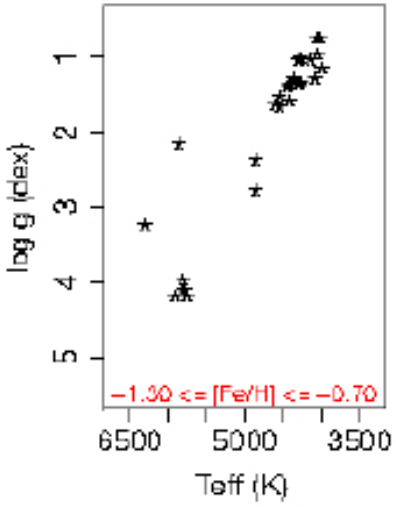
(focus on Aps, [Fe/H] and abundances)

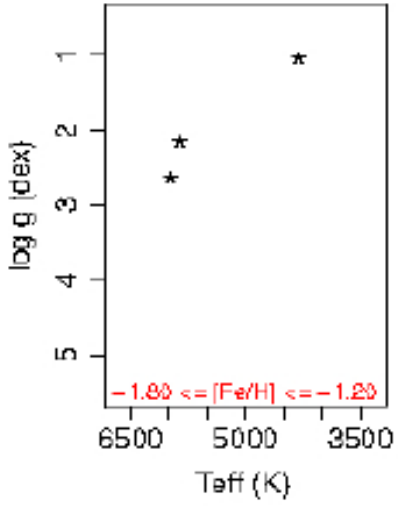
UVES RECOMMENDED iDR1 PARAMETERS

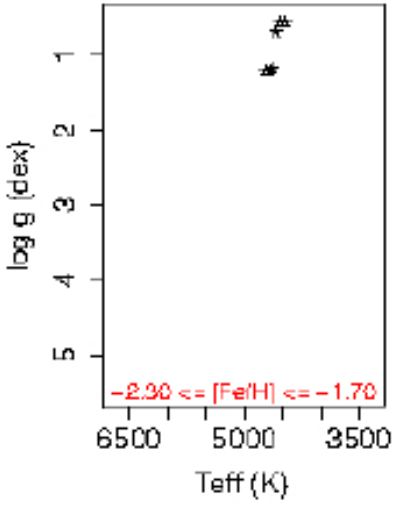
high metallicity

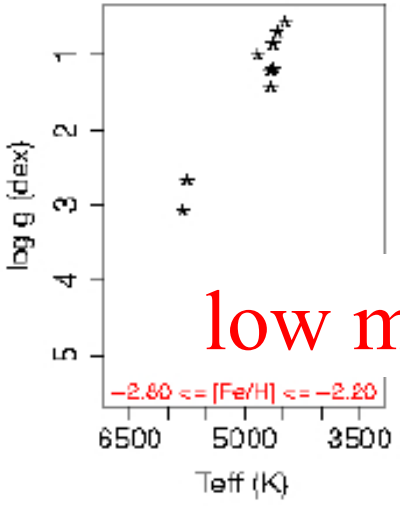












low metallicity

THE INNER RADIAL METALLICITY GRADIENT

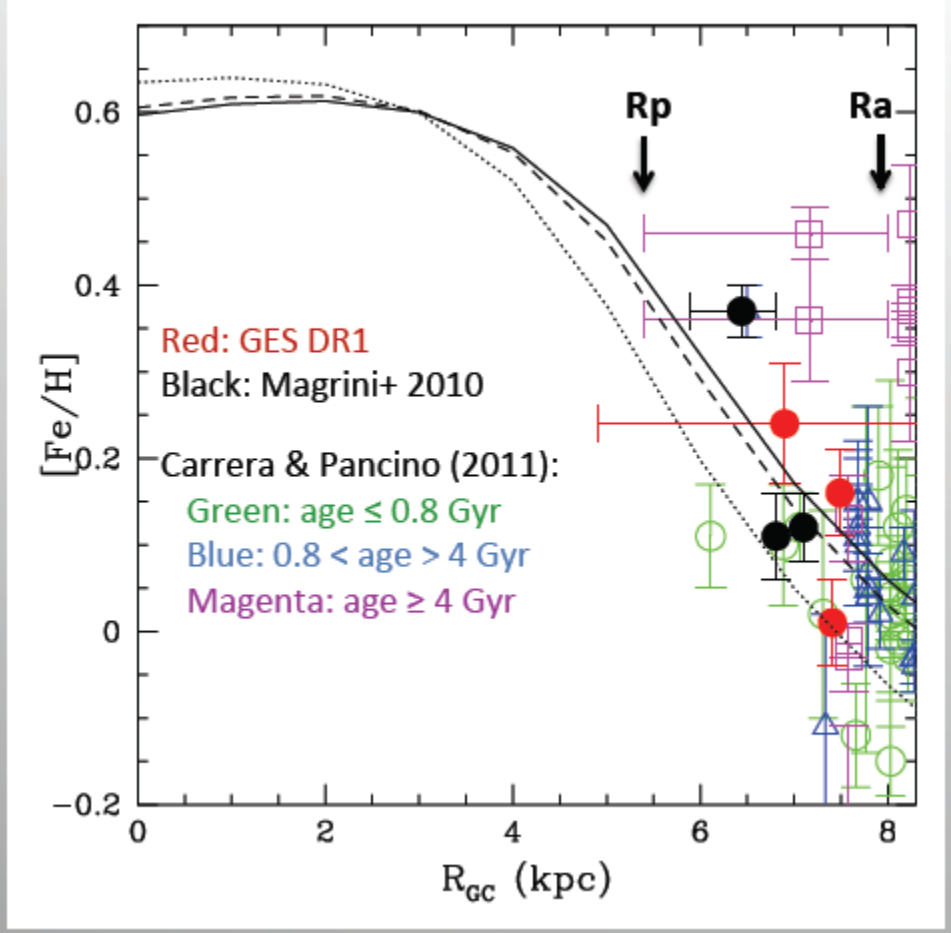
Currently, our understanding of the disk gradient is:

- limited/biased by too small or too inhomogeneous cluster samples
- based (in part) on clusters with too few members/ too large errors
- largely ignoring possible radial migration effects

The combination of

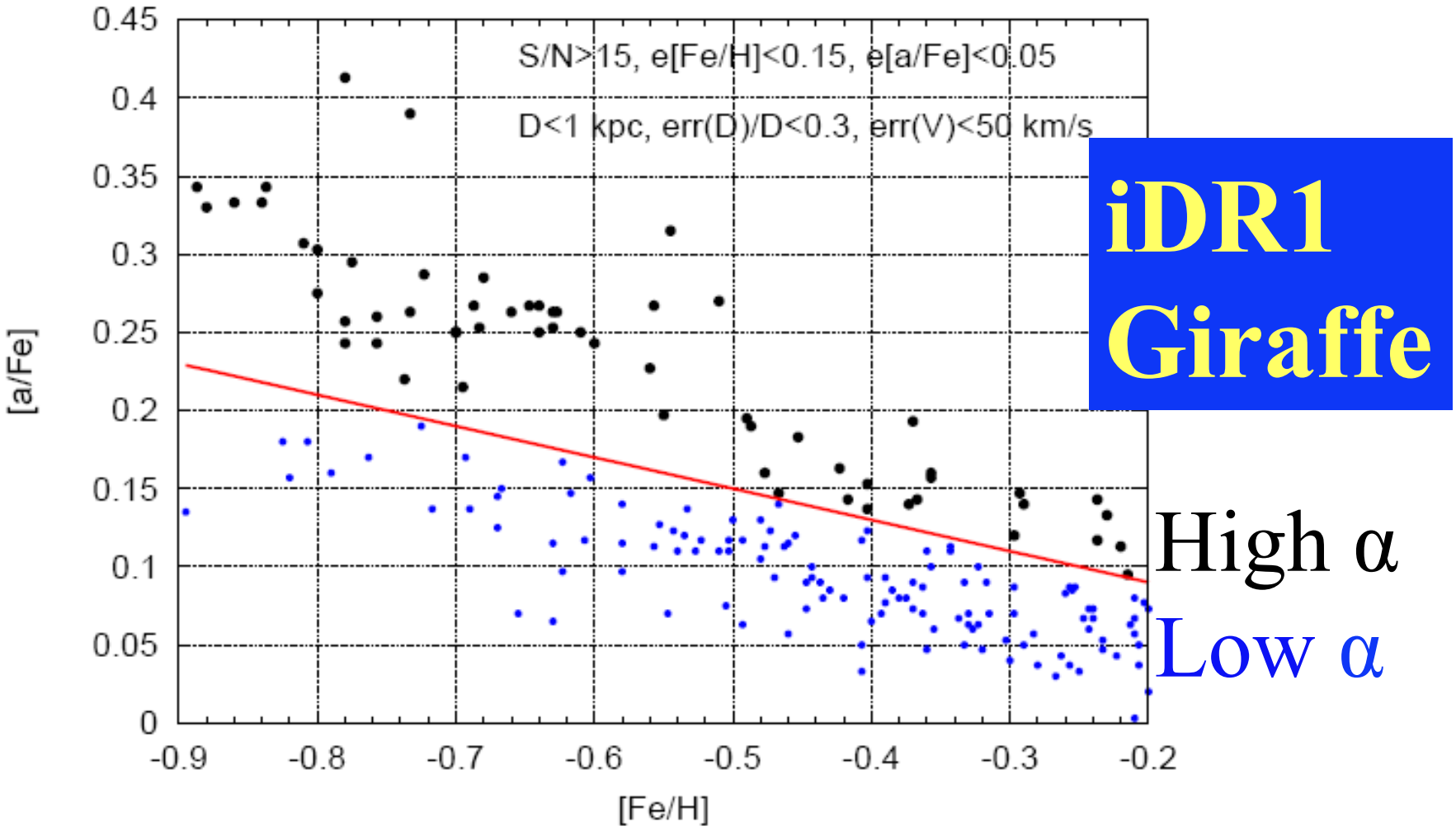
- **Cluster membership, fundamental parameters**
- **RV's, orbits, dynamical studies &**
- **Homogeneous element abundances (chemical tagging)**

provided by GES will fix a lot of this!



Jacobson et al.

THICK TO THIN DISK TRANSITION



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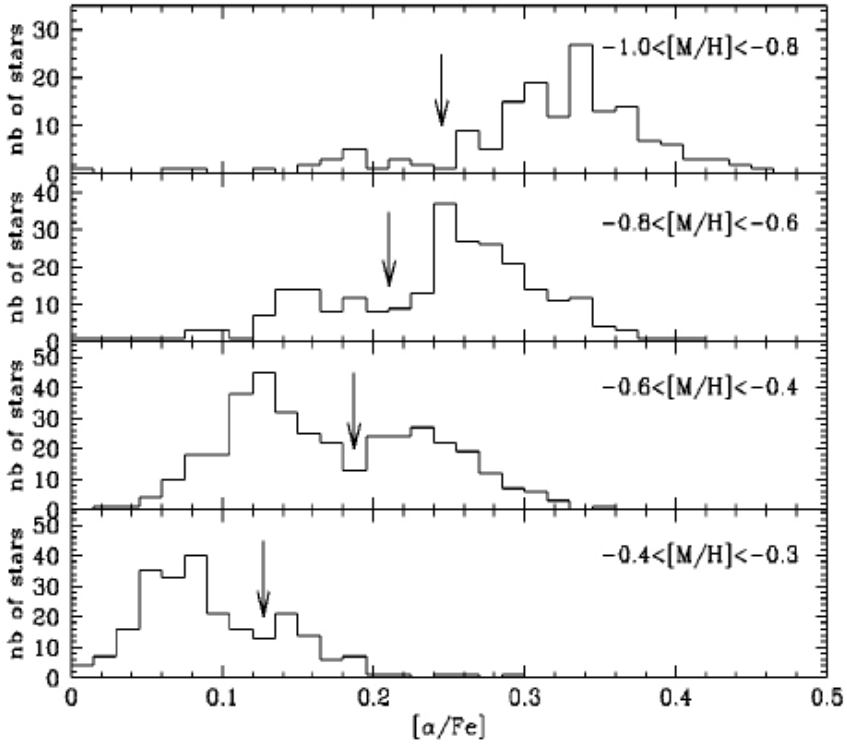
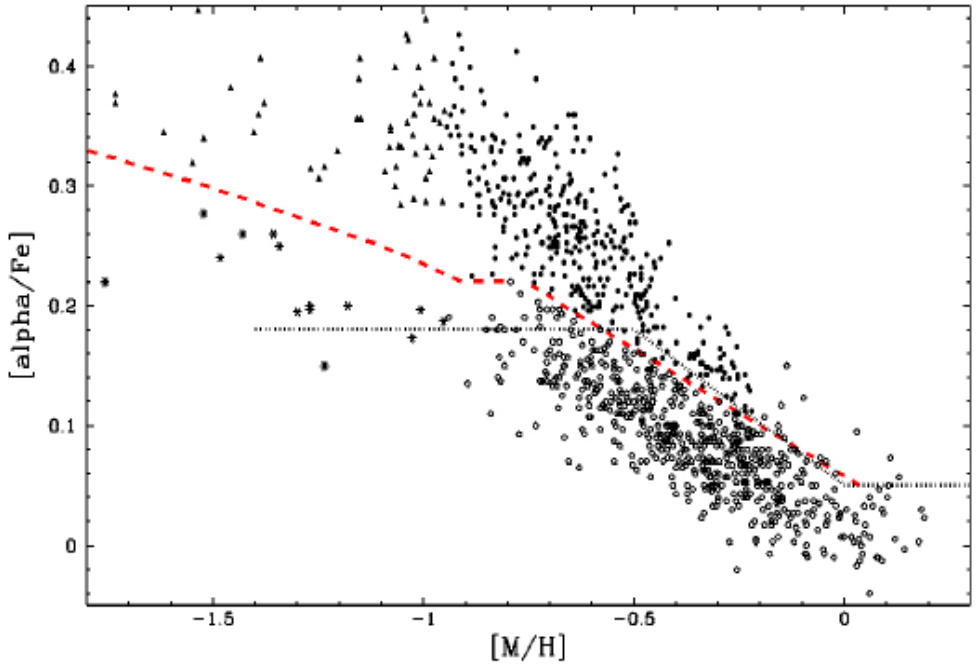
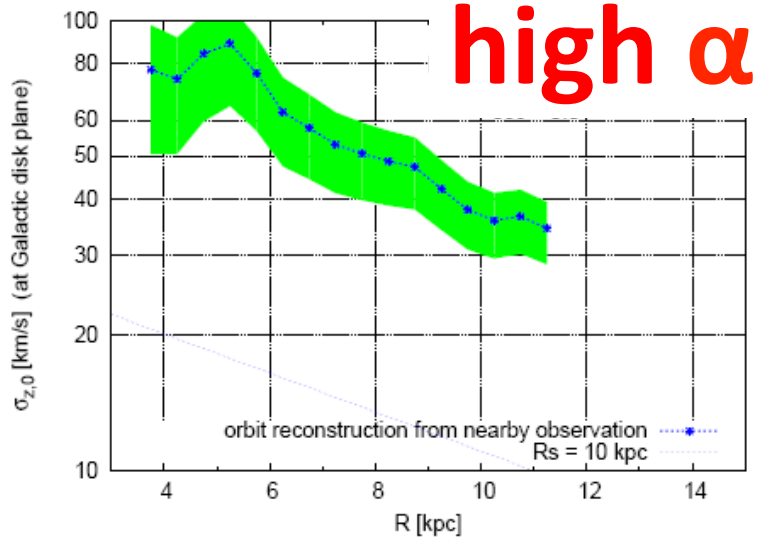


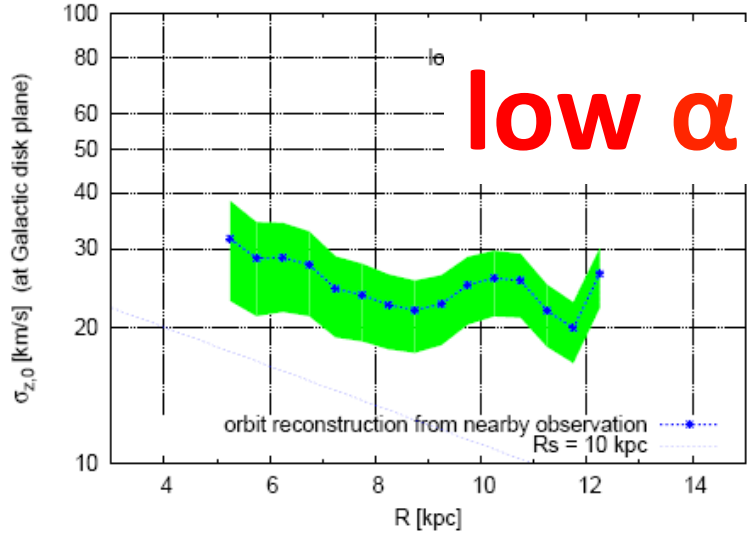


Recio Blanco et al.

THICK TO THIN DISK TRANSITION



the velocity dispersion in z- direction at the Galactic plane →

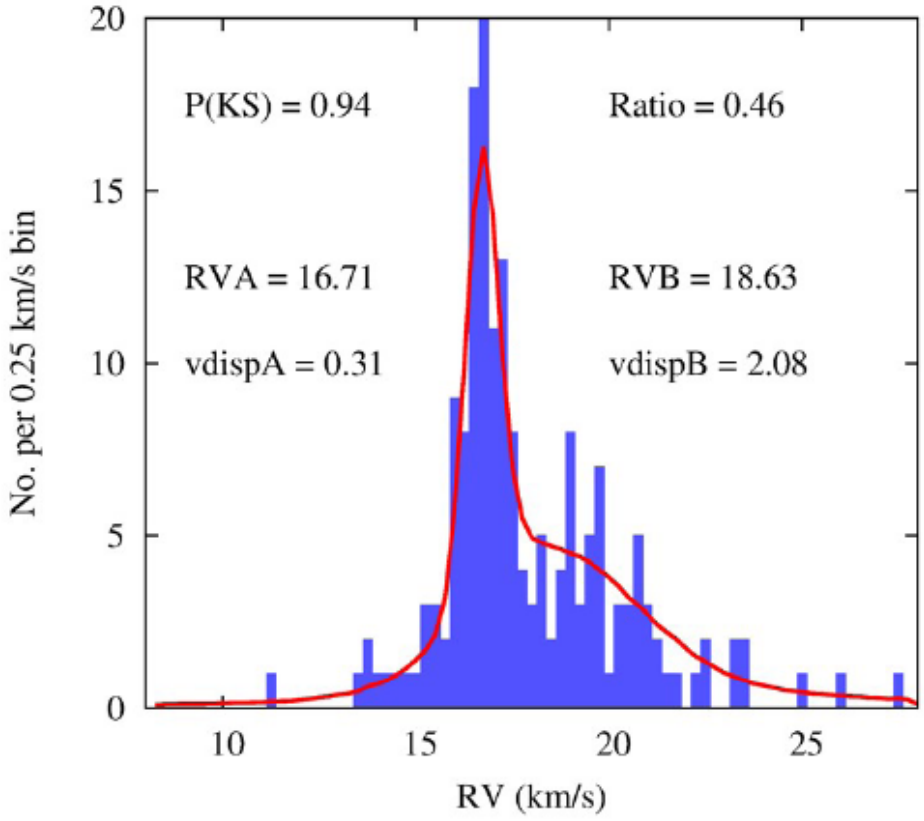


the split is astrophysically real?

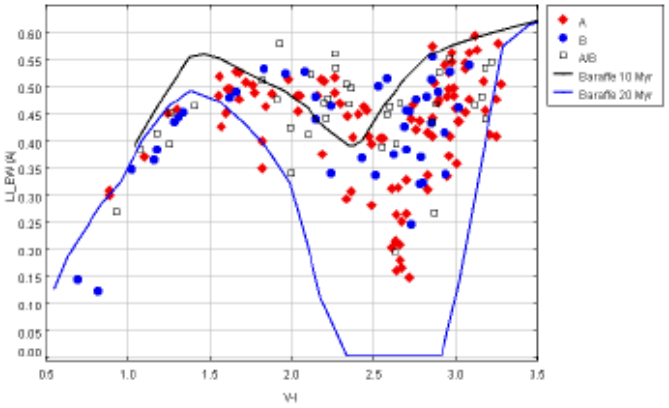
Courtesy: K. Hattori & GG

YOUNG CLUSTER KINEMATICS

γ^2 Vel



Jeffries et al
Franciosini et al



SUMMARY

- GES is meeting its ambitious goals
- First results show the potential of the GES
- First science papers will appear over the next few months
- GES end data taking >2016++? gives overlap with first Gaia data release. Combined → full 6D phase space f(x,y,z,v_x,v_y,v_z), plus AP, and chemistry for a very large number and variety of stars: core science plus legacy science