The Galactic Disc velocity dispersion and its chemical dependences

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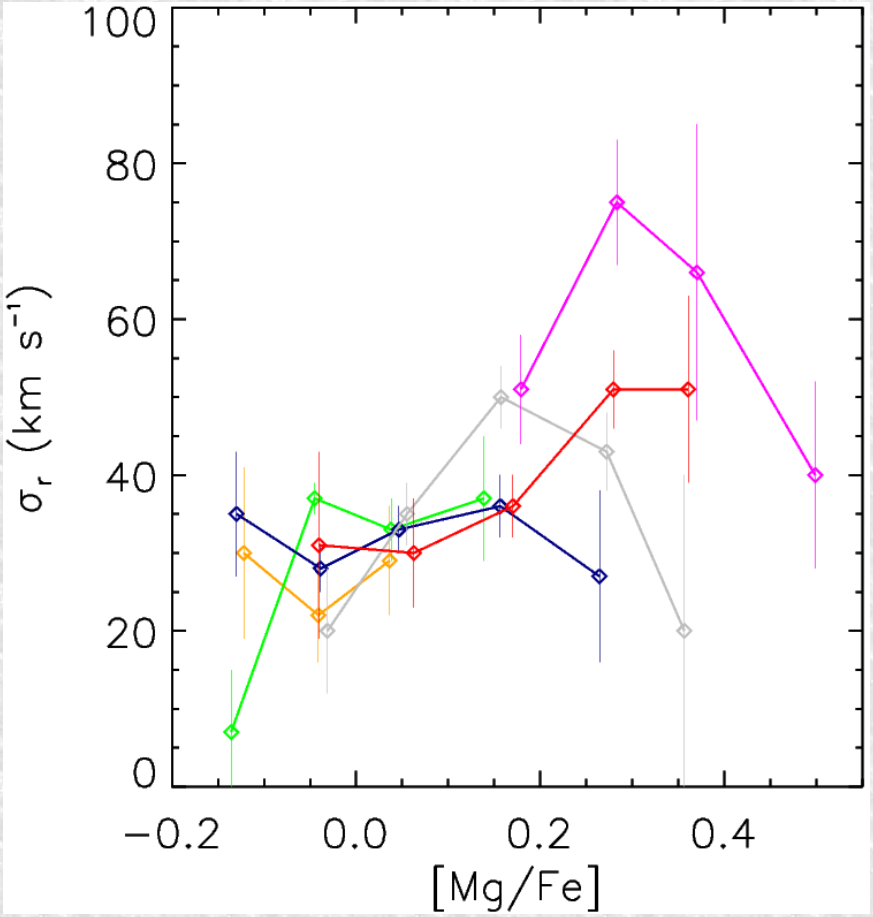
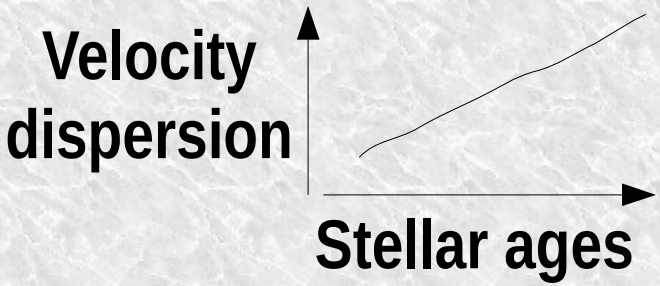


Velocity dispersion: a tool to constrain the MW disc formation



[Mg/Fe] ⟺ age proxy

Velocity dispersion v.s **[Mg/Fe]**

1/ The stellar sample and the Galactic Disc characterization

- ~6800 stars from the iDR 2, GIRAFFE data: HR10 & HR21.
- Recommended parameters & [Fe/H] + [Mg/Fe].
- Derivation of R, Z, V_r, $V\varphi$, V_z (procedure in Kordopatis et al. 2011).

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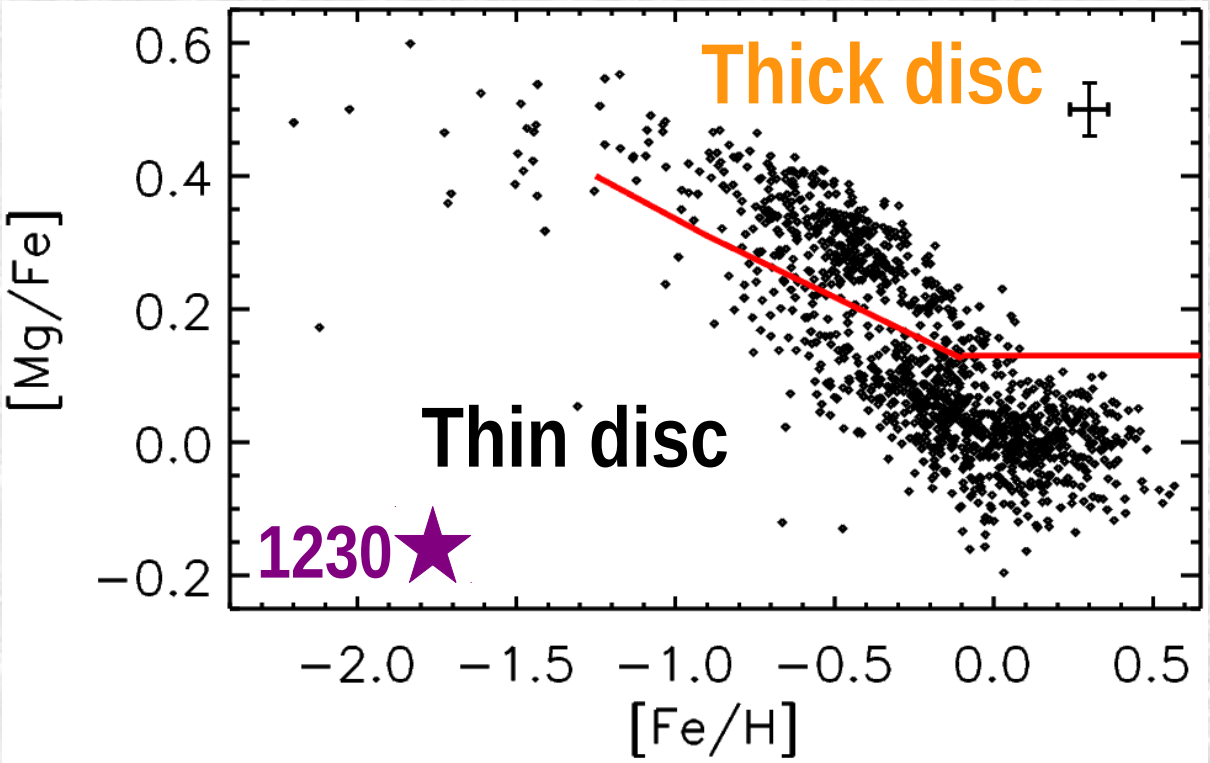
Exploring the chemical gap in the [Mg/Fe] v.s [Fe/H] plane



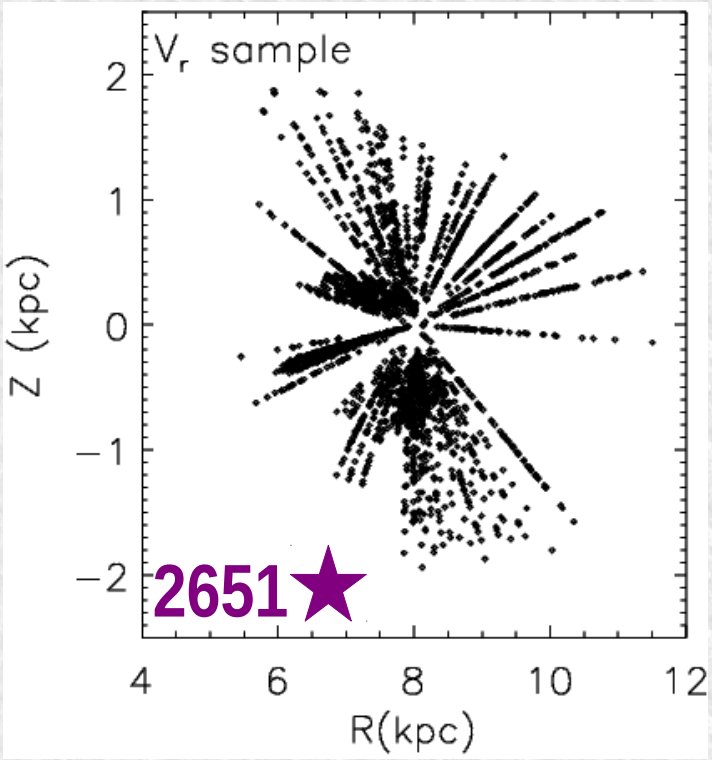
- **Previously observed :**
  Adibekyan et al. 2011
  Nidever et al. 2014
  Recio-Blanco et al. 2014
  Mikolaitis et al. 2014

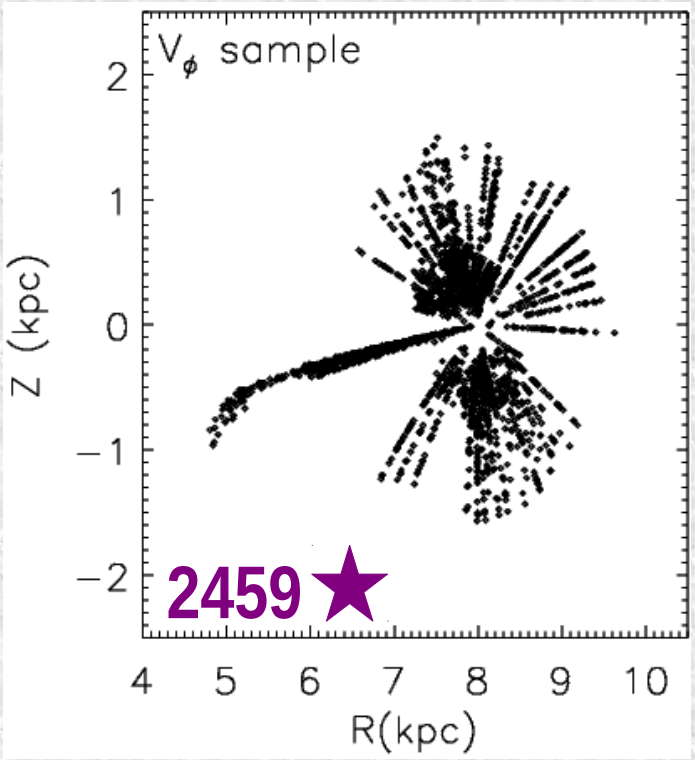
- **Gap detected with GES iDR2 data.**

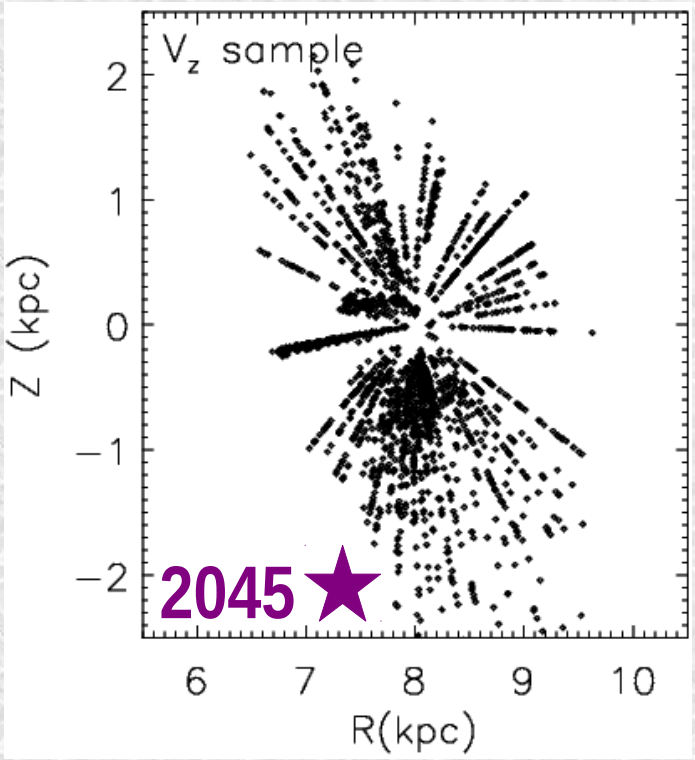
1/ The stellar sample and the Galactic Disc characterization

⇨ **Selection criteria:**

Error(Gal. velocity) ≤ 30 km s^{-1}



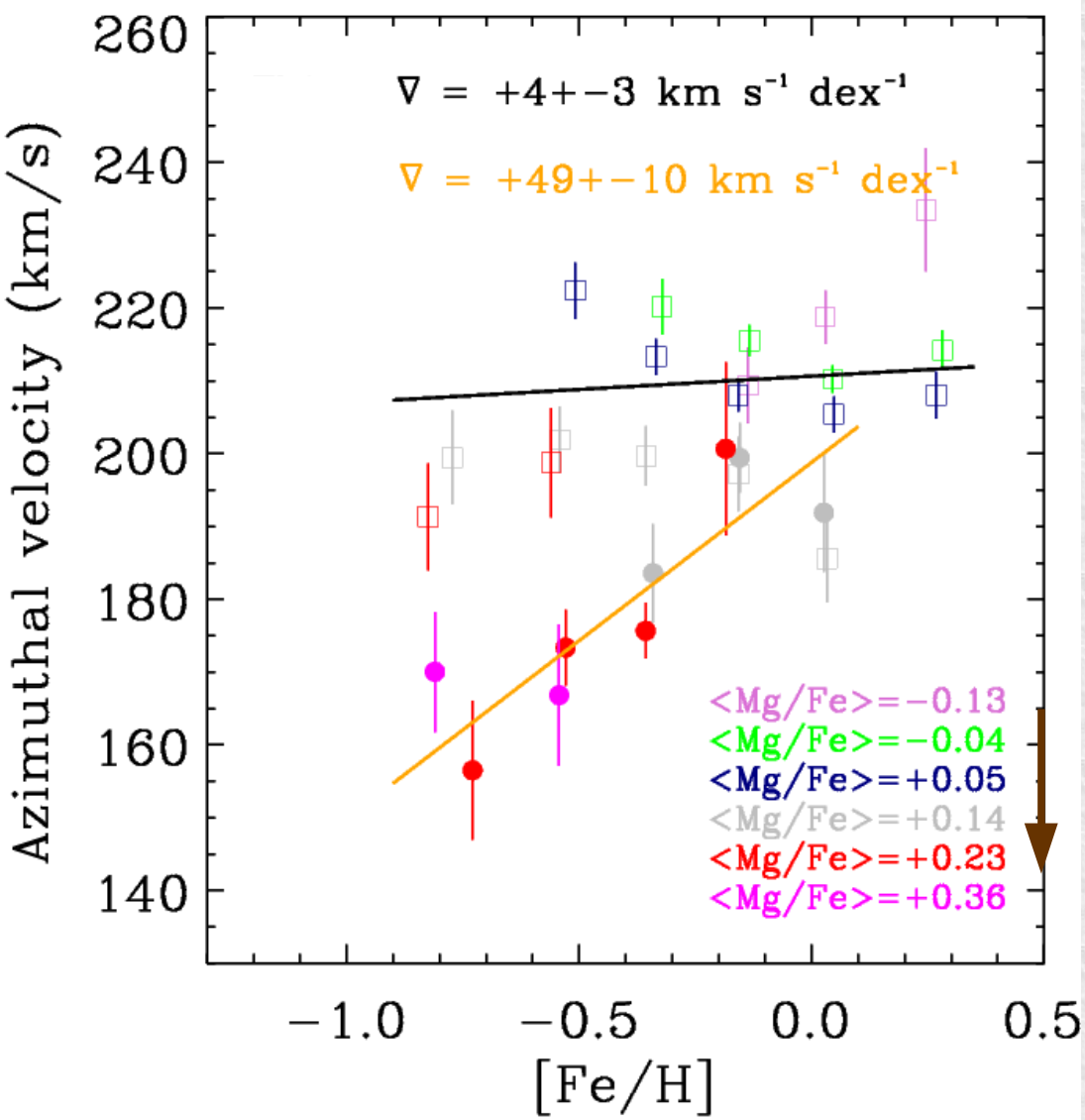




⇨ **Large spatial coverage.**

1/ The stellar sample and the Galactic Disc characterization

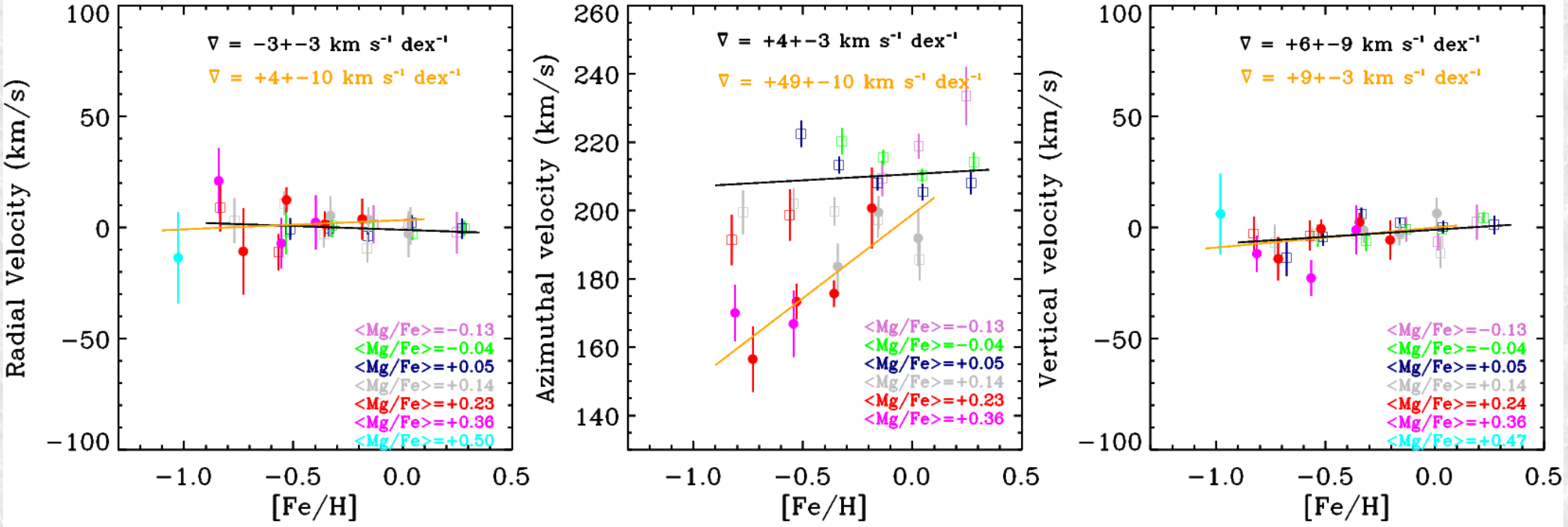
⇨ Velocity gradients in the Galactic Disc



⇨ **Thin disc positive gradient due to the [Fe/H]-poor tail.**

1/ The stellar sample and the Galactic Disc characterization

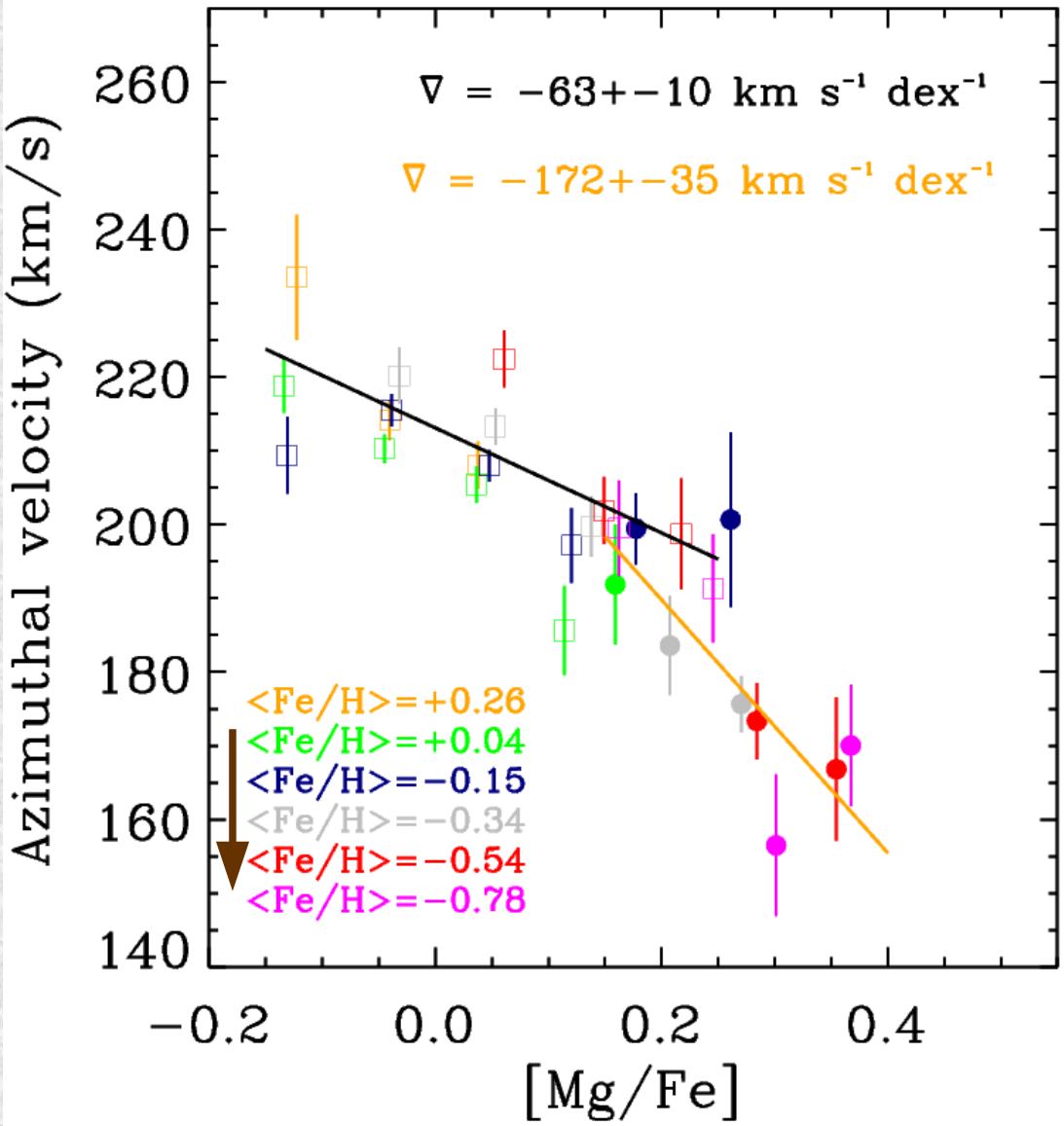
⇨ Velocity gradients in the Galactic Disc



⇨ No tendency for the radial and vertical velocities.

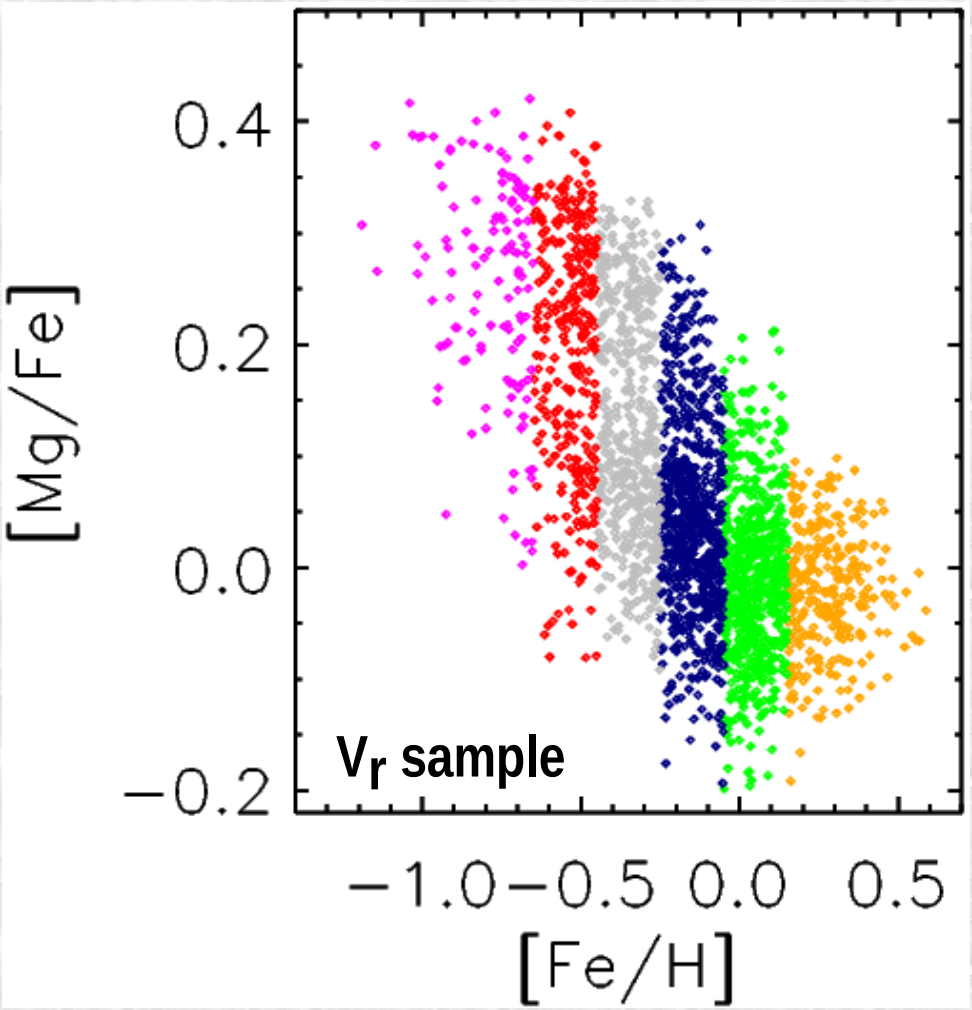
1/ The stellar sample and the Galactic Disc characterization

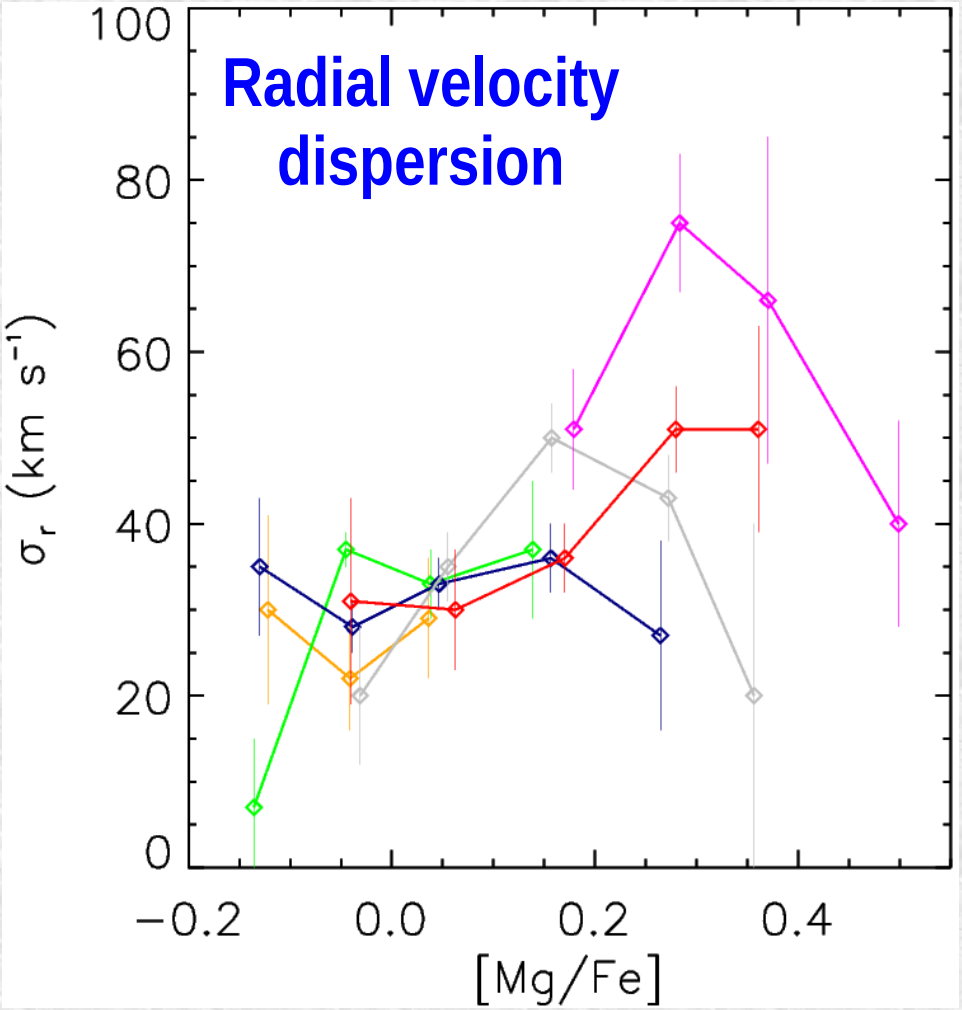
⇨ Velocity gradients in the Galactic Disc



⇨ **Strong anti-correlation for both thin and thick discs.**

2/ The velocity dispersion v.s [Mg/Fe] relation





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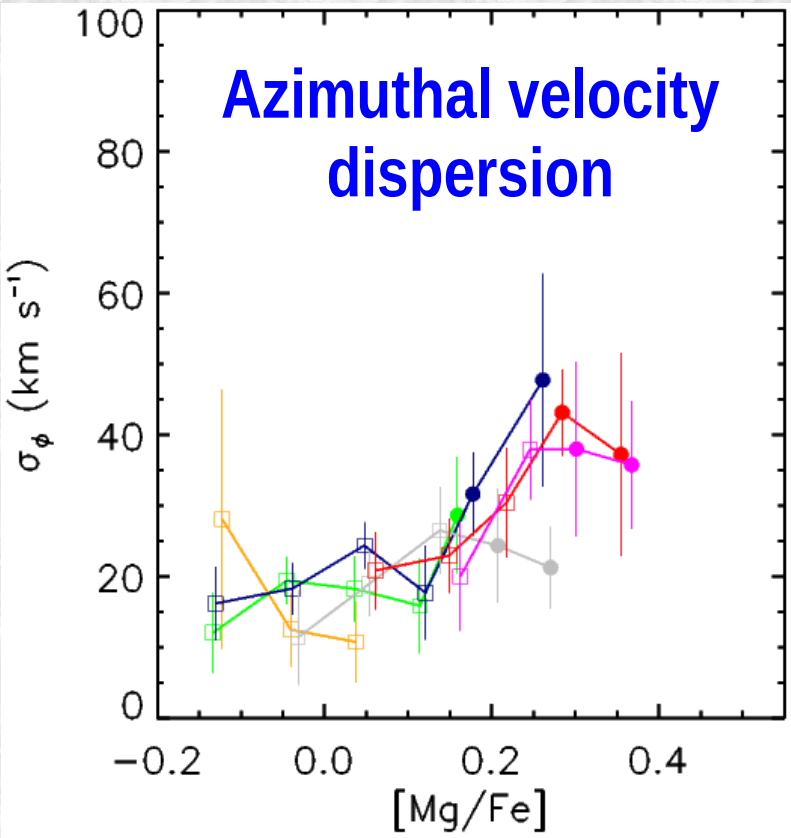
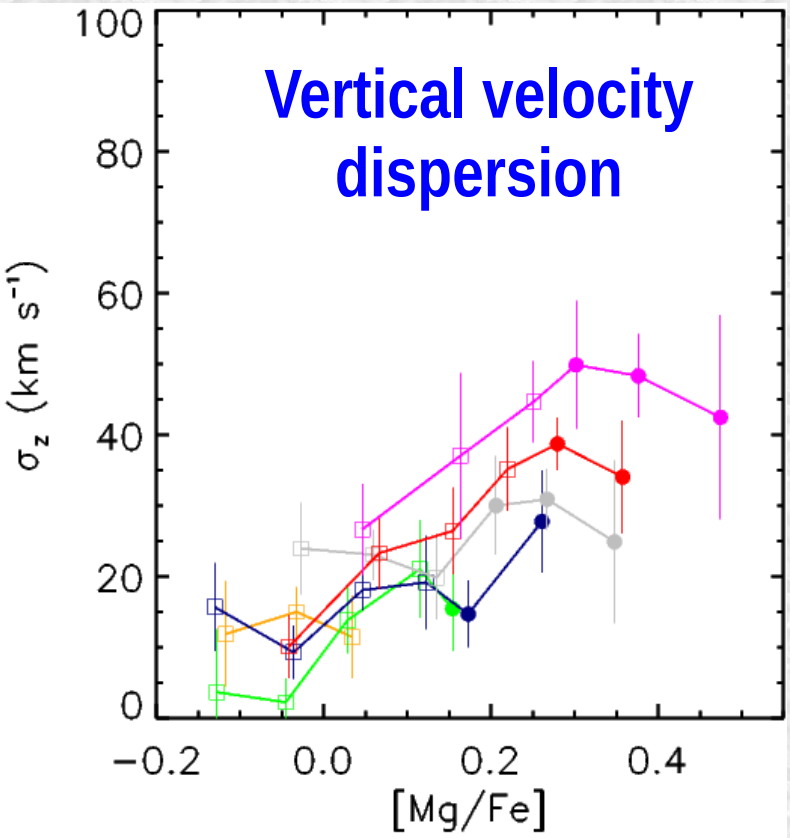
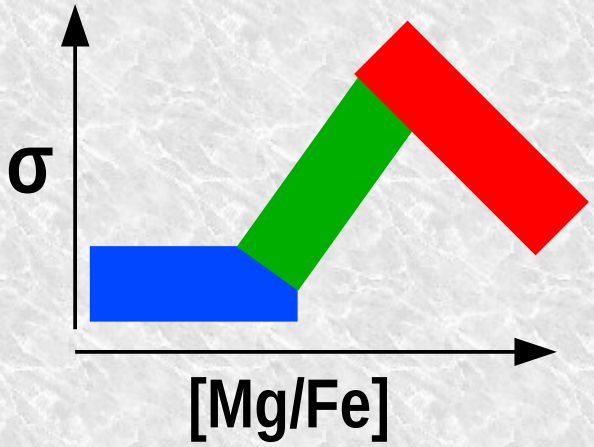


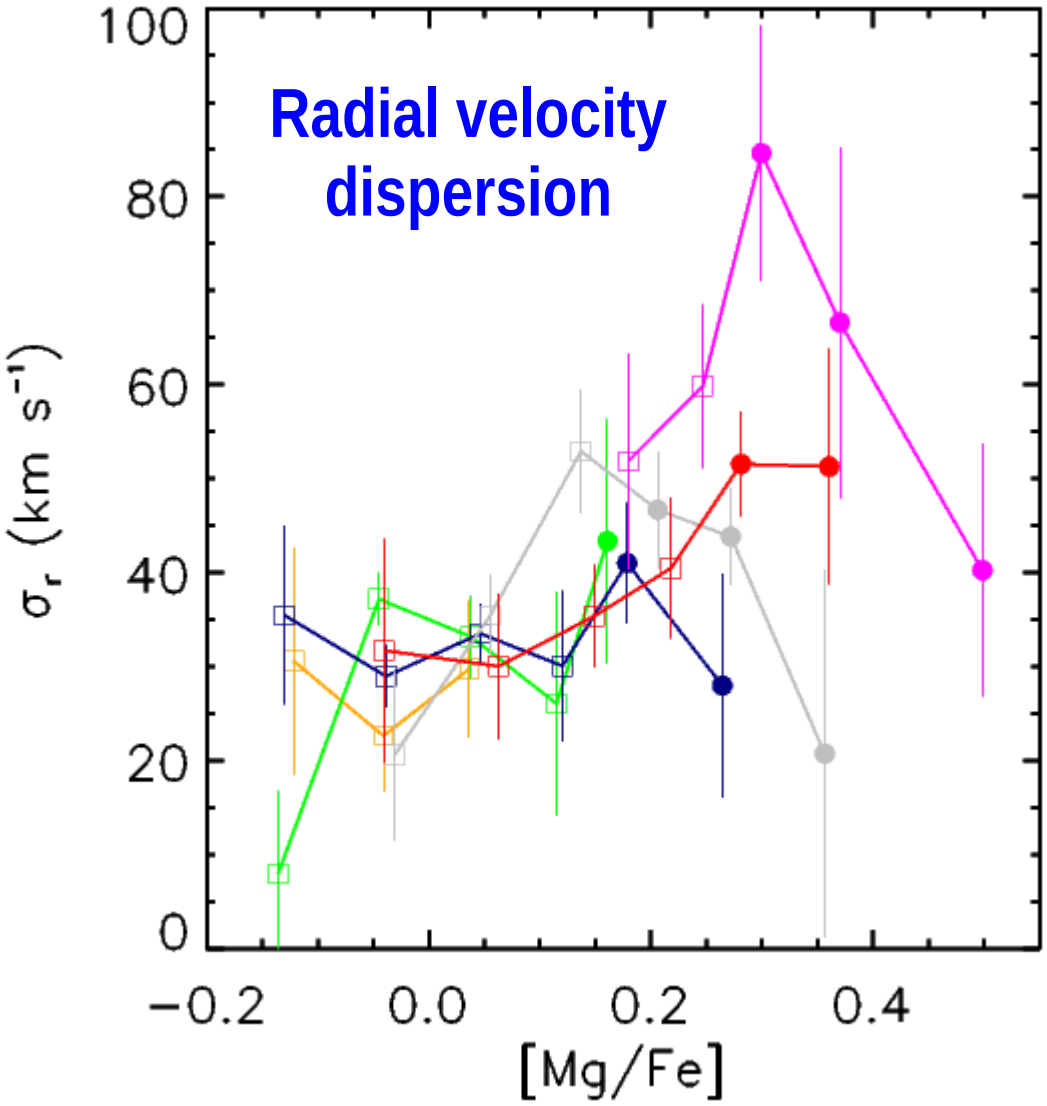


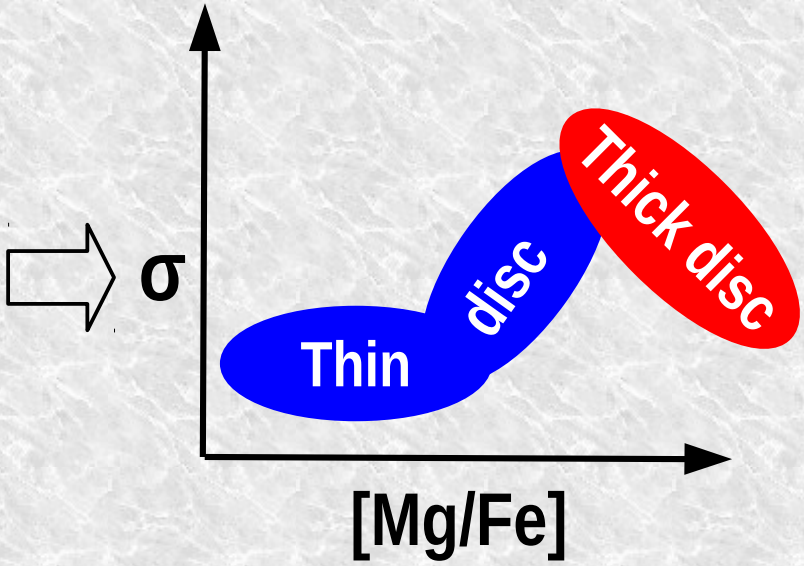
Flat behaviour
Increase
Unexpected decrease



2/ The velocity dispersion v.s [Mg/Fe] relation

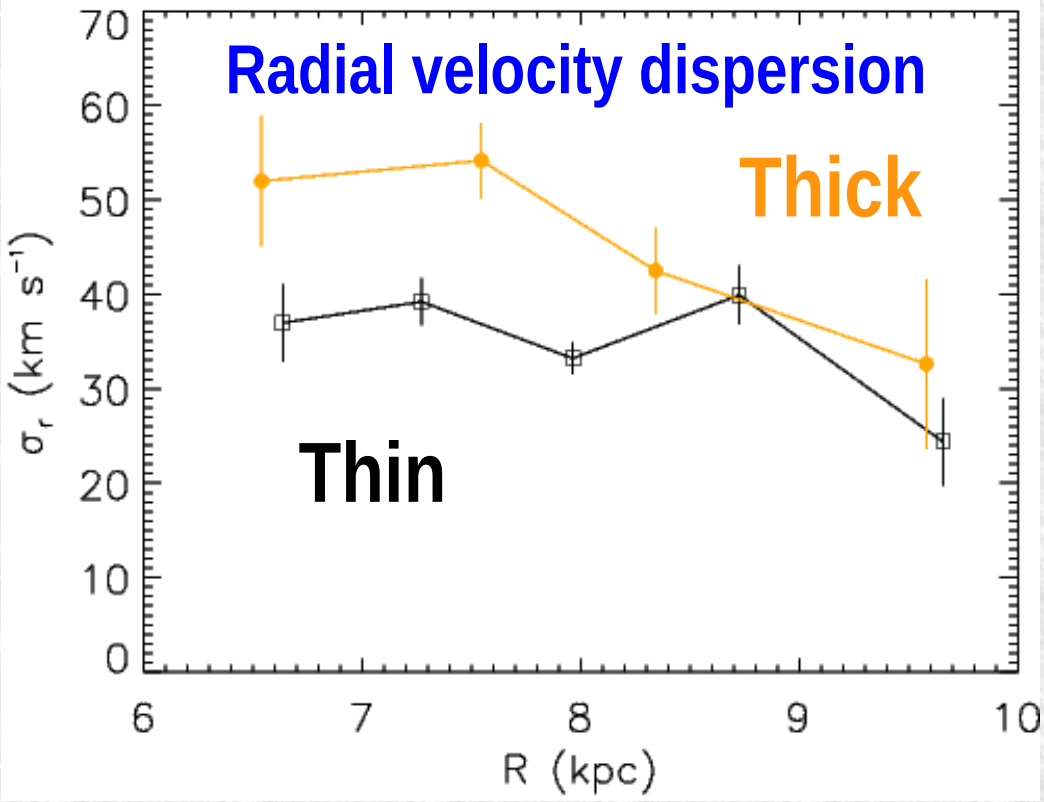
⇨ Thin/thick disc decomposition.

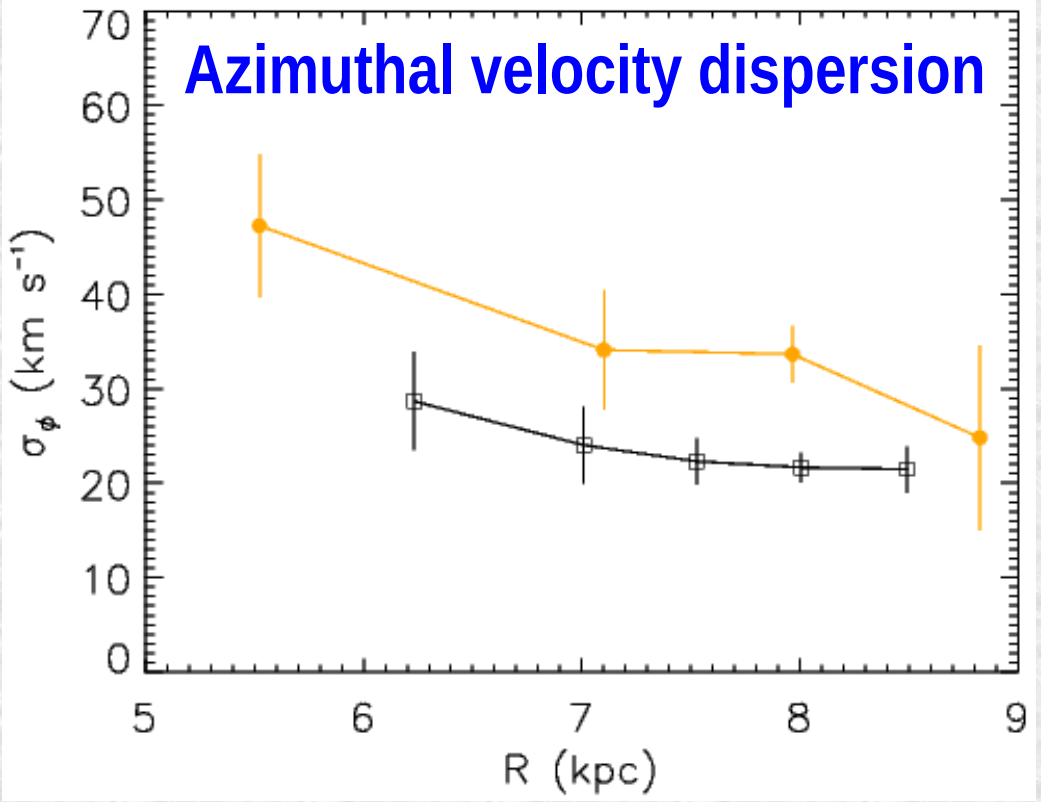




2/ The velocity dispersion v.s [Mg/Fe] relation

⇨ Velocity dispersion *v.s* R:



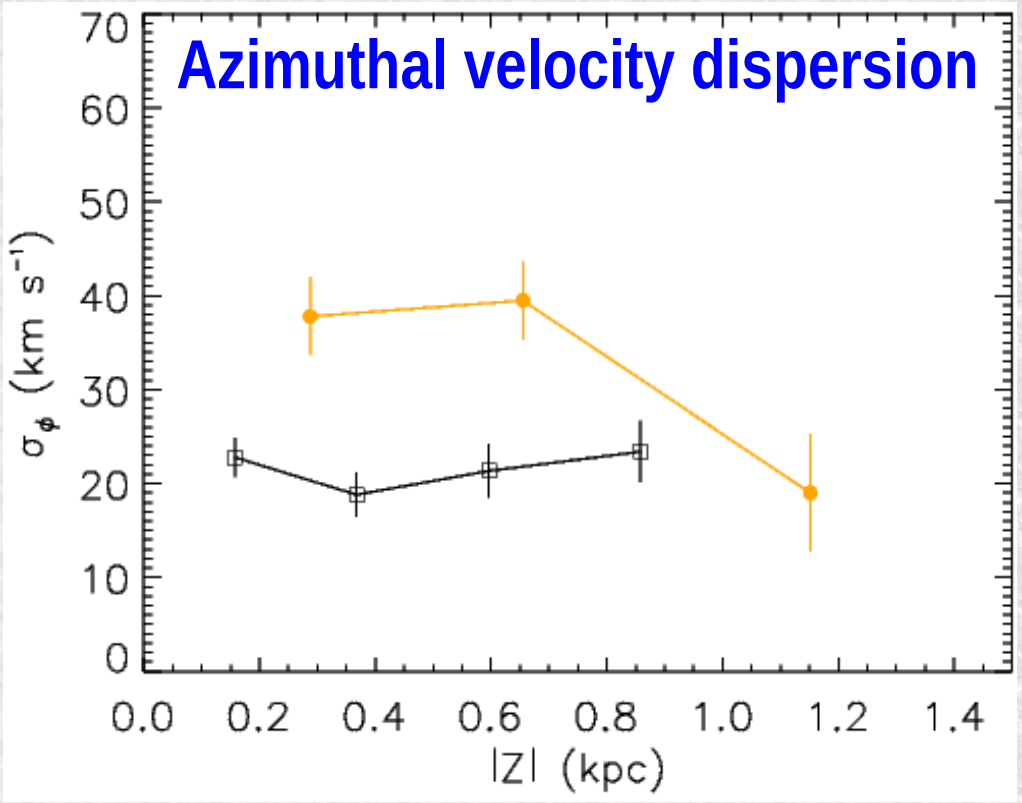


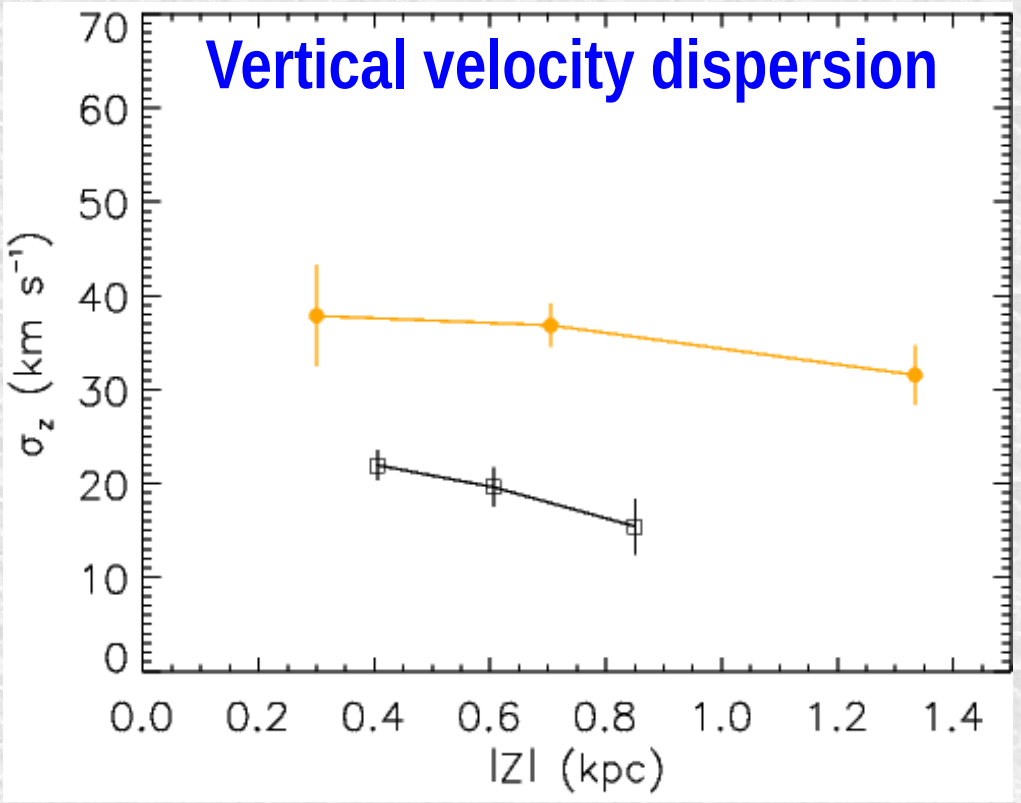
⇨ **Decreasing σ with R for the thick disc.**

↳ **Also observed by Sharma et al. 2014, RAVE & GCS.**

2/ The velocity dispersion v.s [Mg/Fe] relation

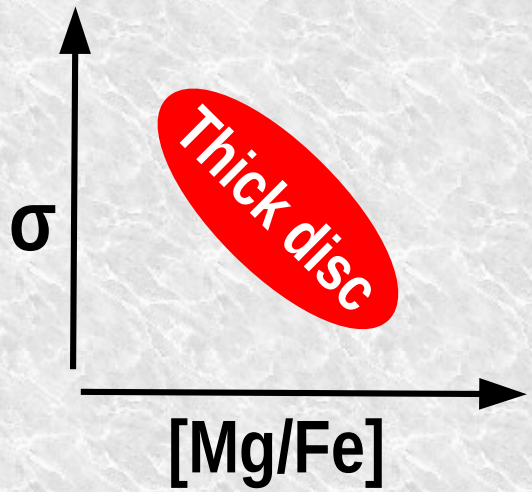
⇨ Velocity dispersion *v.s* Z:





⇨ Decreasing σ_Φ with Z for the thick disc.

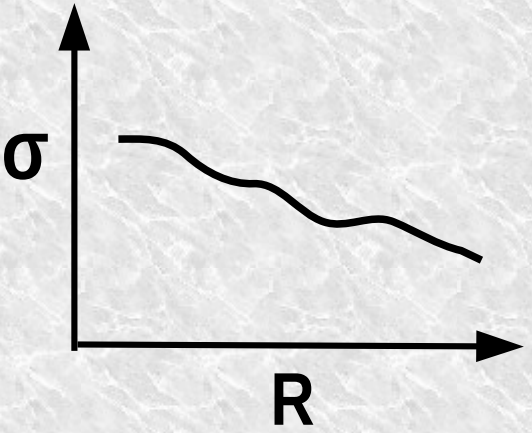
3/ Implications for the thick disc formation



+ { [Mg/Fe] > +0.20 dex & [Fe/H] > -0.35 dex

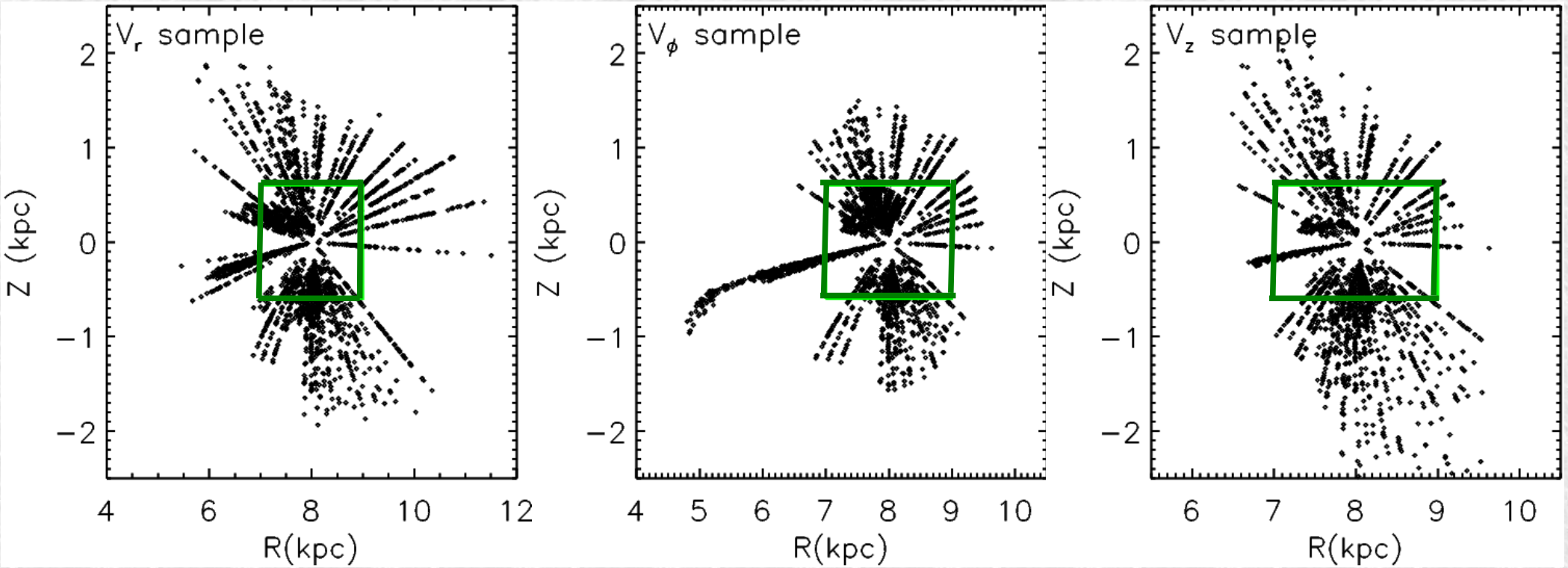
⇨ Population probably not born in a turbulent environment.

⇨ Stars born in the outer disc ?



3/ Implications for the thick disc formation

- Decreasing sequence previously observed ?
  - Minchev et al. 2014, RAVE.



3/ Implications for the thick disc formation

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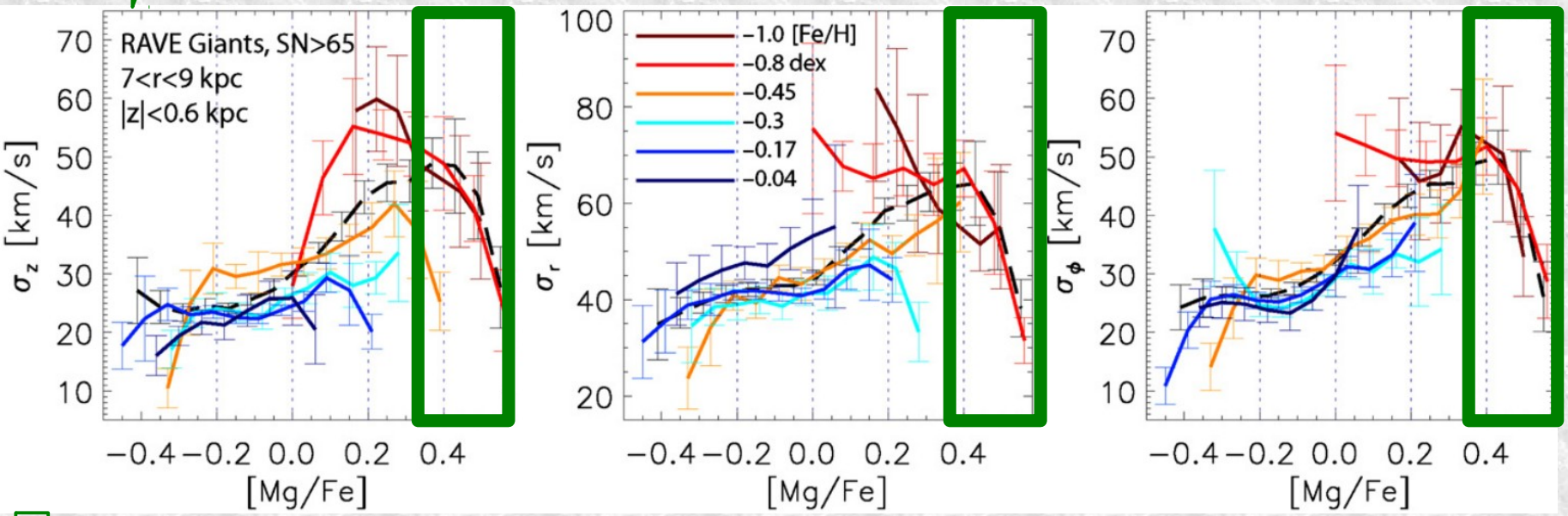
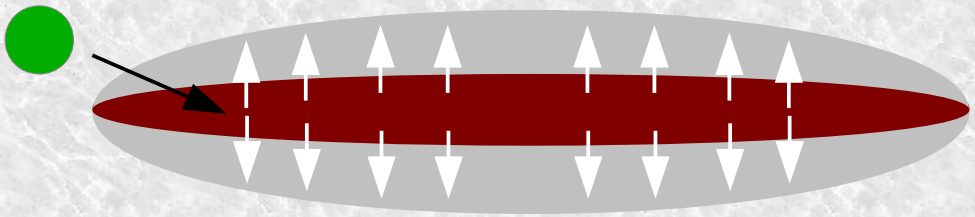


⇨ Mergers → Churning from the inner regions

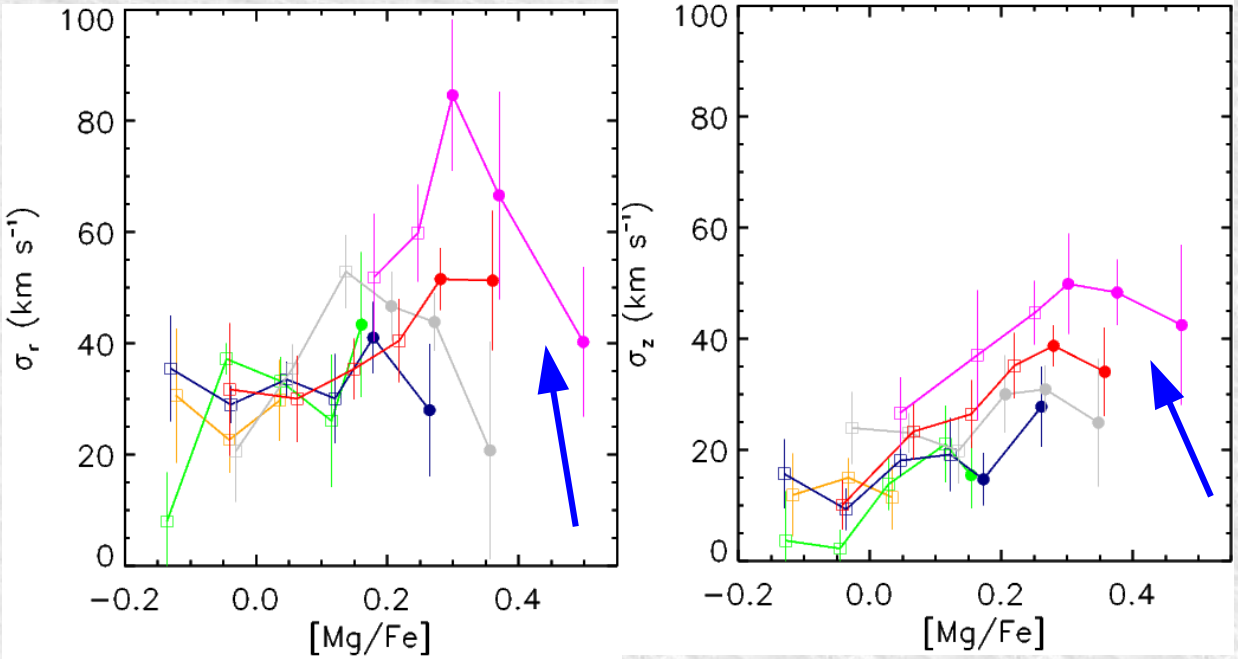
⇨ Our study: Mg>0.2 dex → New merger temporal sequence.

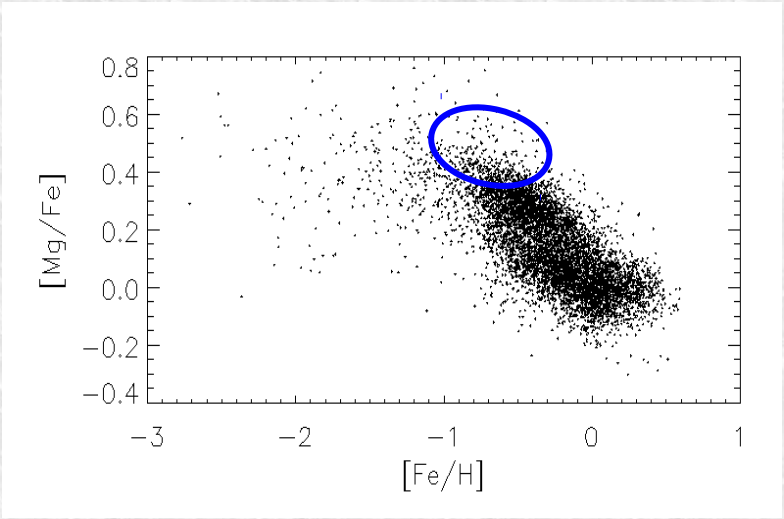
3/ Implications for the thick disc formation

⇨ Villalobos & Helmi (2008):



⇨ **Remnant cool old disc predicted**





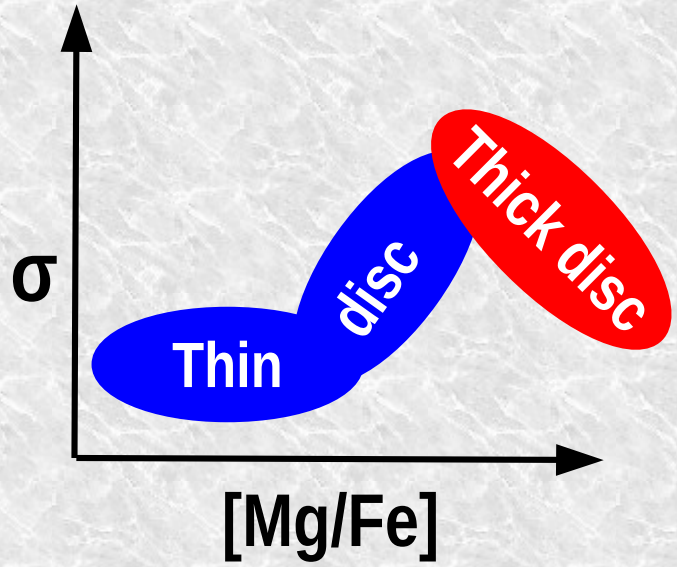
⇨ Good candidates for the remnant old primary disc.

3/ Implications for the thick disc formation

⇨ **Recent study by Haywood et al. (2013):**

- No observed σ decrease with the ages.
- Turbulent gaseous thick disc phase proposed.

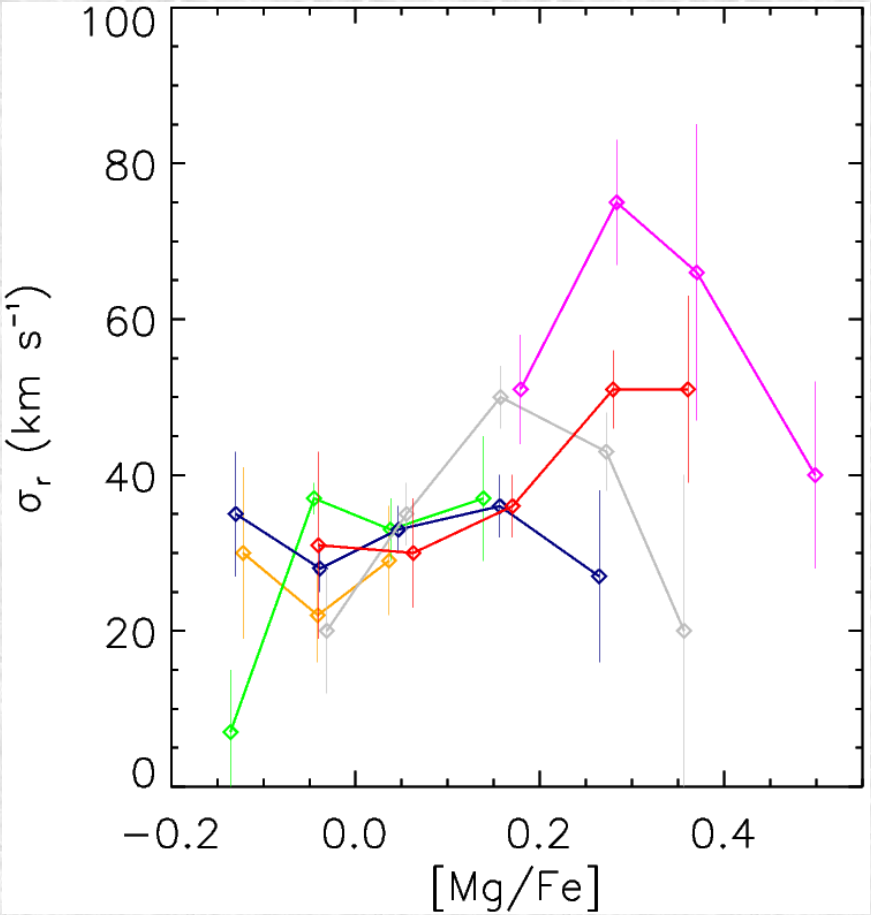
We found:



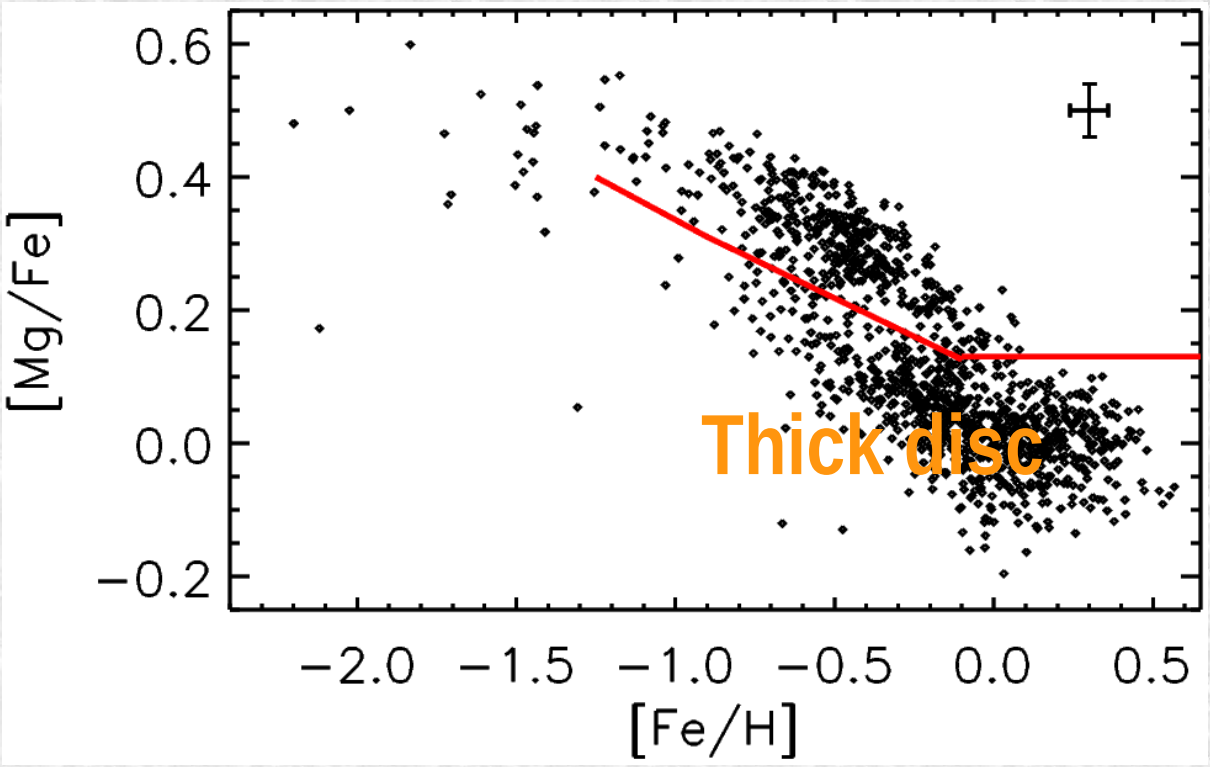
⇨ **Difference could be explained by the ≠ volume probed?**

4/ Conclusion

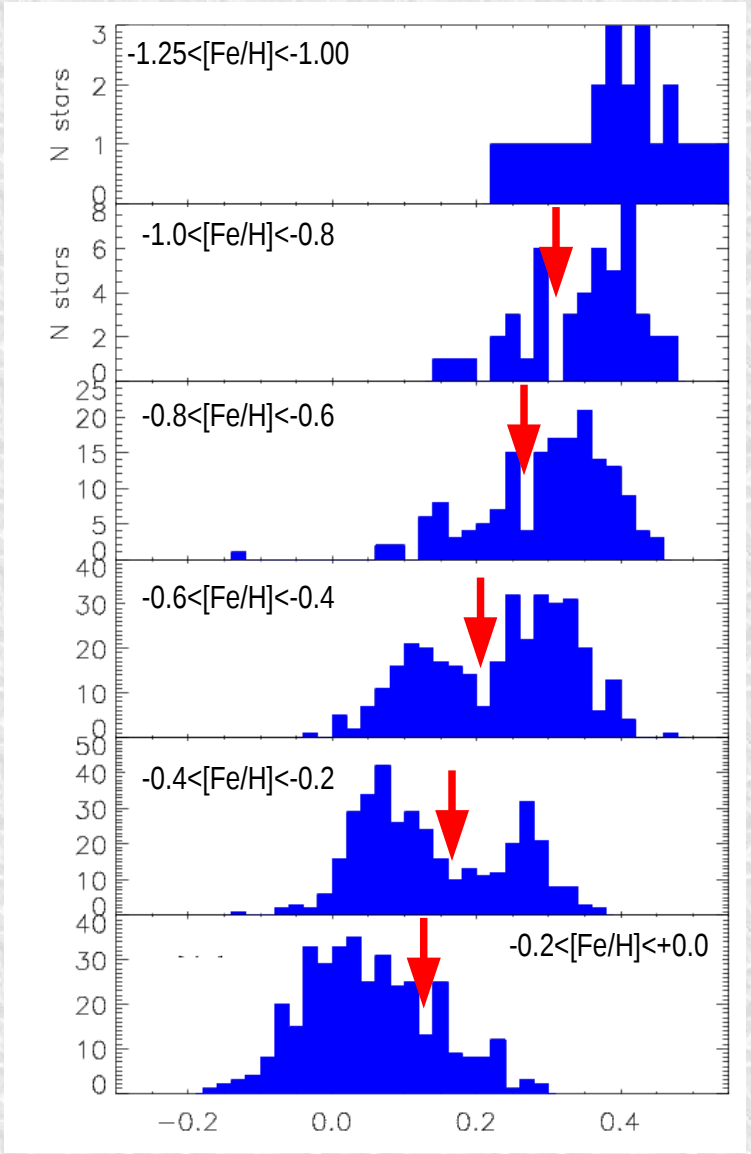
- Large spatial volume (6 < R < 10 kpc and |Z| < 2 kpc).
- New azimuthal velocity gradient derived for the thin disc.
- Unexpected decline of σ for [Mg/Fe] > +0.2 dex.



- Stars possibly born in a quite steady state
- Outer disc origin ?


0.6
0.4
0.2
0.0
−0.2
[Mg/Fe]
−2.0
−1.5
−1.0
−0.5
0.0
0.5
[Fe/H]
Thick disc

Thin disc


N stars
-1.25<[Fe/H]<-1.00
-1.0<[Fe/H]<-0.8
-0.8<[Fe/H]<-0.6
-0.6<[Fe/H]<-0.4
-0.4<[Fe/H]<-0.2
-0.2<[Fe/H]<+0.0
−0.2
0.0
0.2
0.4