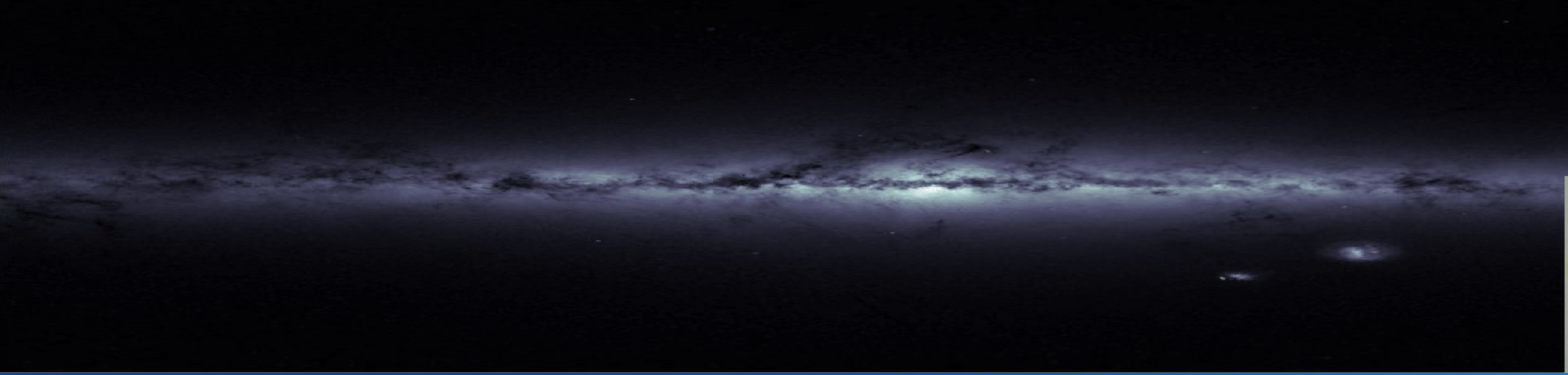


The AMBRE Project
Chemical tagging of the Galactic disc

Patrick de Laverny

G. Guilgion, S. Mikolaitis & AMBRE collaborators

Lagrange/OCA, Nice (France)

Chemical tagging of the Galactic disc

The Ambre Project

AMBRE A Galactic Archaeology project based on ESO archived HR spectra (de Laverny et al., 2013)

Credits : A. Recio-Blanco

Main Goals

- Provide advanced ESO data produtcs
- Homogeneous stellar parametrisation & chemical analysis
- Provide large data samples for Galactic/stellar studies

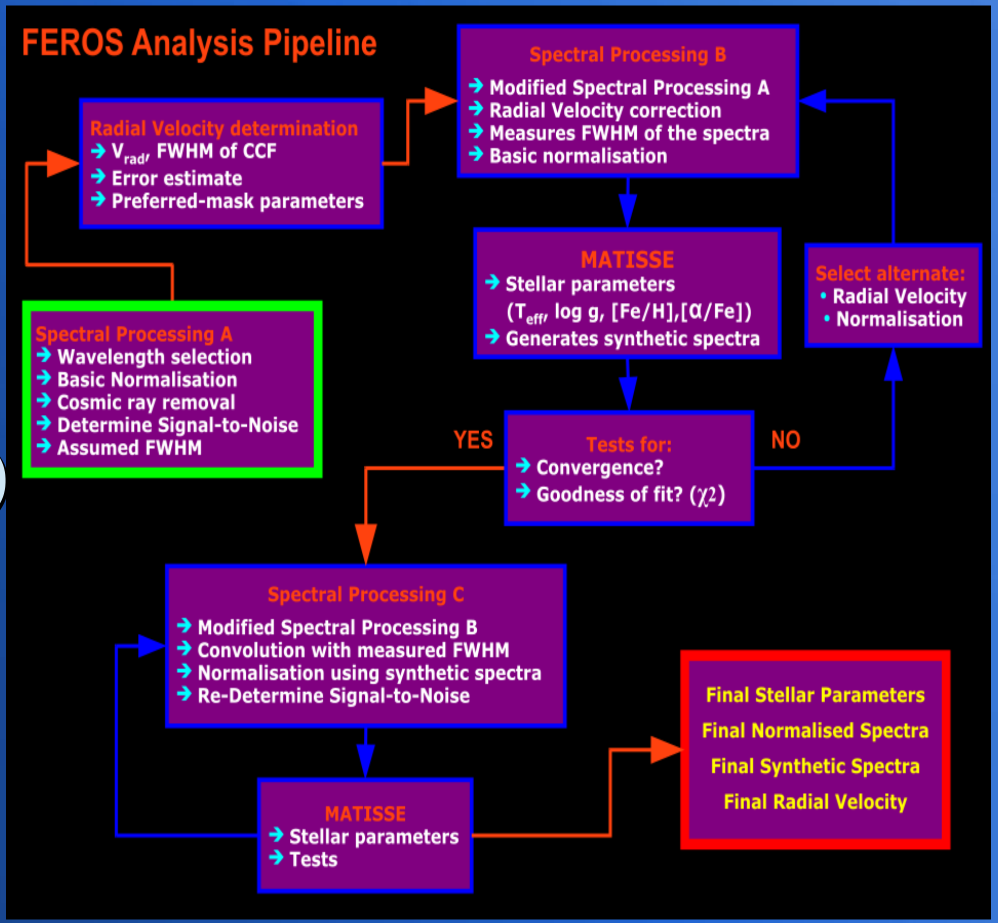
Chemical tagging of the Galactic disc

The Ambre Project

Methodology   Parametrisation pipeline

for Vrad, Teff, log(g), [M/H], [α/Fe]

- MATISSE algorithm (Recio-Blanco et al., 2006)
- FGKM-type spectra grid (de Laverny et al. 2012)



Fully parametrised samples

- 6 508 FEROS spectra (Worley et al., 2012)
- 93 116 HARPS spectra (de Pascale+2014)
- 12 403 UVES spectra (Worley et al. 2016)

Warning :

several repeats !

Chemical tagging of the Galactic disc

The Ambre Project

Chemical tagging

* On-the-fly line profile fitting (χ^2 minimisation):

→ Iron-peak element abundances for 4 666 stars (Mikolaitis et al., 2016)

* GAUGUIN Gauss-Newton method (Bijaoui et al., 2012)

→ Li abundances for 7 300 stars (Guiglion et al., 2016)

Chemical tagging of the Galactic disc

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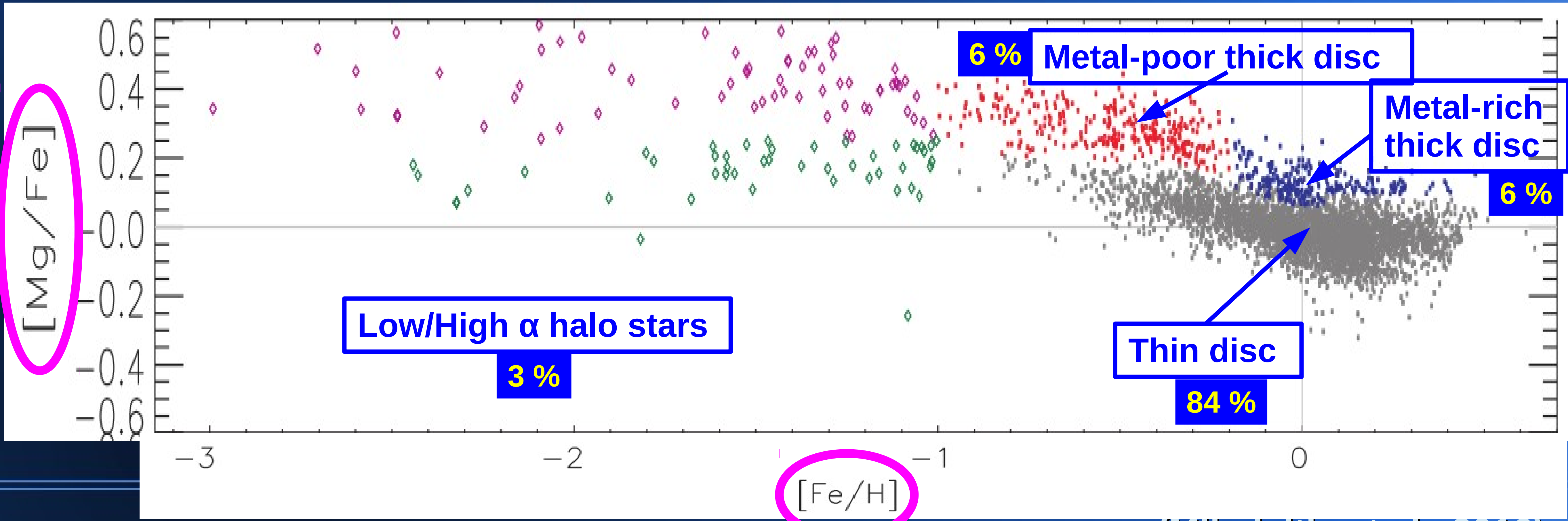
Chemical tagging of the Galactic disc

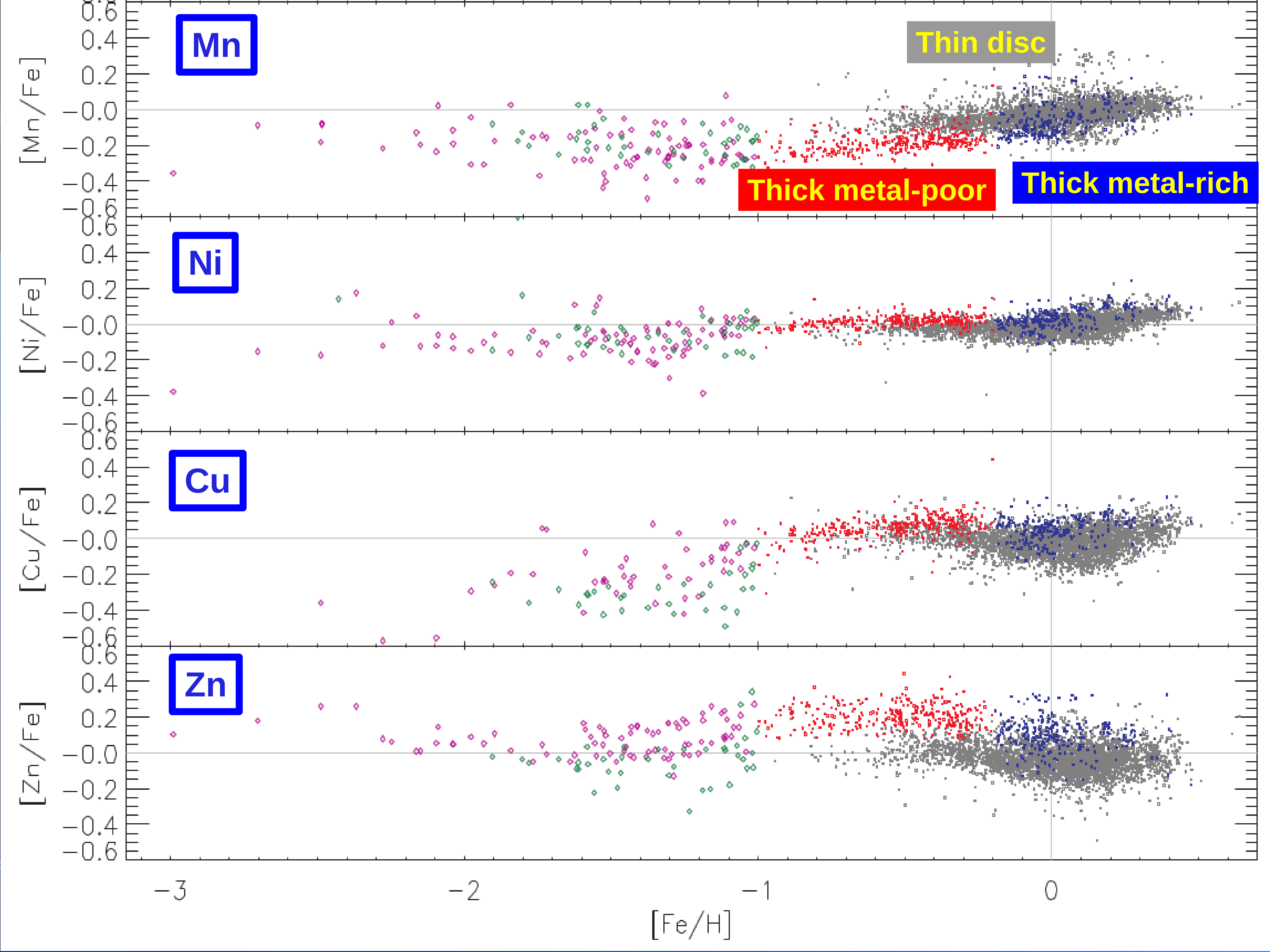
Iron-peak elements

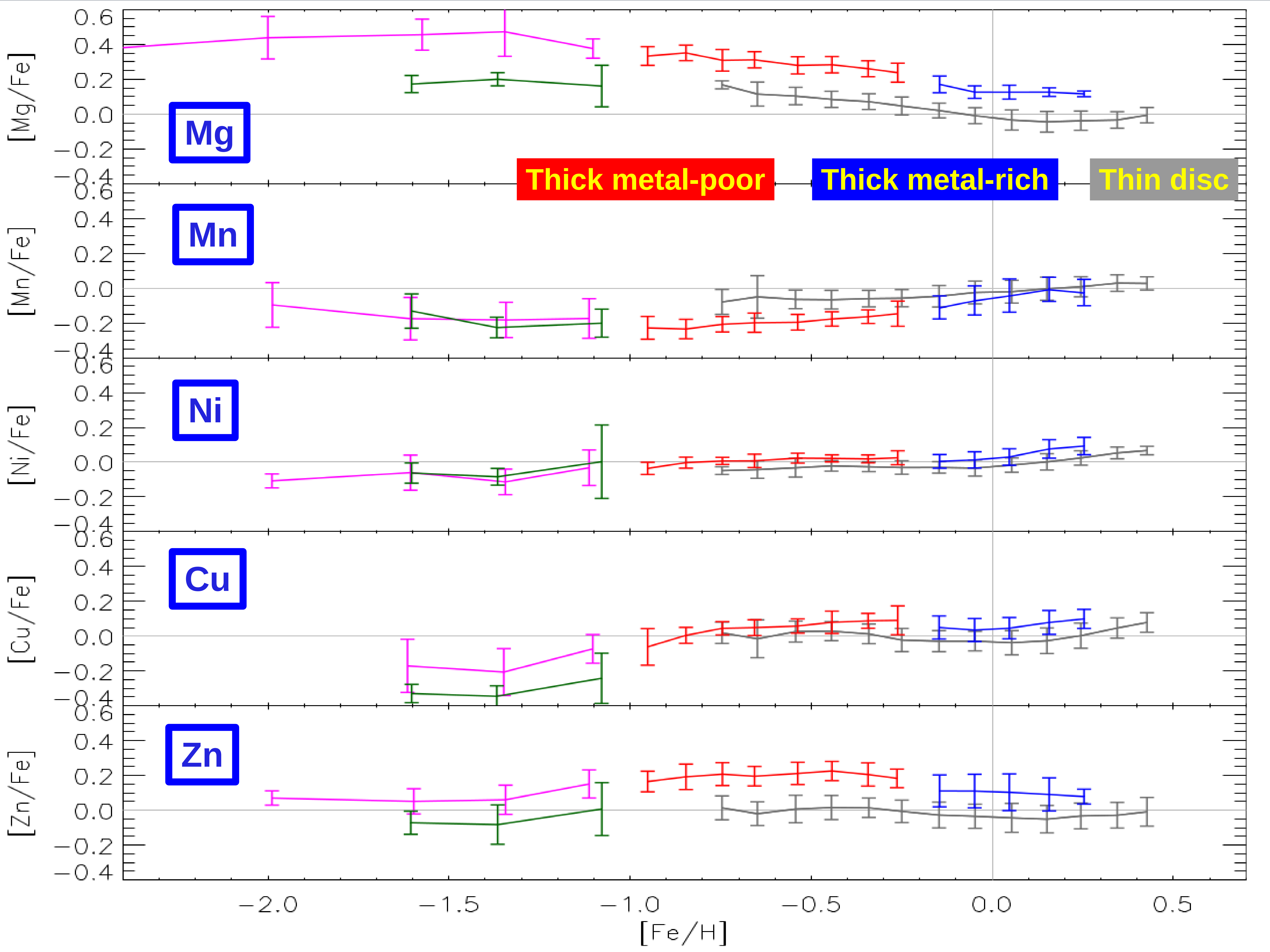
LTE abundances for 4 666 stars Mg, Mn, Fe, Ni, Cu, Zn

Chemical separation of the Galactic substructures

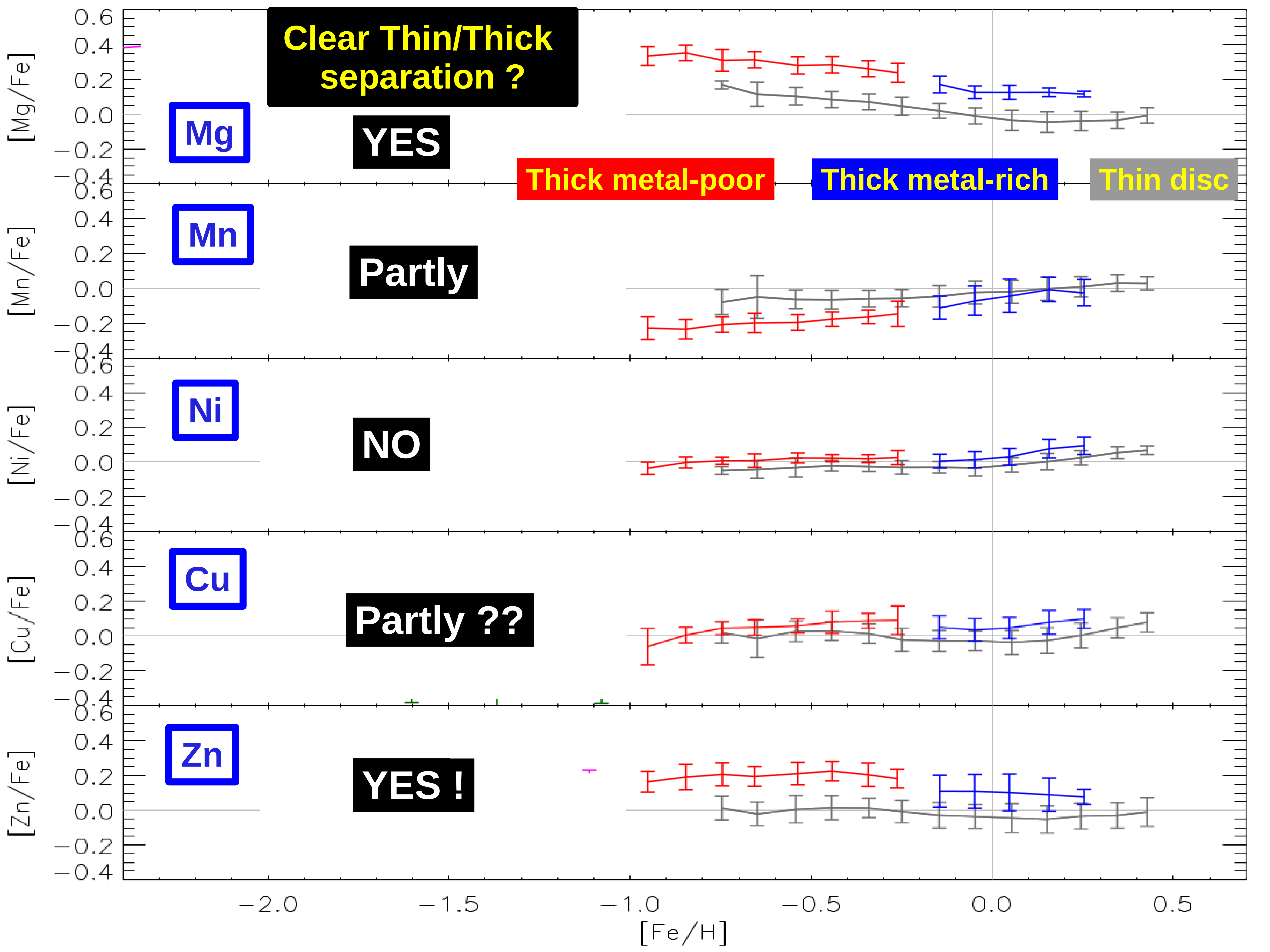


(Mikolaitis et al., 2016)


Mn
Ni
Cu
Zn
Thin disc
Thick metal-poor
Thick metal-rich
[Mn/Fe]
[Ni/Fe]
[Cu/Fe]
[Zn/Fe]
[Fe/H]
−3
−2
−1
0
0.6
0.4
0.2
−0.0
−0.2
−0.4
−0.6



Mg
Mn
Ni
Cu
Zn
Thick metal-poor
Thick metal-rich
Thin disc
[Mg/Fe]
[Mn/Fe]
[Ni/Fe]
[Cu/Fe]
[Zn/Fe]
[Fe/H]

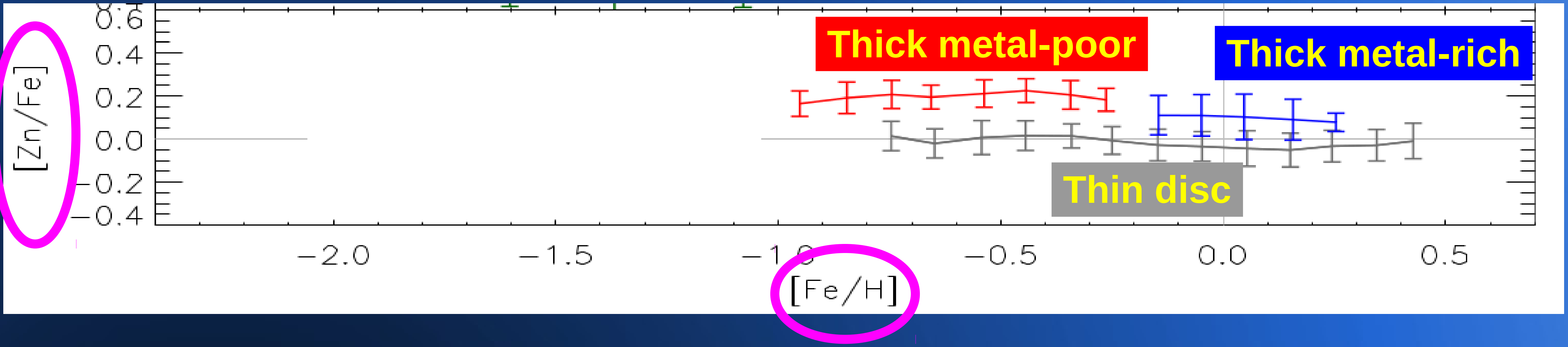


Clear Thin/Thick separation ?
Mg
YES
Thick metal-poor
Thick metal-rich
Thin disc
Mn
Partly
Ni
NO
Cu
Partly ??
Zn
YES !
[Mg/Fe]
[Mn/Fe]
[Ni/Fe]
[Cu/Fe]
[Zn/Fe]
[Fe/H]

Chemical tagging of the Galactic disc

Iron-peak elements

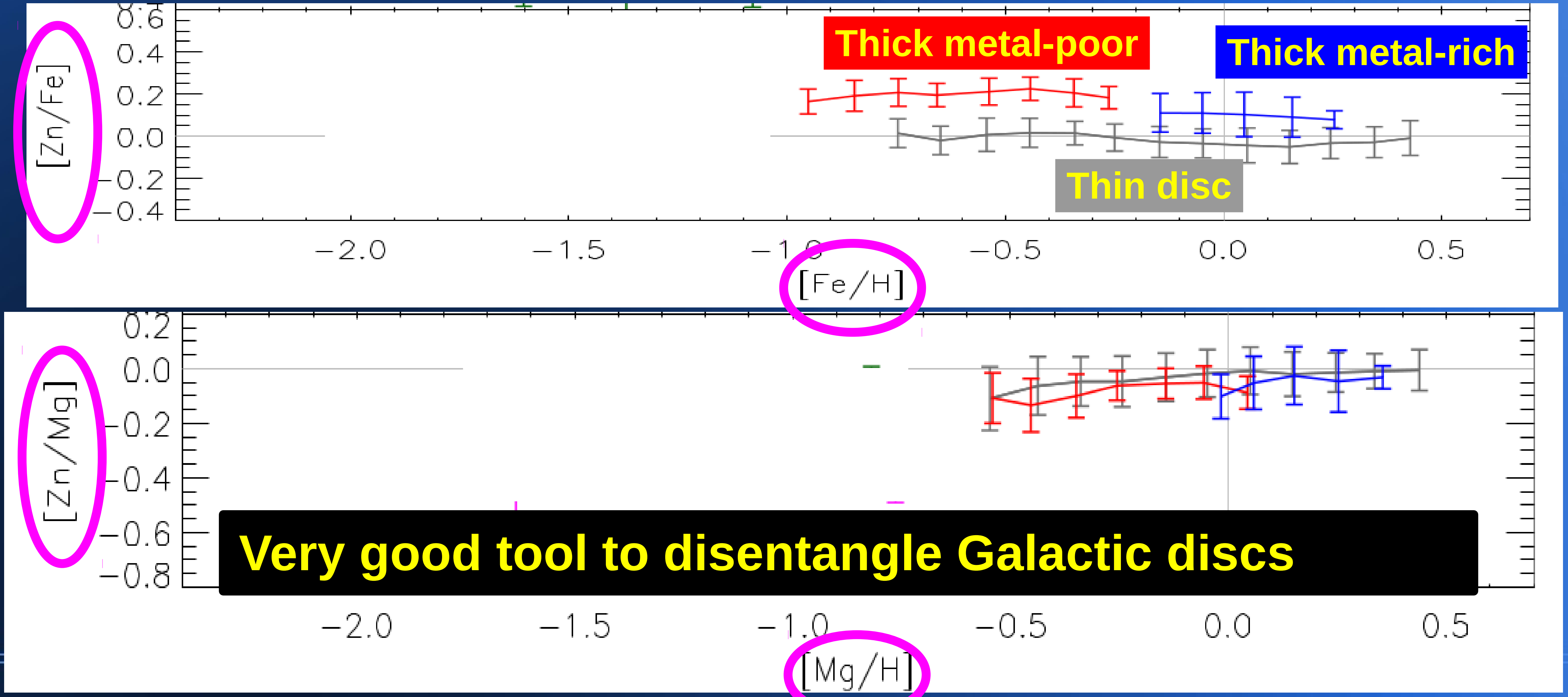
Zinc – behaves like an α element



Chemical tagging of the Galactic disc

Iron-peak elements

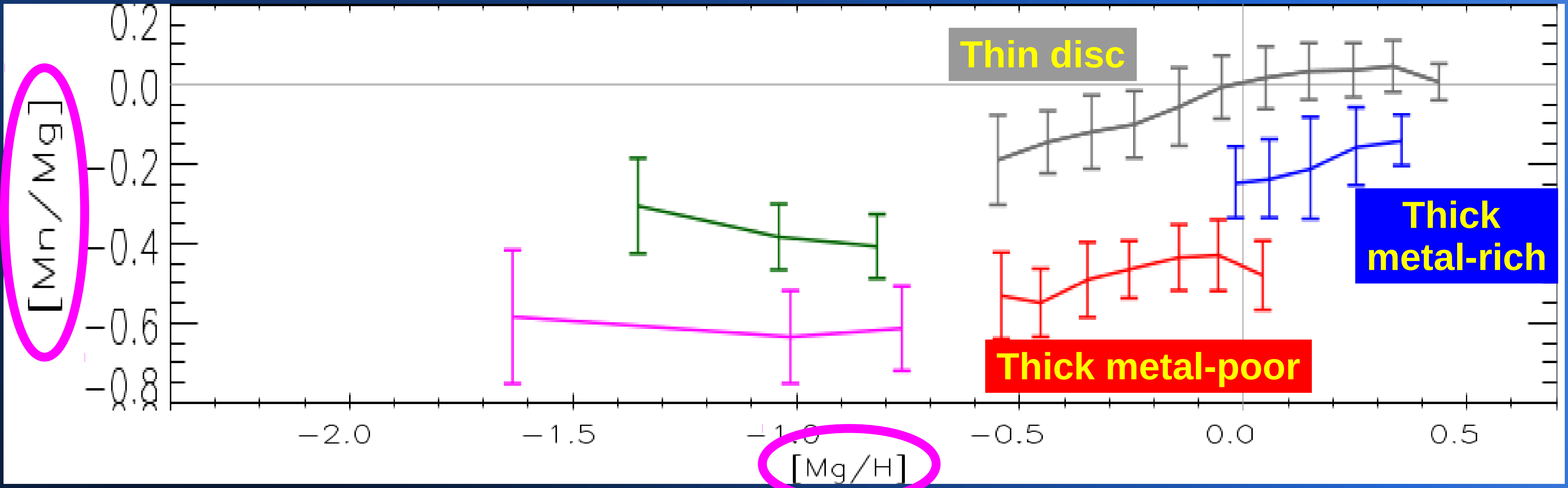
Zinc – behaves like an α element : <u>Produced in massive stars</u>



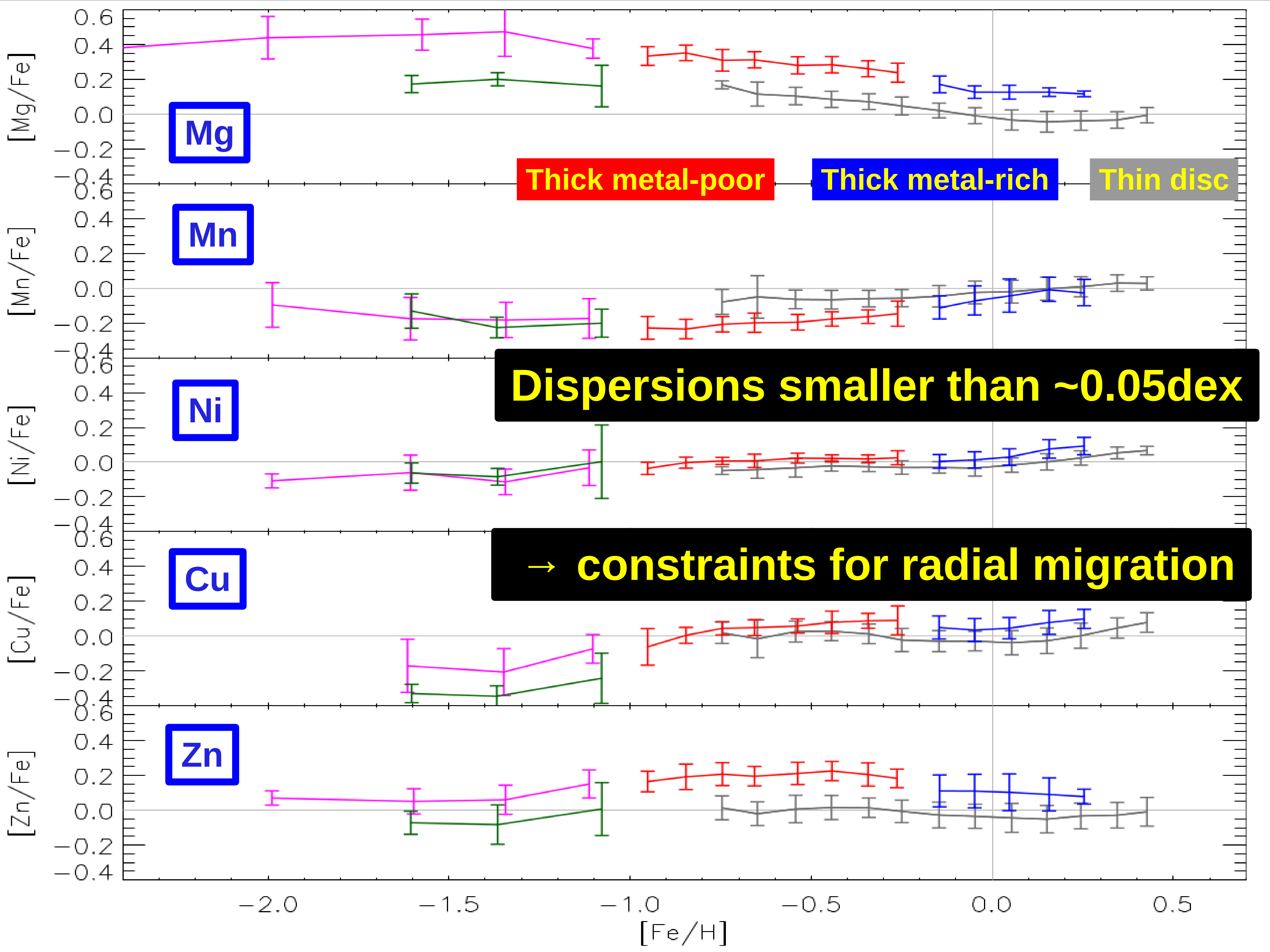
Chemical tagging of the Galactic disc

Iron-peak elements

[Mn/Mg] → Mn from SNIa & Mg from SNII



Very good chemical index to disentangle Galactic populations



Mg
Mn
Ni
Cu
Zn
Thick metal-poor
Thick metal-rich
Thin disc
Dispersions smaller than ~0.05dex
→ constraints for radial migration
[Mg/Fe]
[Mn/Fe]
[Ni/Fe]
[Cu/Fe]
[Zn/Fe]
[Fe/H]
0.6
0.4
0.2
0.0
−0.2
−0.4
−2.0
−1.5
−1.0
−0.5
0.0
0.5

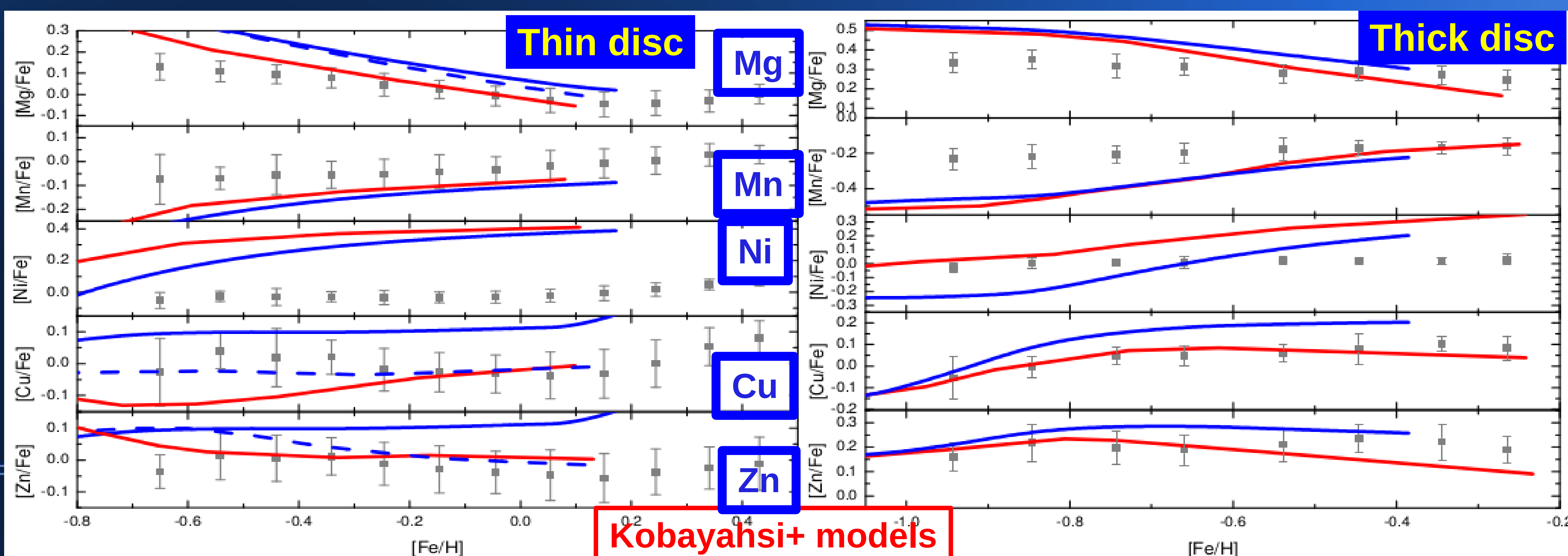
Chemical tagging of the Galactic disc

Iron-peak elements

Comparison with Galactic chemical evolutionary models

Mg, Zn & Cu partially well reproduced

Larger discrepancies for Mn and Ni

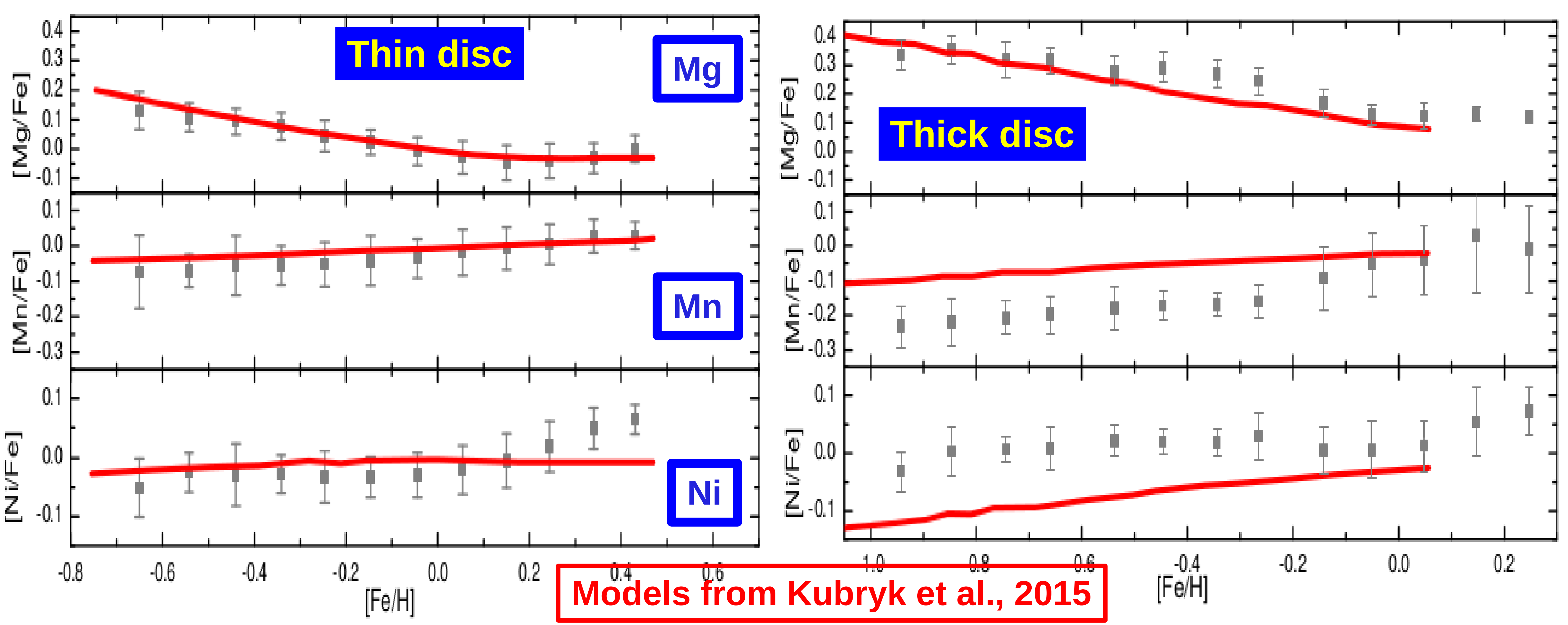


Chemical tagging of the Galactic disc

Iron-peak elements

Comparison with Galactic chemical evolutionary models

Better agreement if yields match Solar composition



Chemical tagging of the Galactic disc

The Ambre Project

Chemical tagging

* On-the-fly line profile fitting (χ^2 minimisation):

Iron-peak element abundances for 4 666 stars (Mikolaitis et al., 2016)

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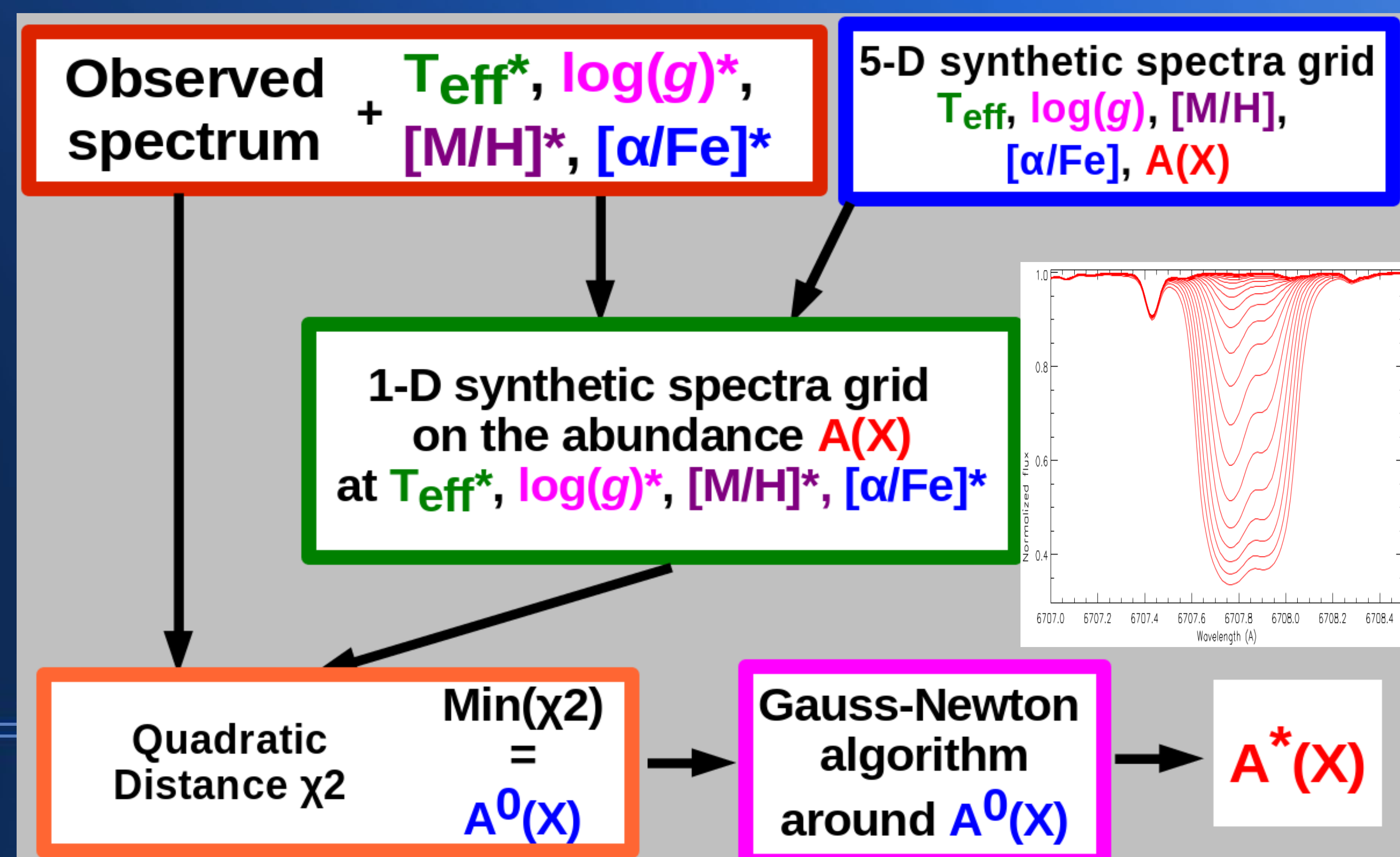
→ Li abundances for 7 300 stars

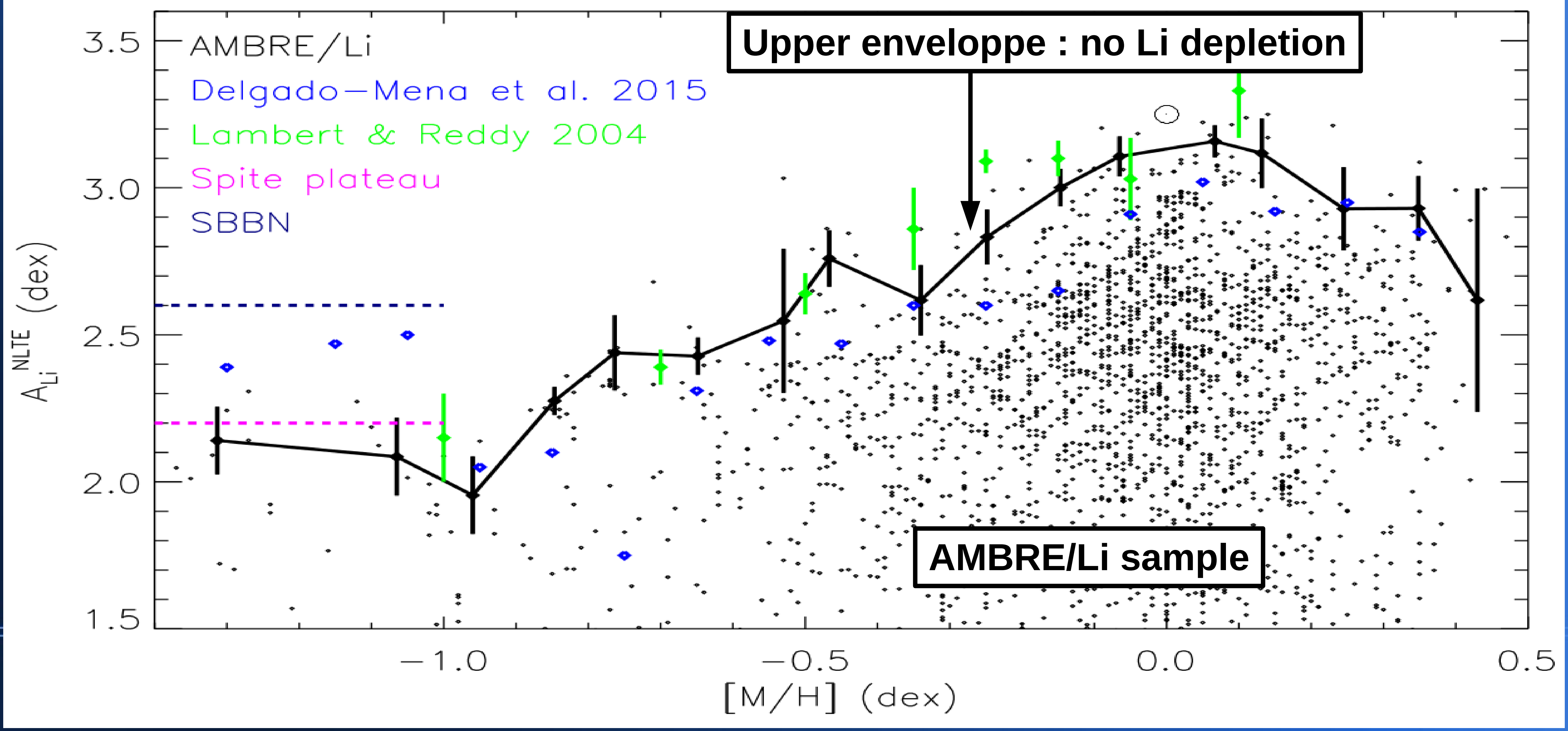
(Guiglion et al., 2016)



Chemical tagging of the Galactic disc

Lithium

Very high quality homogeneous NLTE A(Li) for 2264 dwarfs



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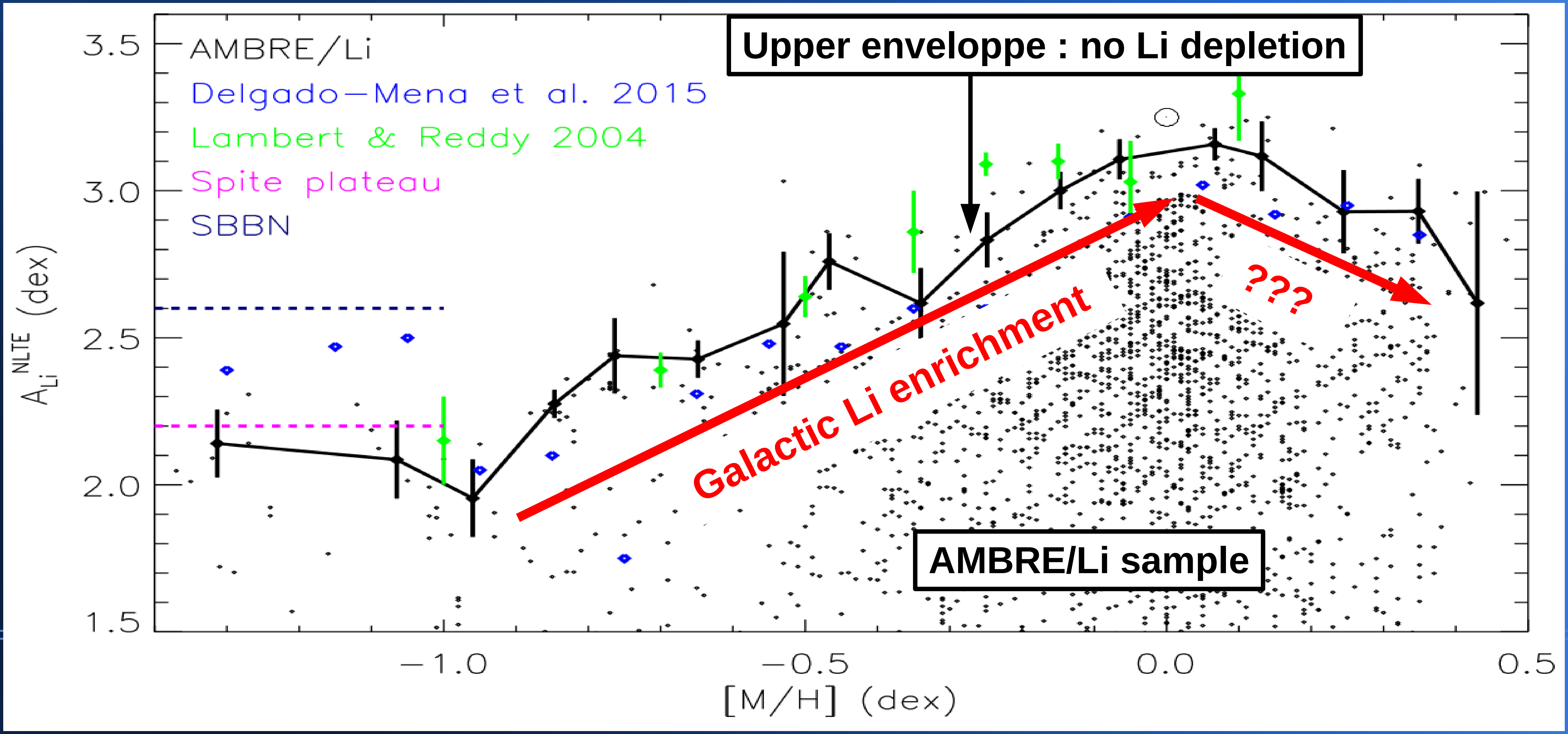
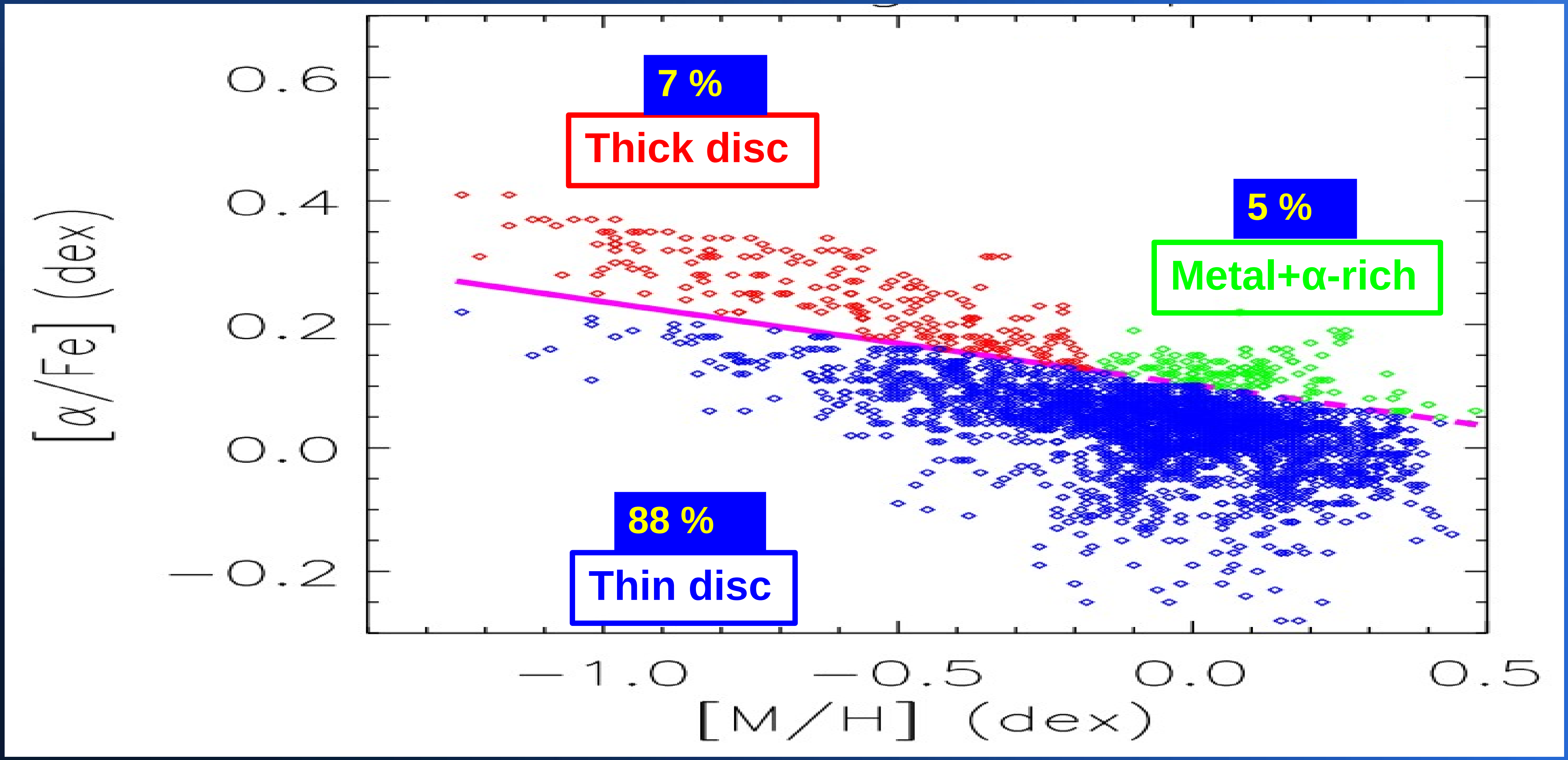


Chemical tagging of the Galactic disc

Lithium

Lithium in Galactic populations : chemical separation

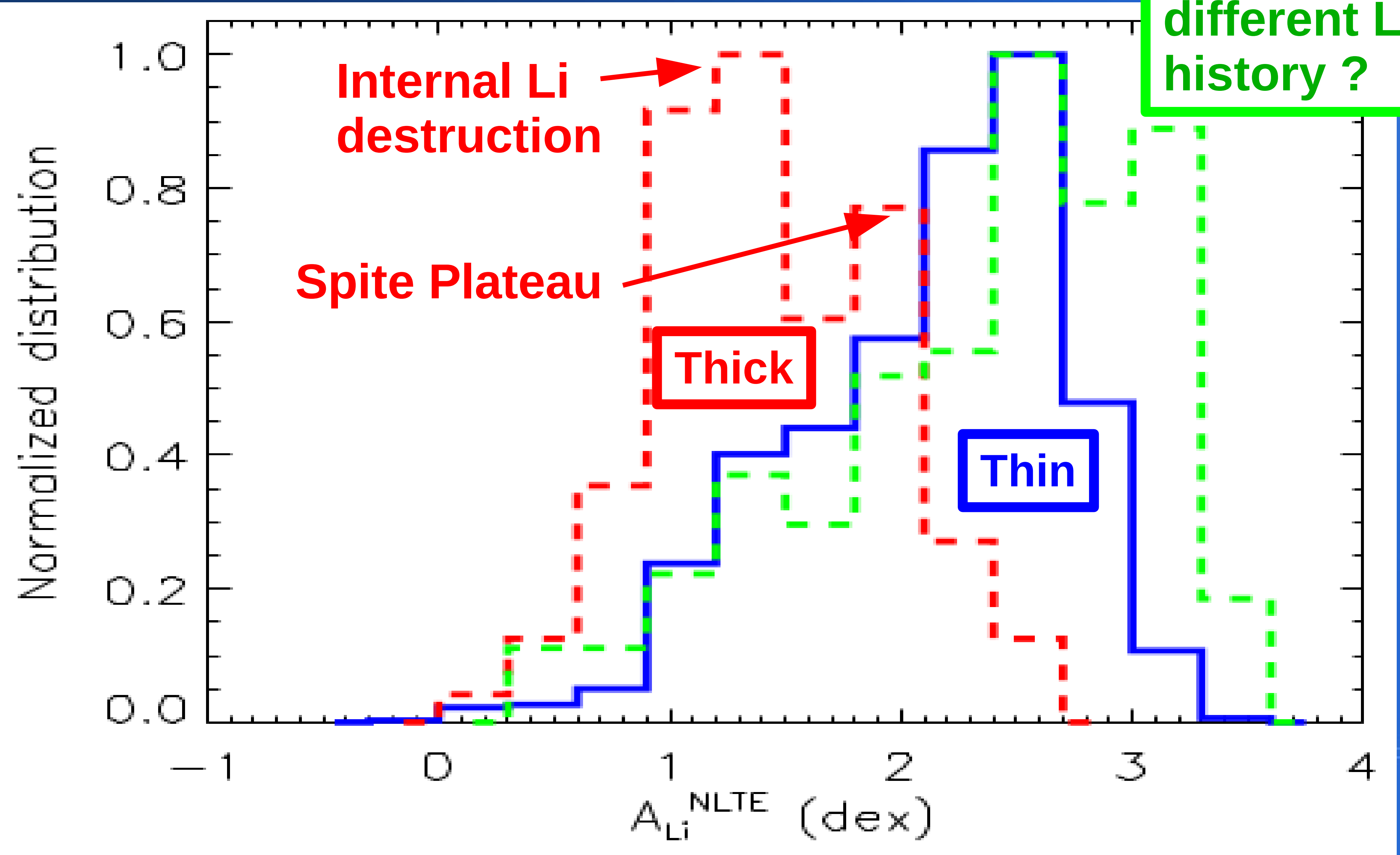


Chemical tagging of the Galactic disc

Lithium

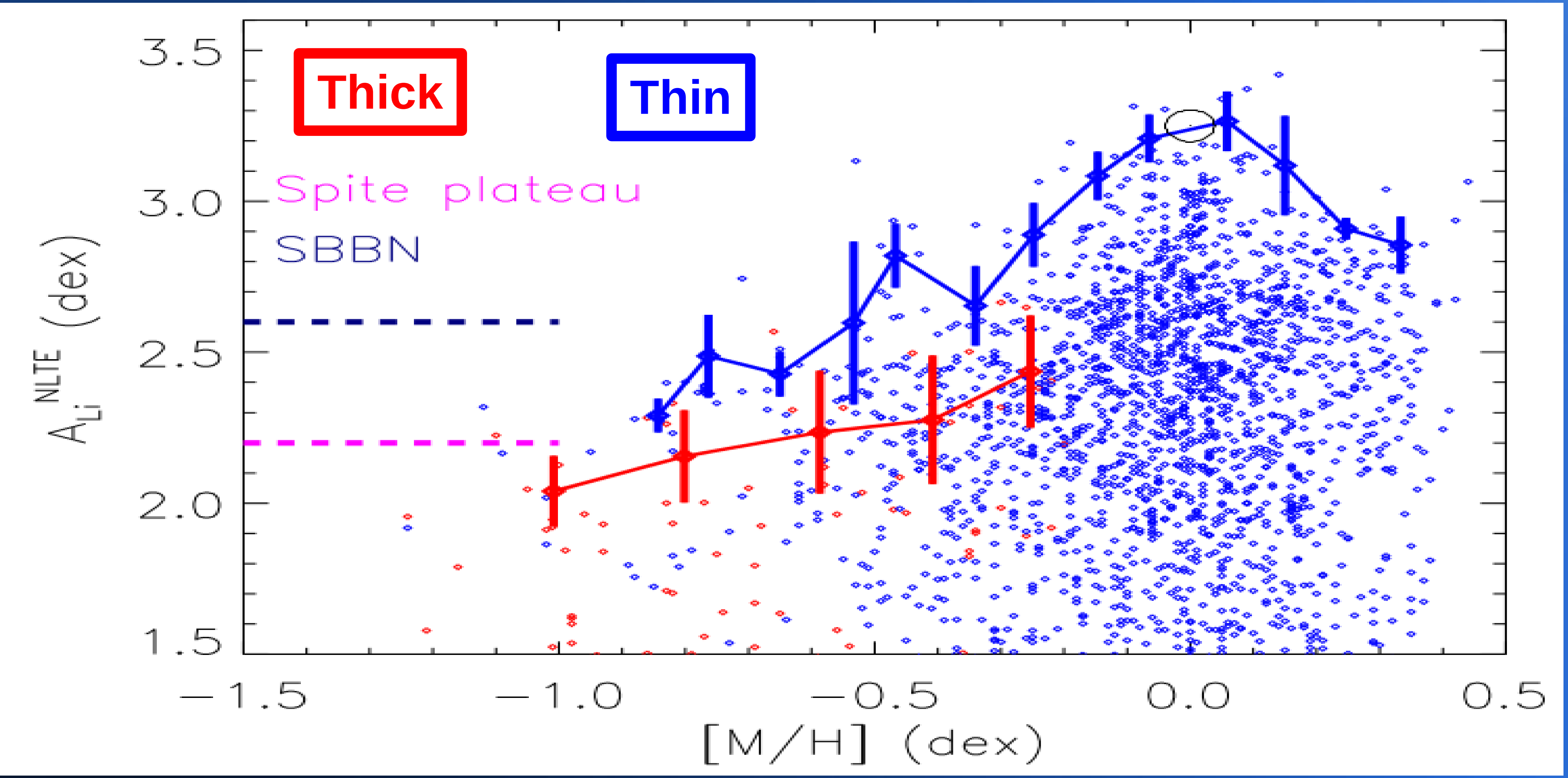
Lithium in Galactic populations

Metal+α rich : different Li history ?



Chemical tagging of the Galactic disc

Lithium



Chemical tagging of the Galactic disc

The Ambre Project

Summary for lithium

– Clear distinct Li evolution in the thin and thick discs

– Thin disc: Li in the ISM increases with [M/H] up to Solar values
Li decreases at higher metallicities

– Thick disc: Initial ISM Li enrichment ~ Spite Plateau
Small increase with [M/H]

– Metal+α-rich stars: More enriched than thin disc stars
Different chemical history?

Chemical tagging of the Galactic disc

The Ambre Project

Summary for iron-peak elements

– Thin/Thick discs well disentangled not only with [α/Fe]

but also with [Zn/Fe] and [Mn/Mg]

– Very small dispersion in chemical species for both discs

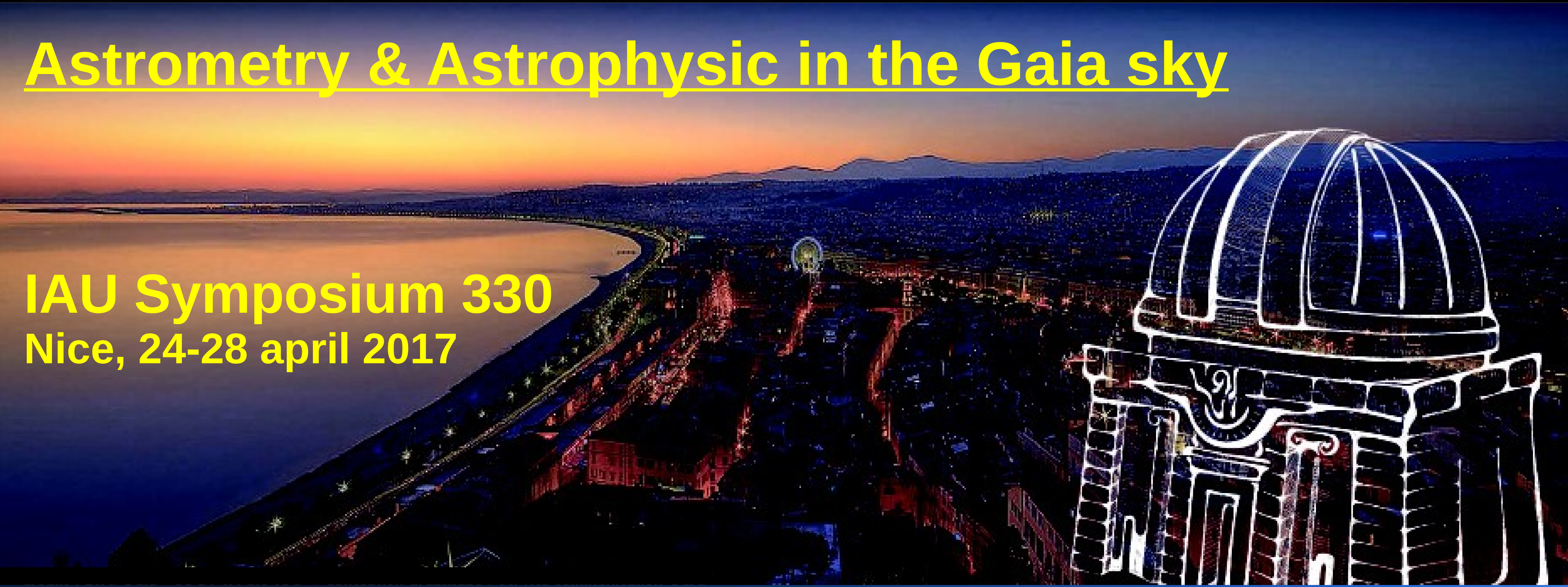
→ efficiency of the radial migration

– Model comparison : lack of some theoretical yields ?

Announcement

Science with Gaia

<u>**Astrometry & Astrophysic in the Gaia sky**</u>



IAU Symposium 330

Nice, 24-28 april 2017

https://iaus330.sciencesconf.org/

<u>**Important dates**</u> Abstract submission: december 4, 2016

IAU grants: november 1rst,2106