UNIVERSITÀ DEGLI STUDI DI TRIESTE

INFN TRIESTE

Osservatorio Astronomico di Trieste
Astronomical Observatory of Trieste

Lithium in the closest satellite of the Milky Way

Gabriele Cescutti,
Paolo Molaro and Xiaoting Fu

ifpU

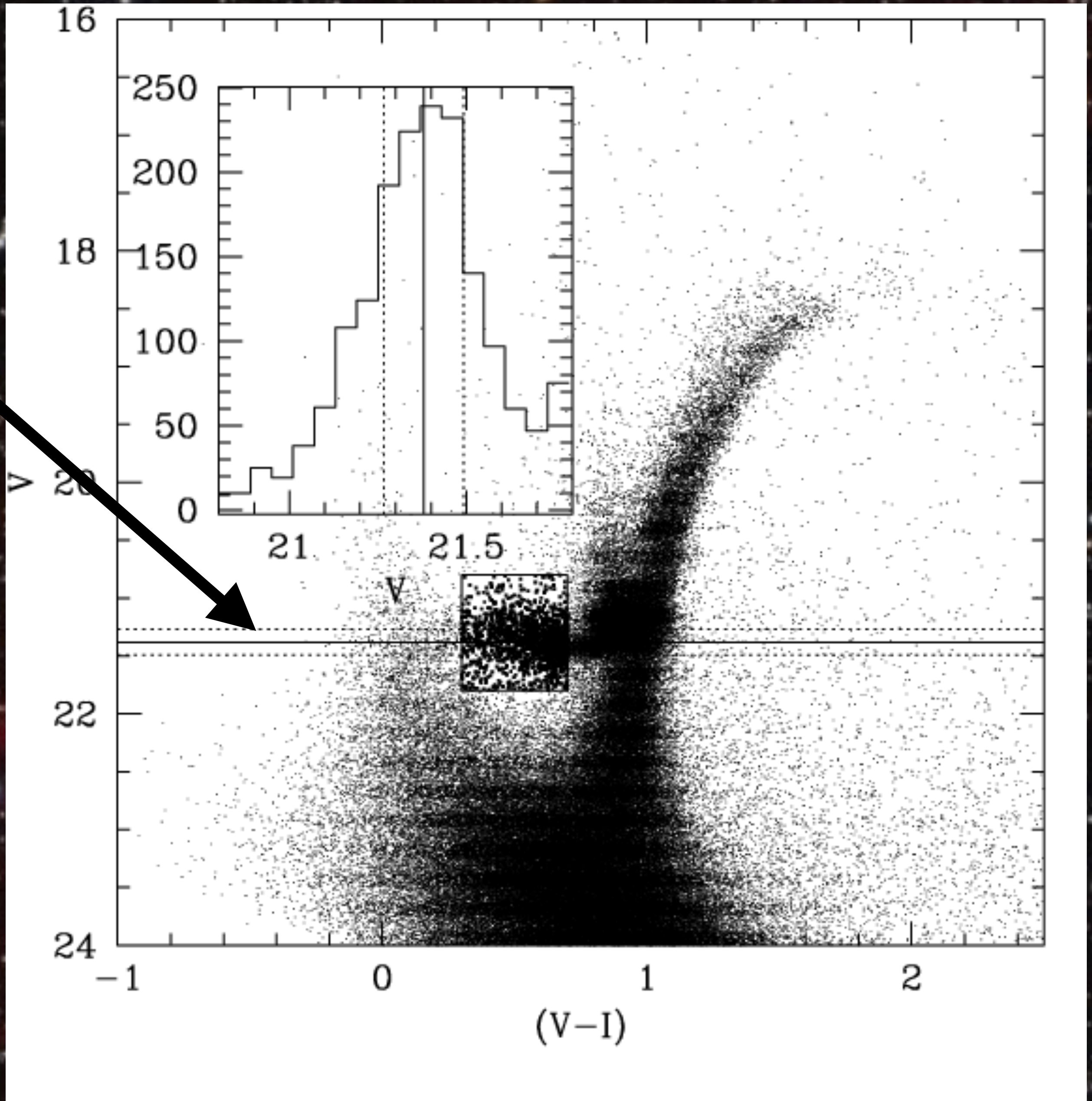
ChETEC INFRA

GIANTS XI, 20 Ottobre 2022

Satellite?

Fornax dwarf galaxy

In a satellite galaxy, dwarf stars (V~22)
are out of reach at present
maybe with ELT?
(at VLT >100 nights)



but see Li abundance of RGBs for the globular cluster M54 connected to Sagittarius dSph
(Mucciarelli et al. 2014)

Enceladus!

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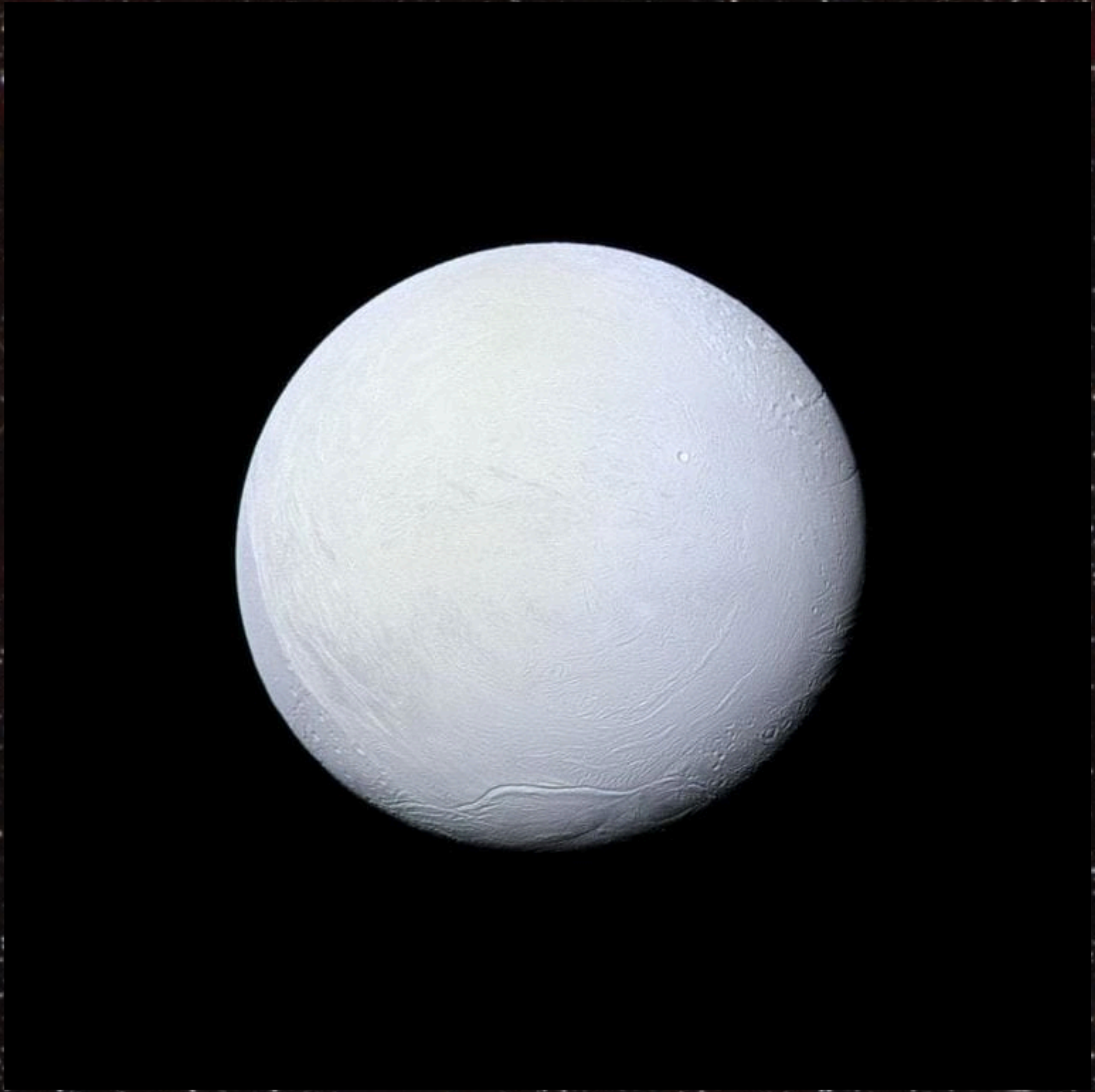
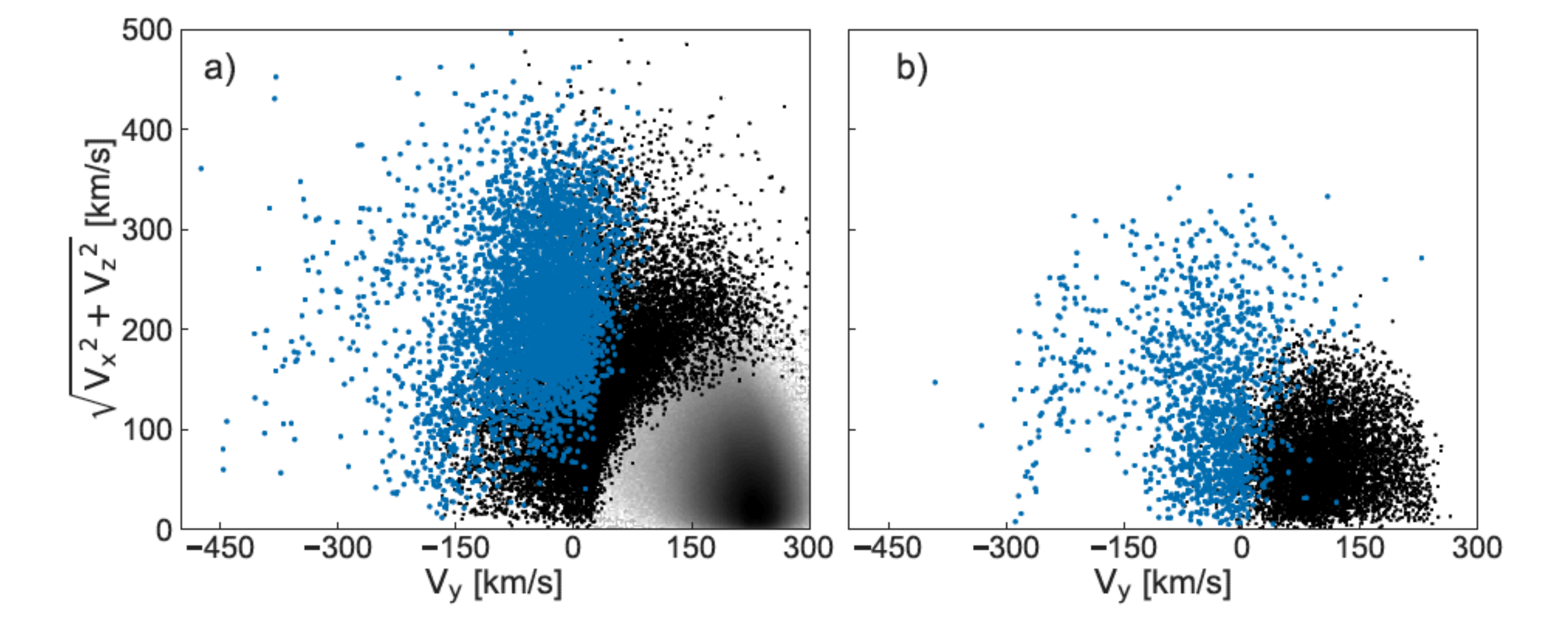


Enceladus!

Gaia-Enceladus

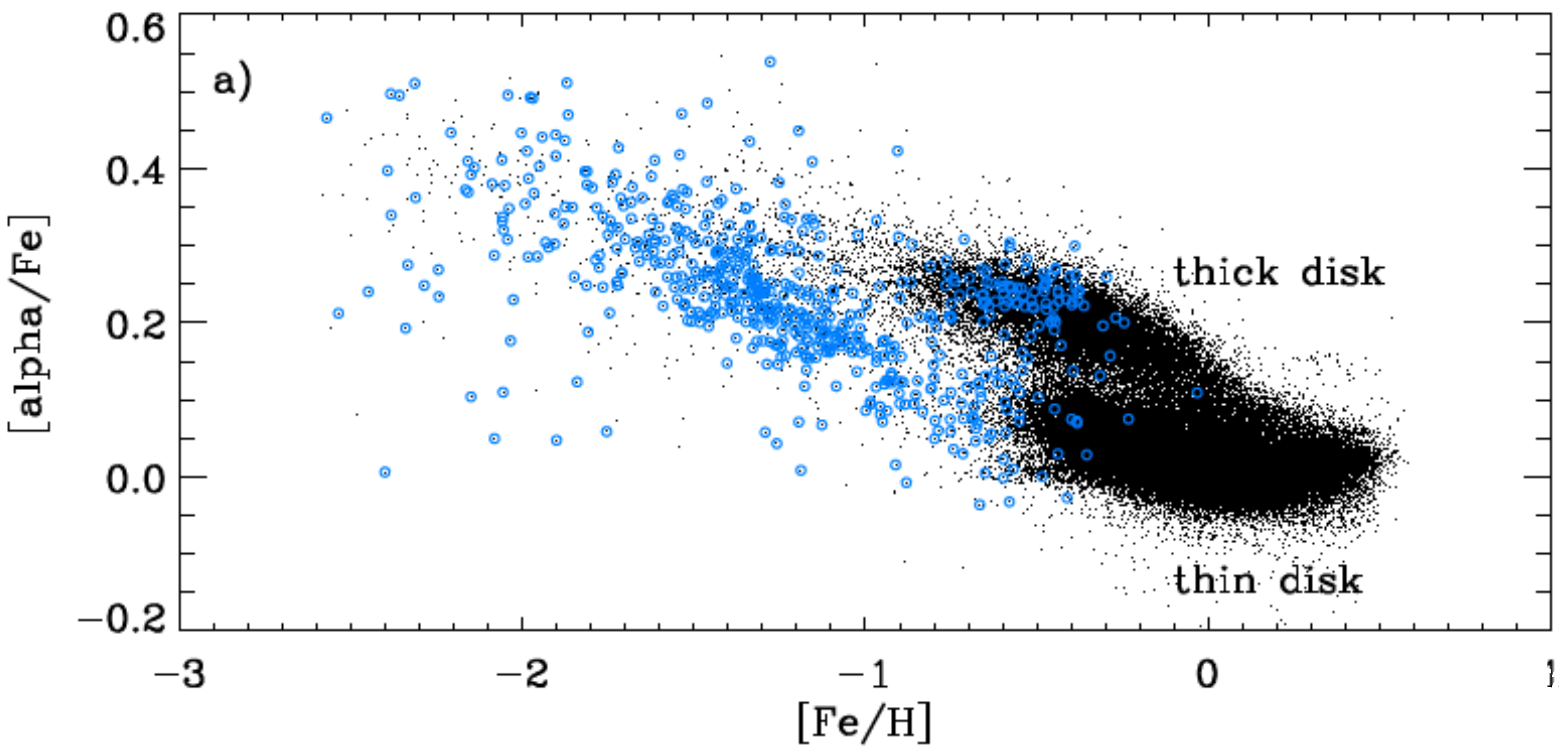
Helmi et al. 2018



kinematic signatures of an ancient satellite that merged with the Milky Way

Gaia-Enceladus

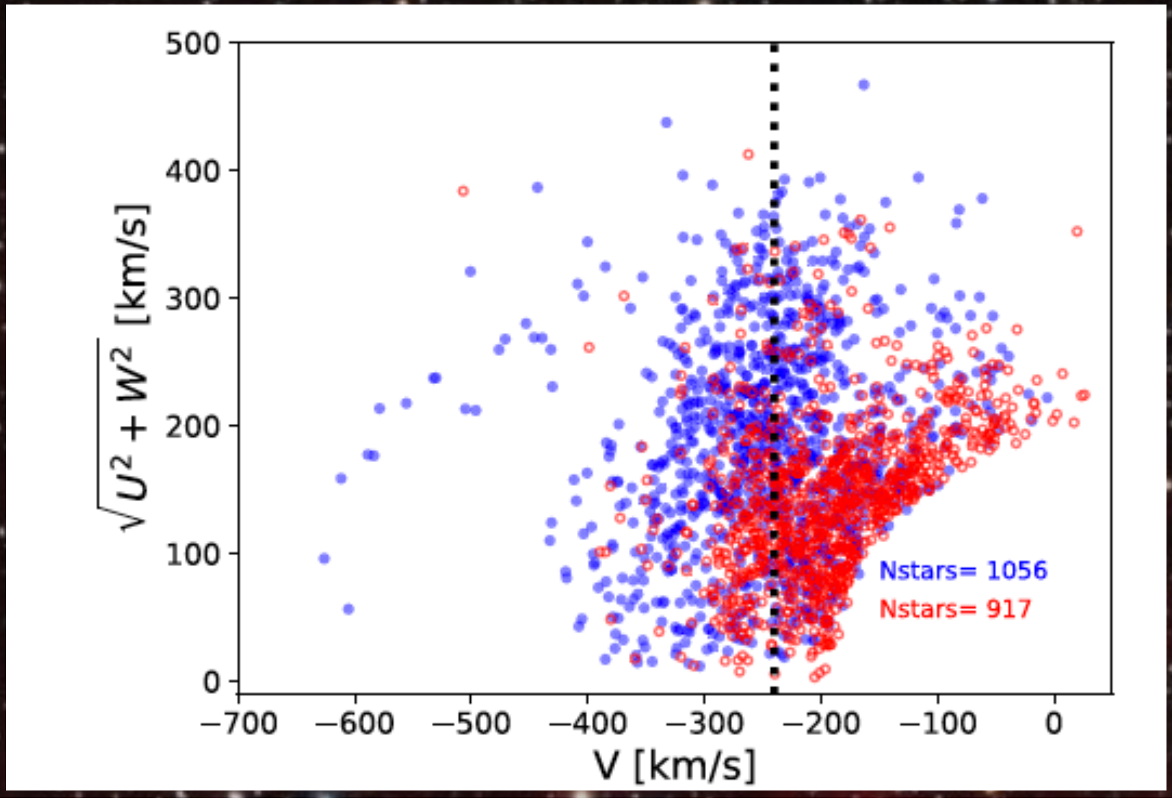
Helmi et al. 2018

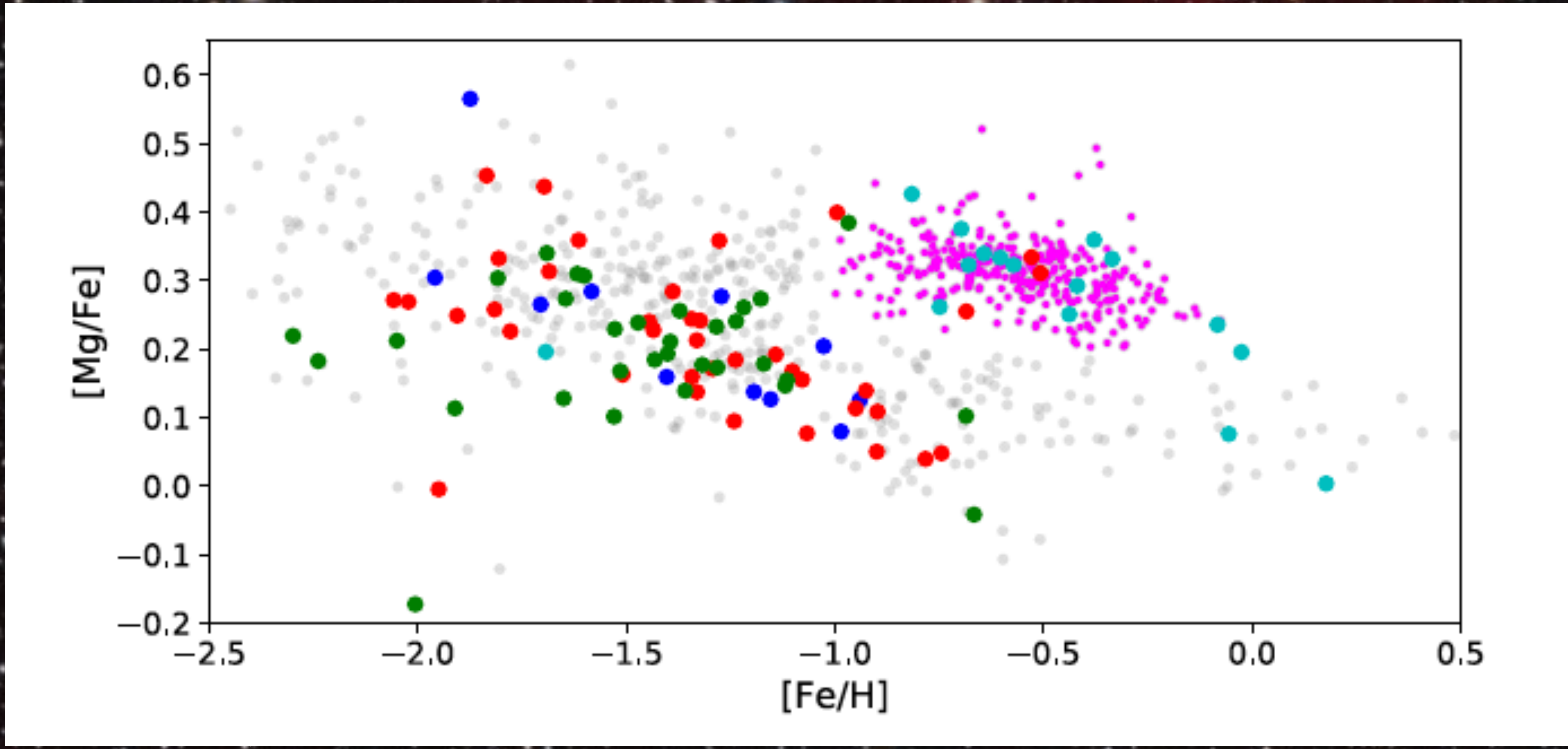


Chemical signatures of an ancient satellite that merged with the Milky Way

APOGEE data

Gaia-Enceladus 2

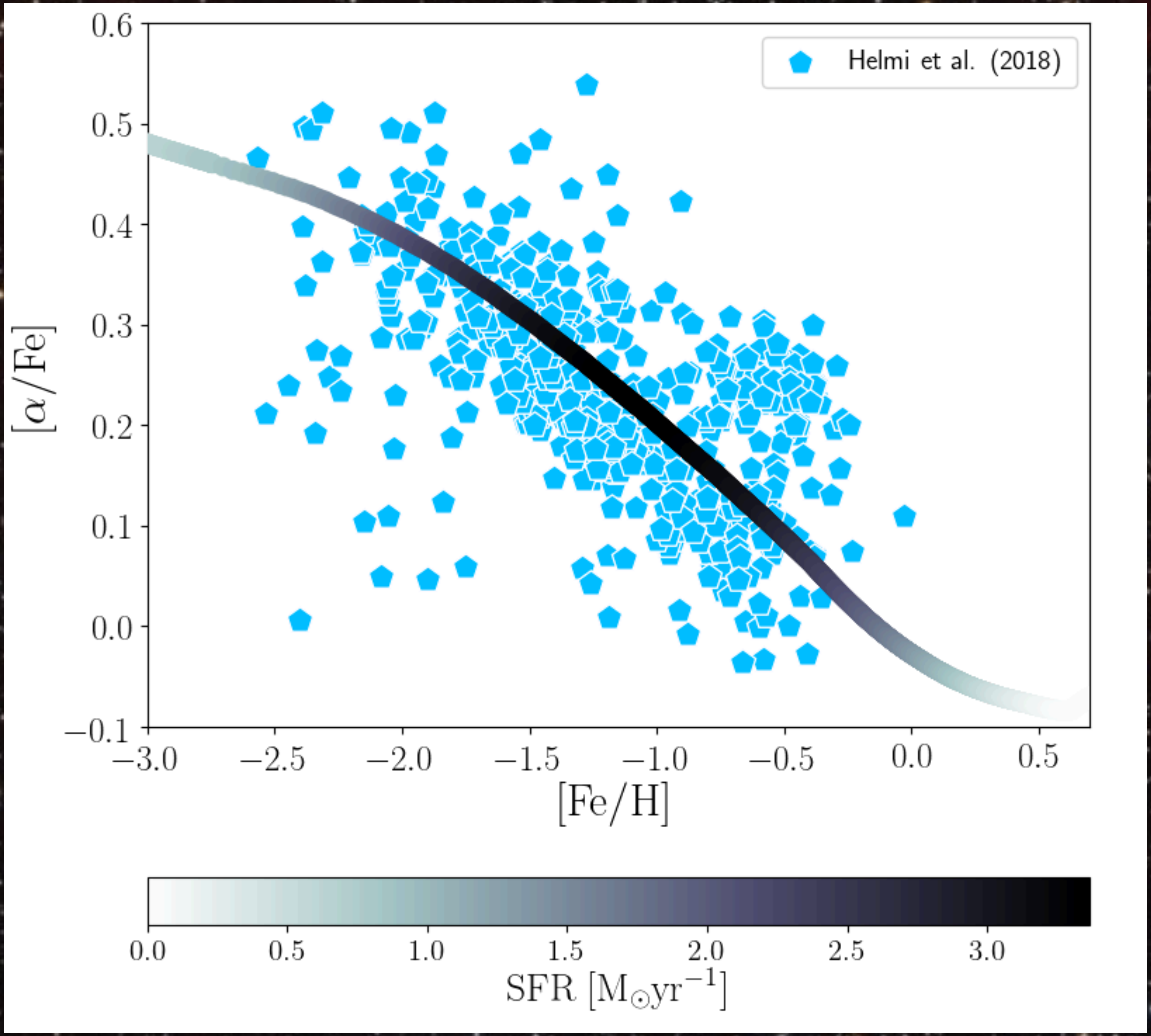




APOGEE data

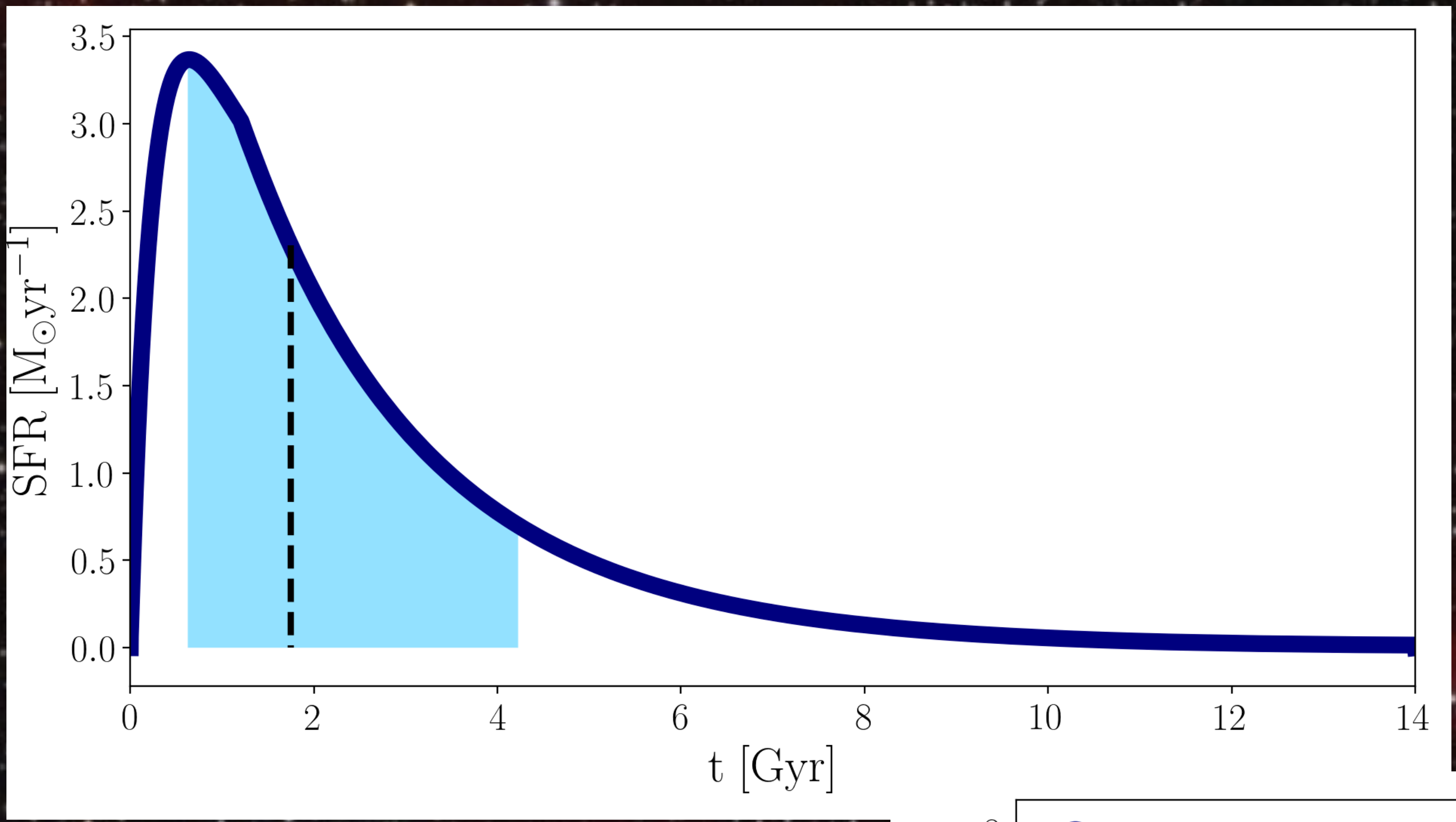
Haywood et al. 2018

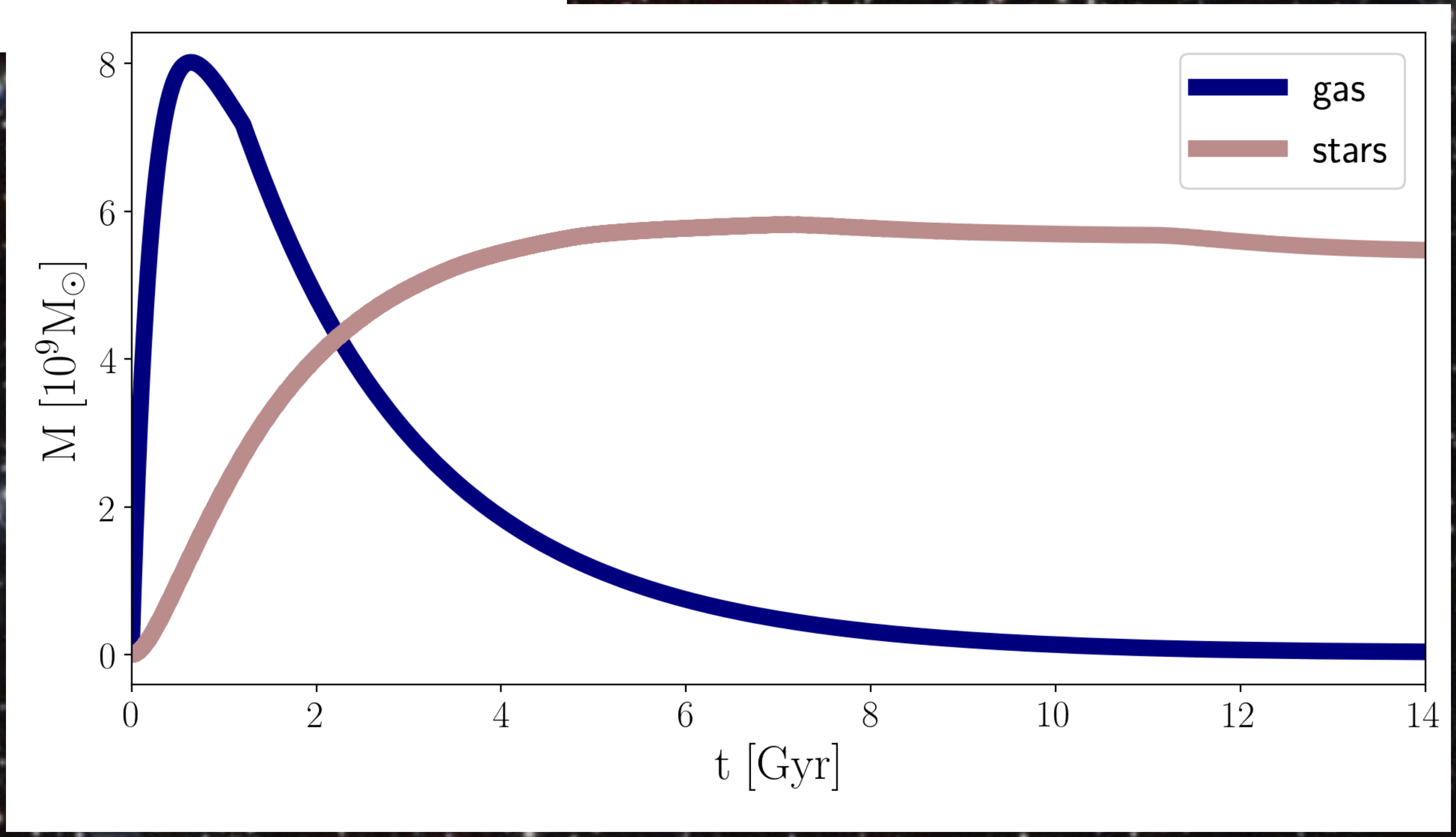
Chemical Evolution Model for Gaia-Enceladus



Vincenzo, Spitoni, Calura et al. 2019

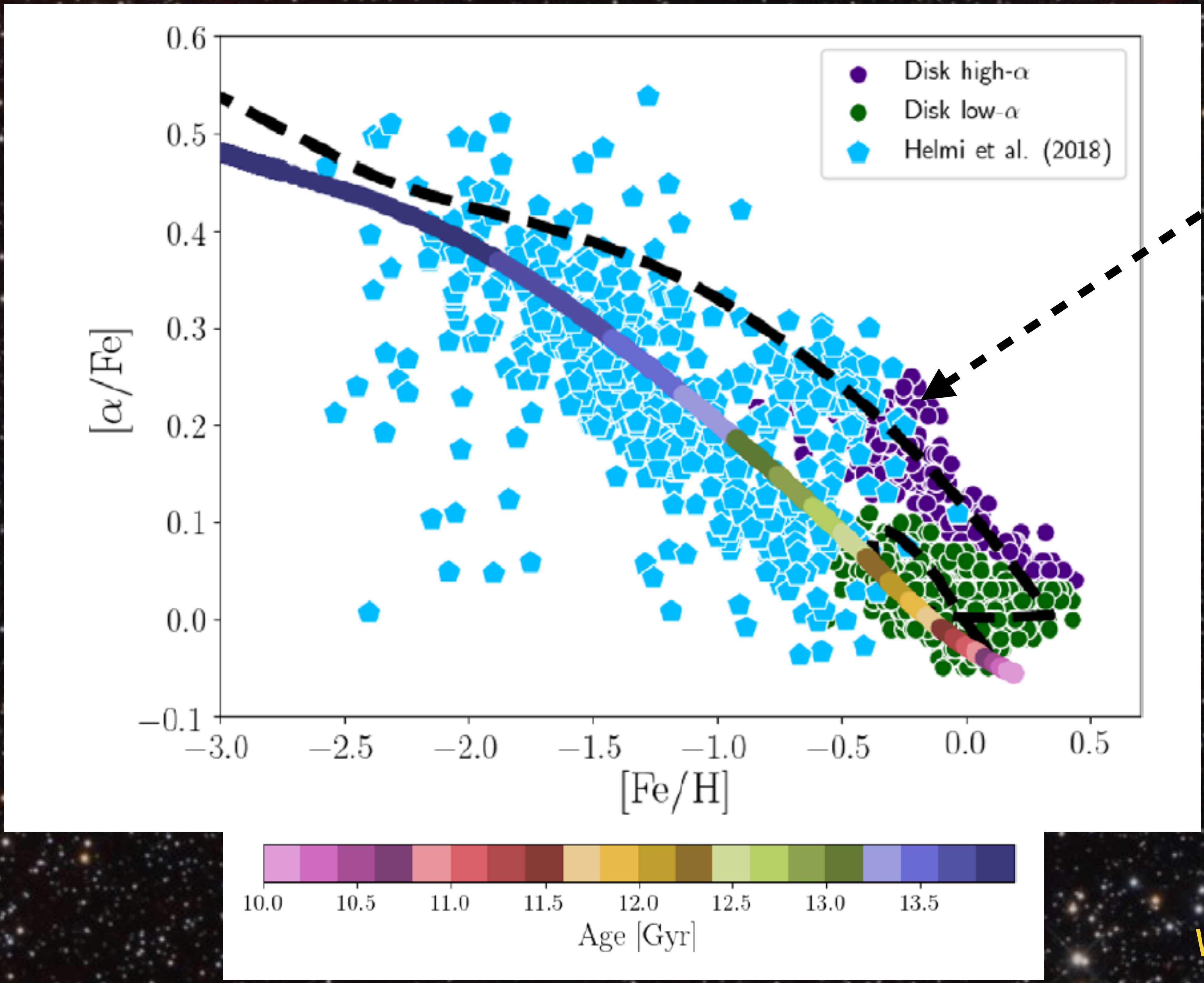
Chemical ev. Model for Gaia-Enceladus





Vincenzo et al. 2019

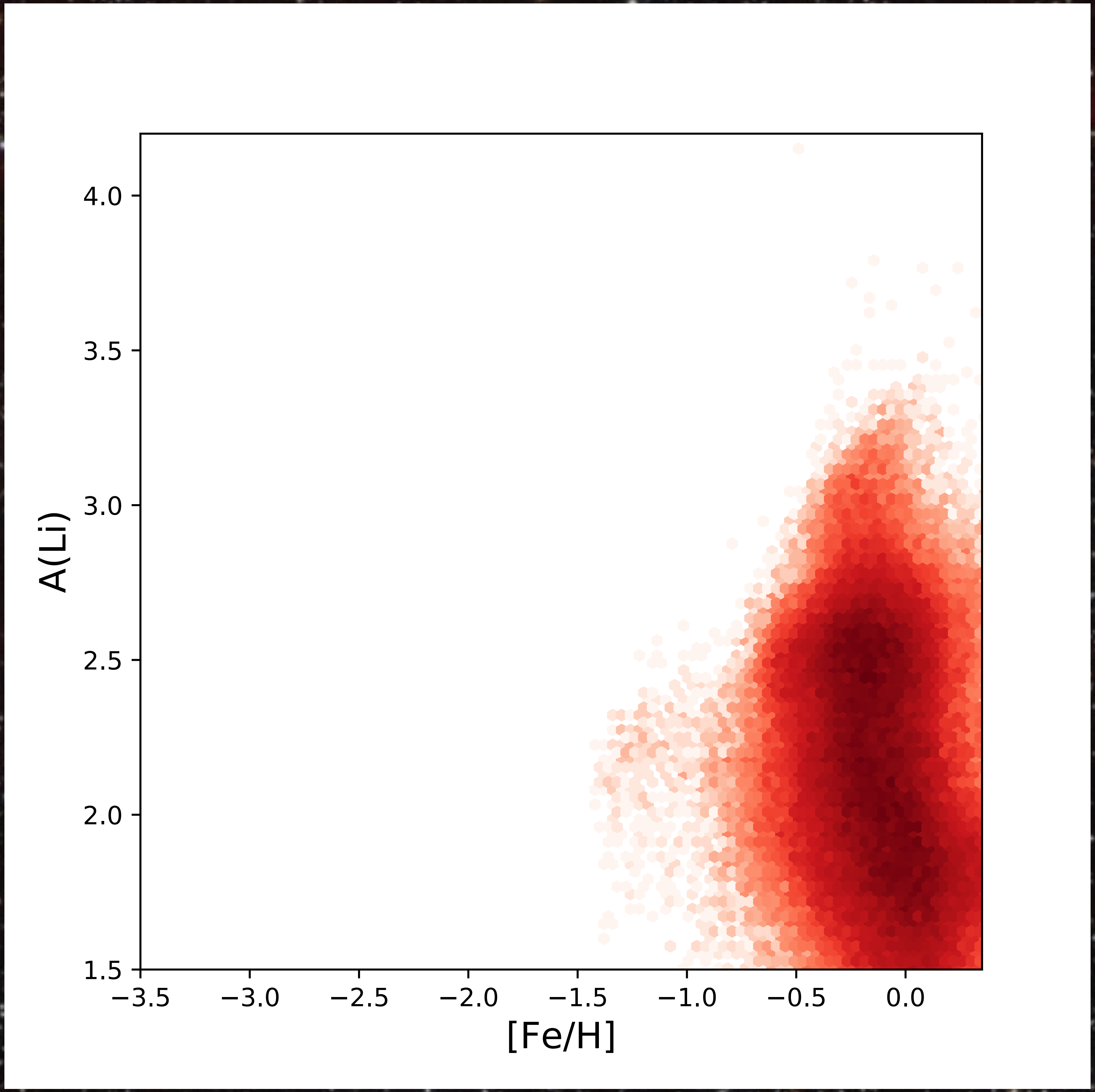
Comparison with the discs



Spitoni et al. 2019

Vincenzo et al. 2019

Galah database



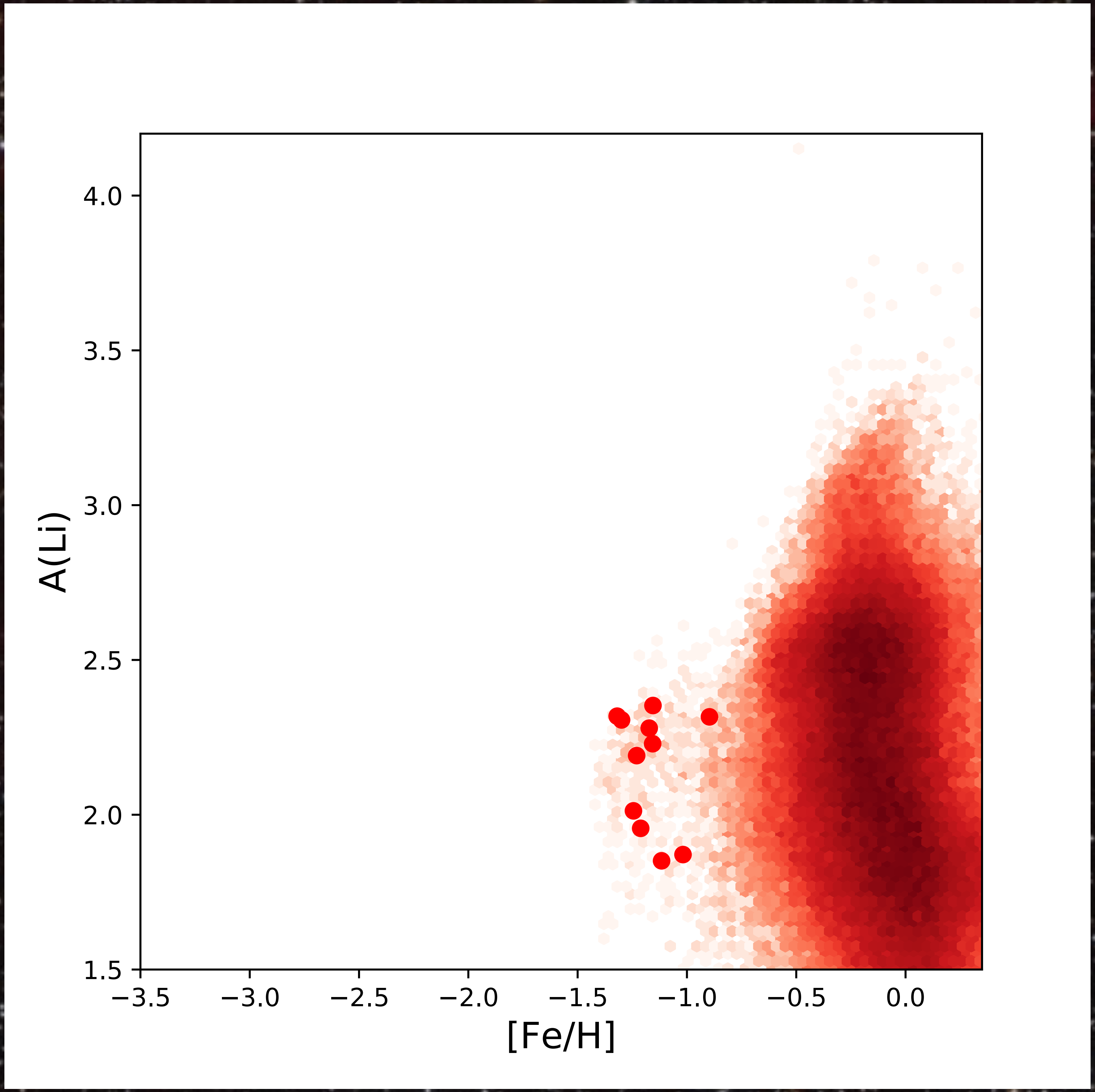
dwarf stars

T>5700K

log>3.65

Cescutti et al. 2020

Observational data of Lithium in Enceladus



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Enceladus members from GALAH ●

Cescutti et al. 2020

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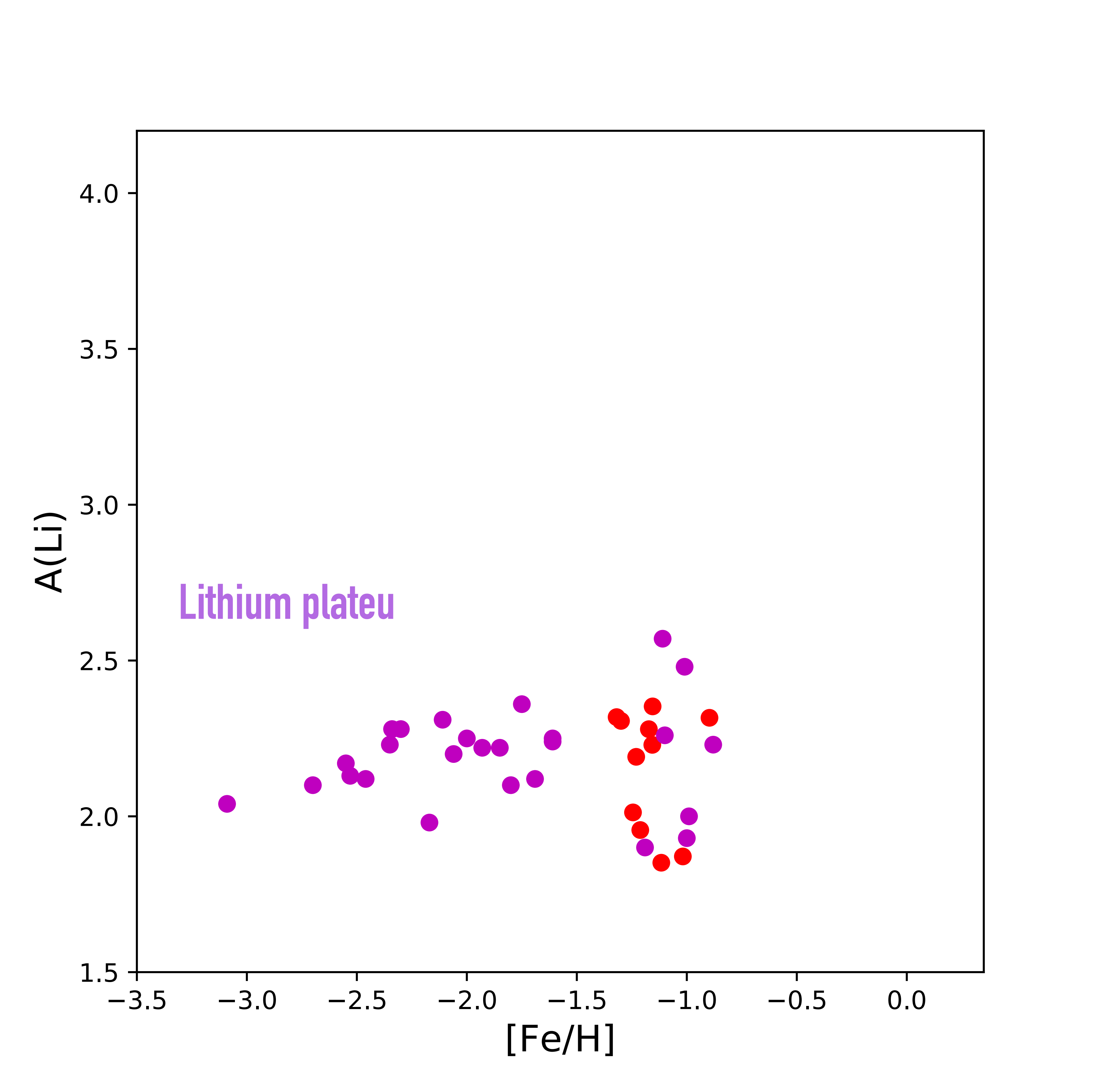

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members from Literature

Enceladus members

SAGA Database
JINA Database
Aguilera-Gomez+18

Cescutti et al. 2020

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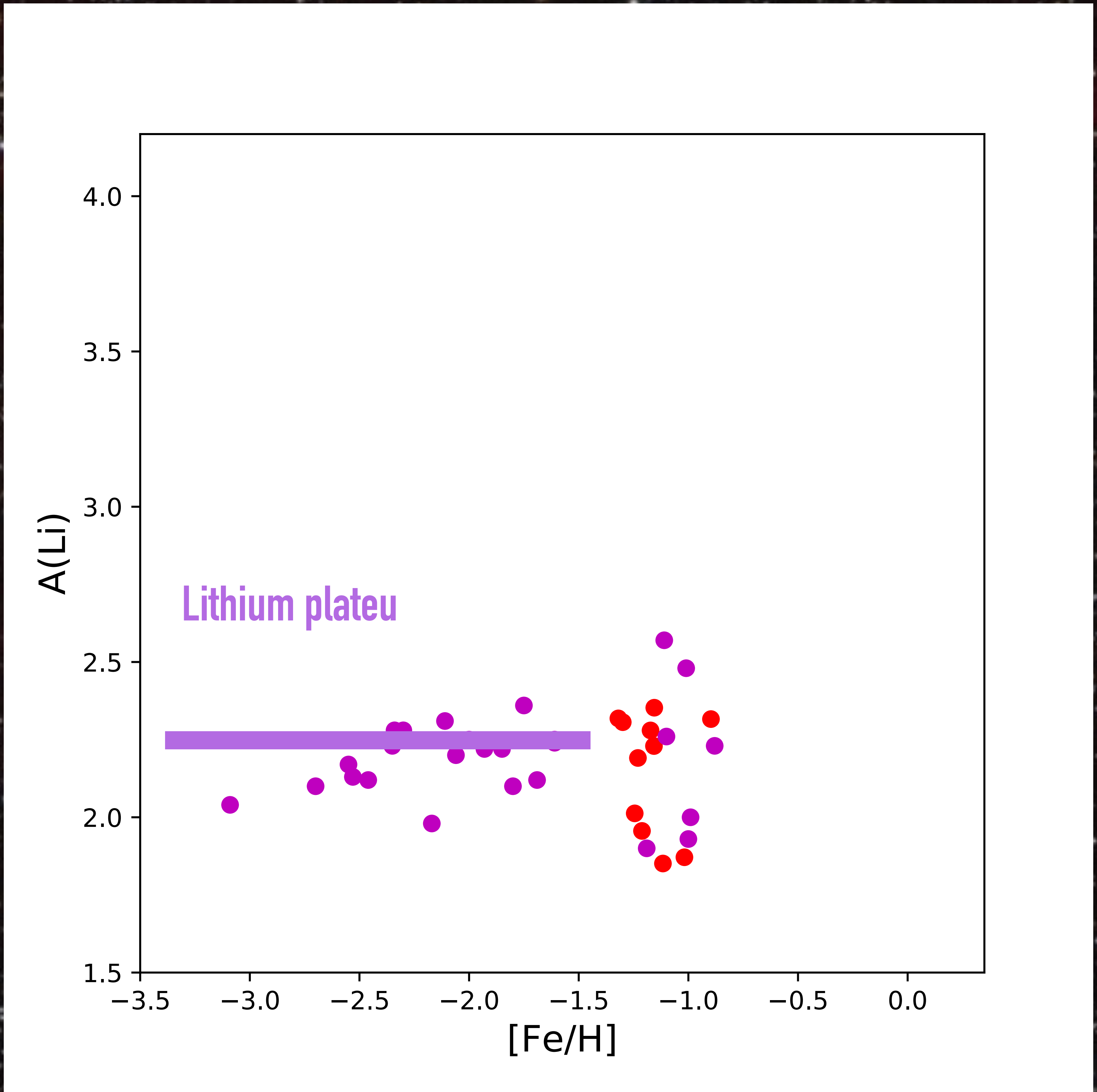

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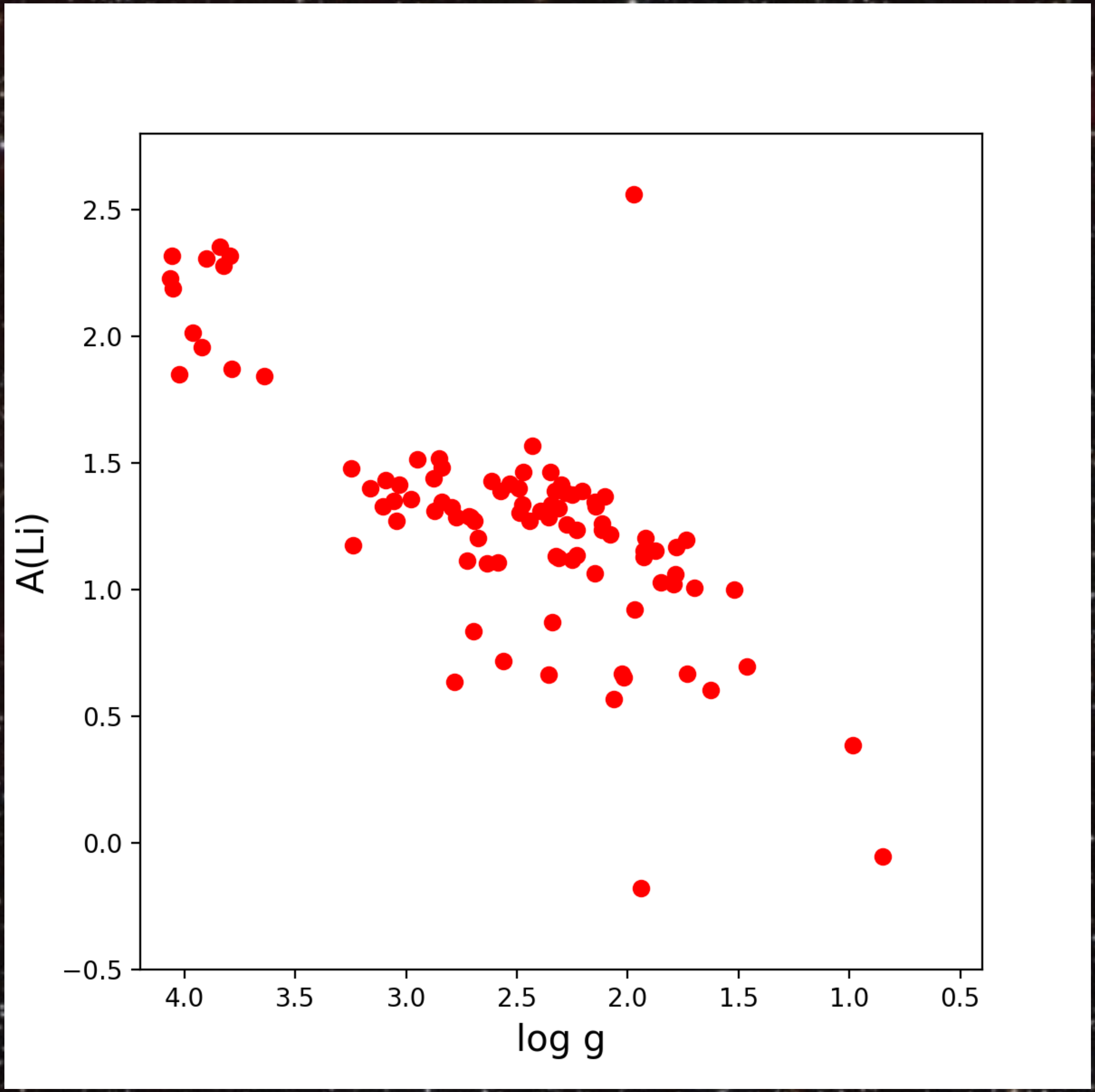

All stars!

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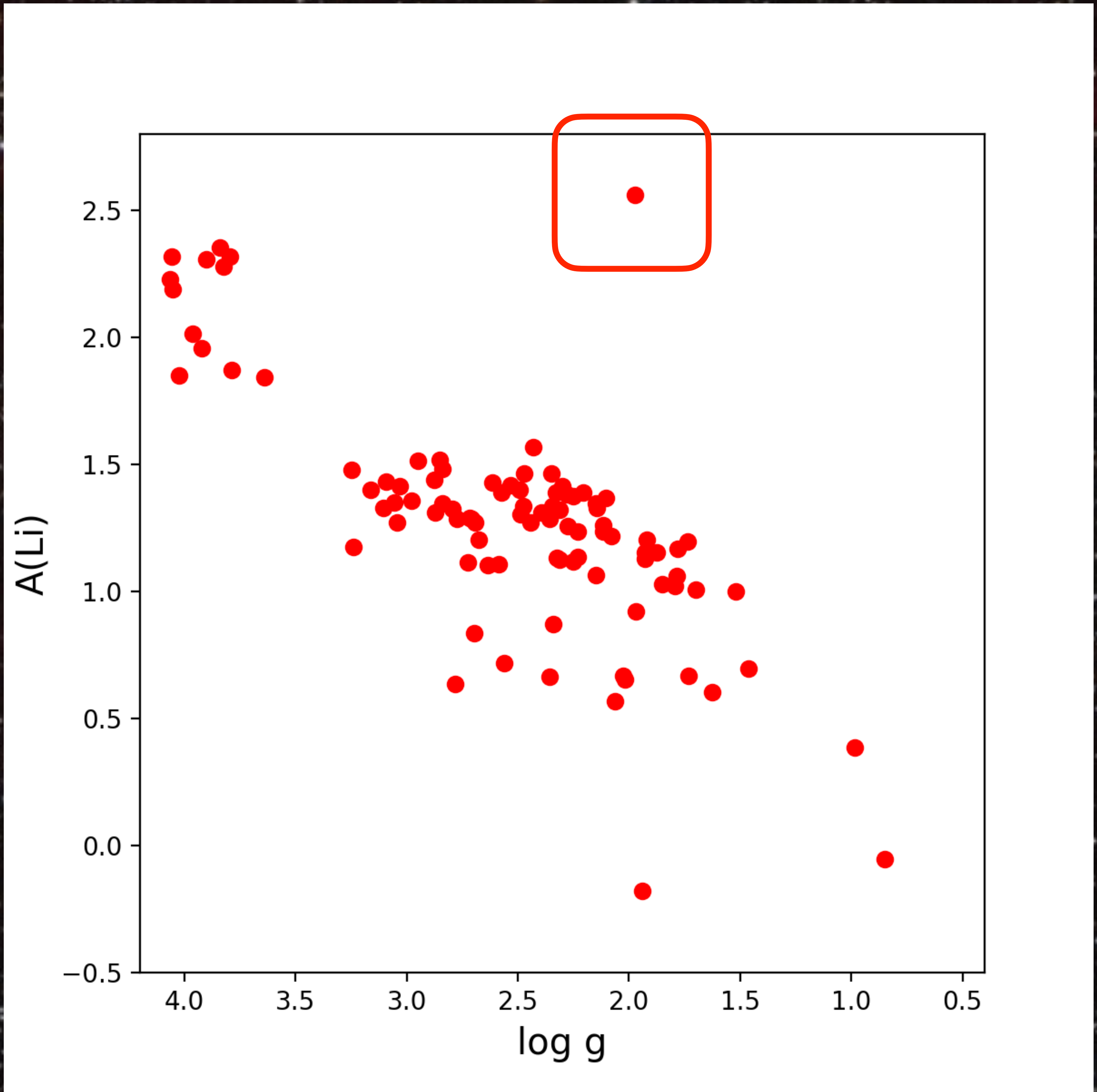

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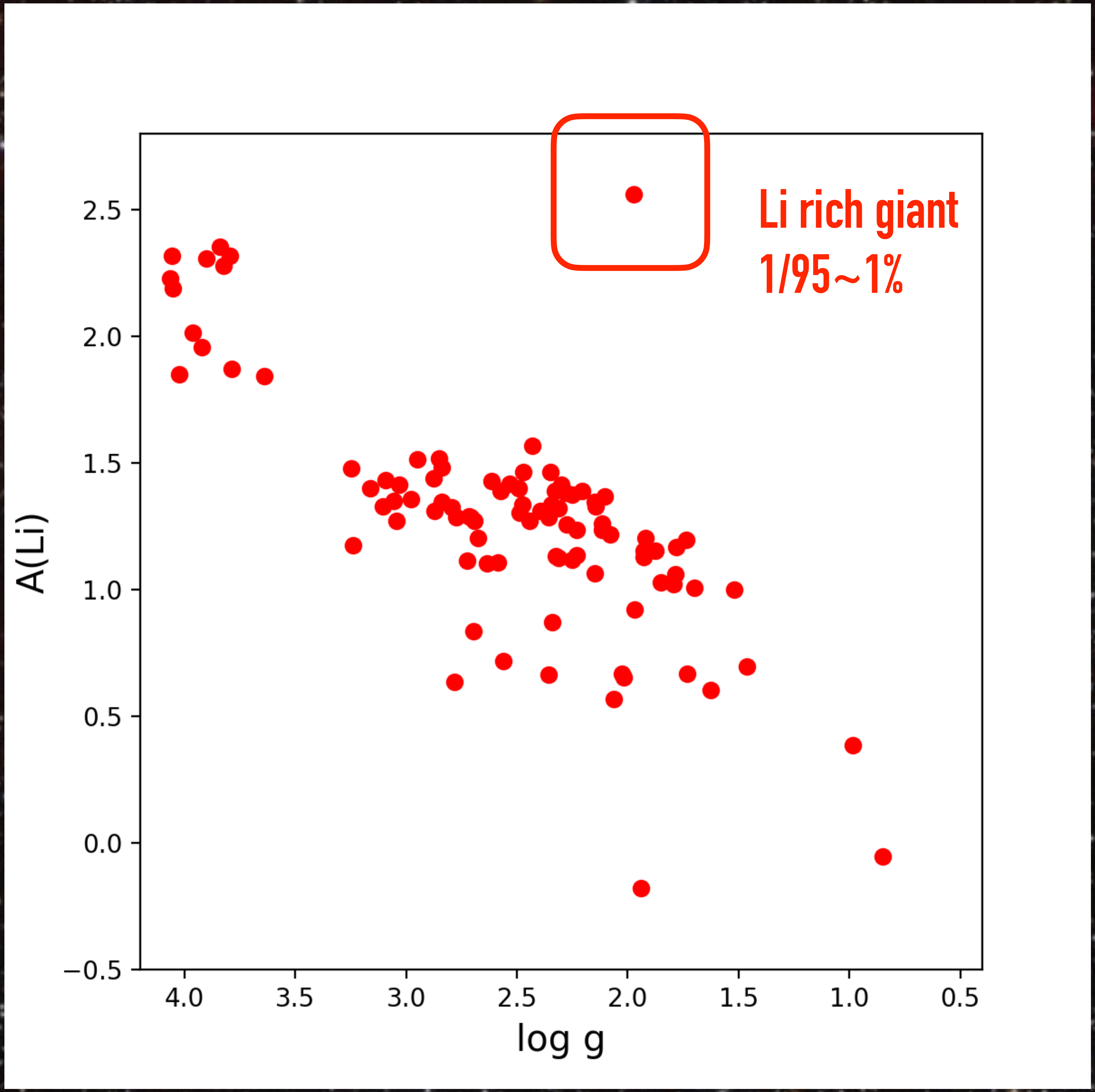

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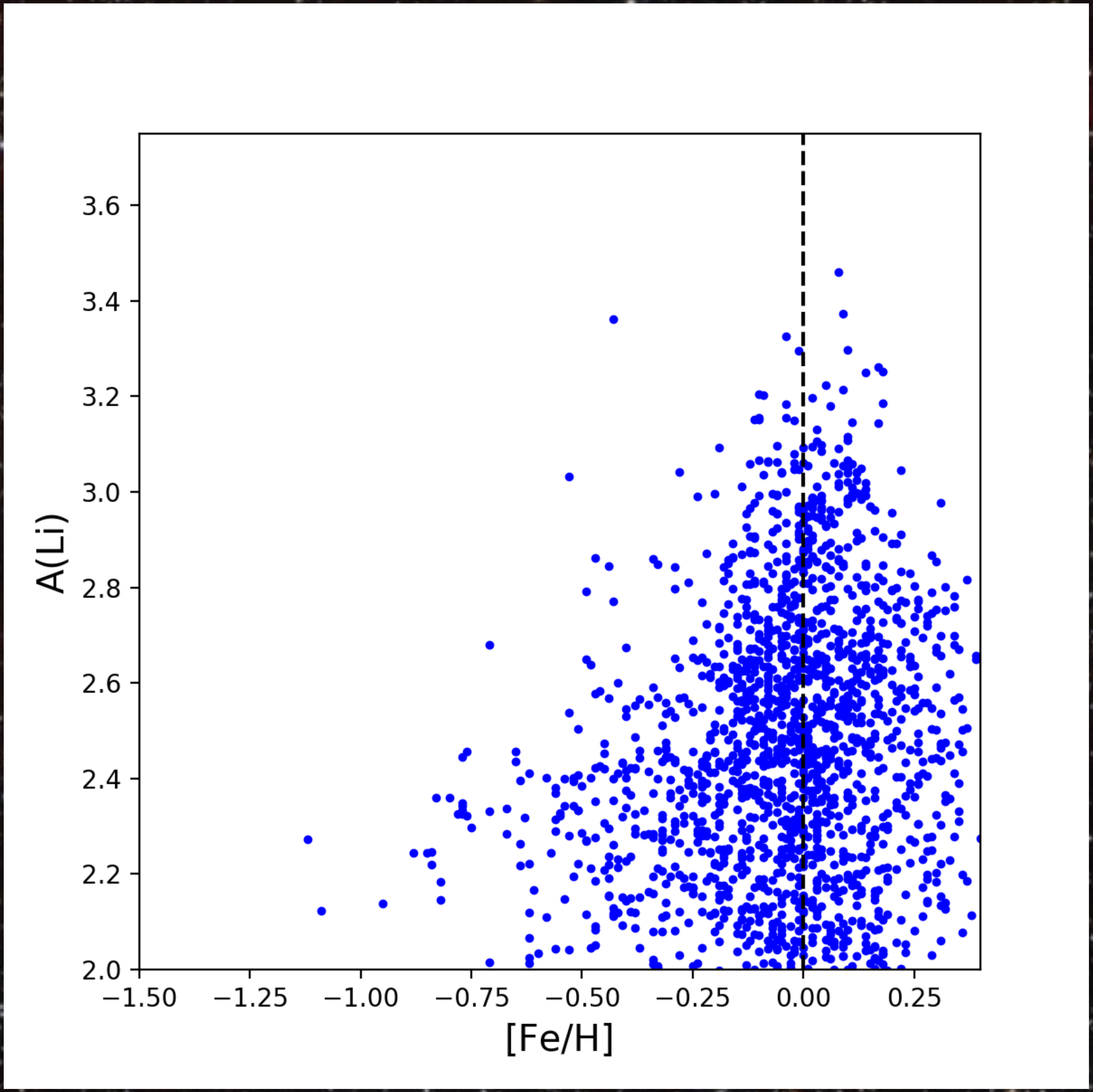
Lithium in the thin disc



AMBRE data
Guiglion+16

Cescutti&Molaro 2019

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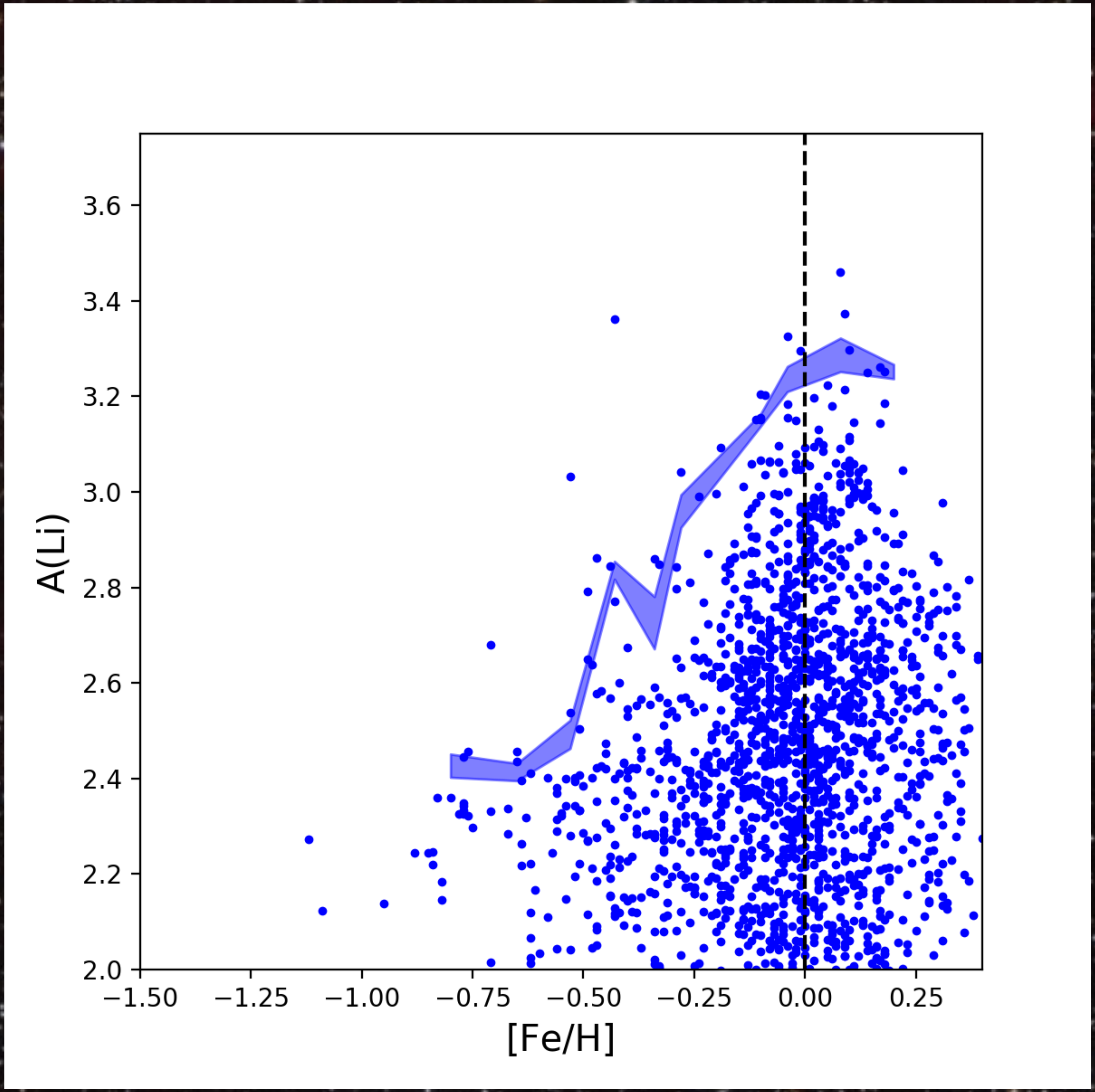

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Cescutti&Molaro 2019

Main Assumptions

We consider :

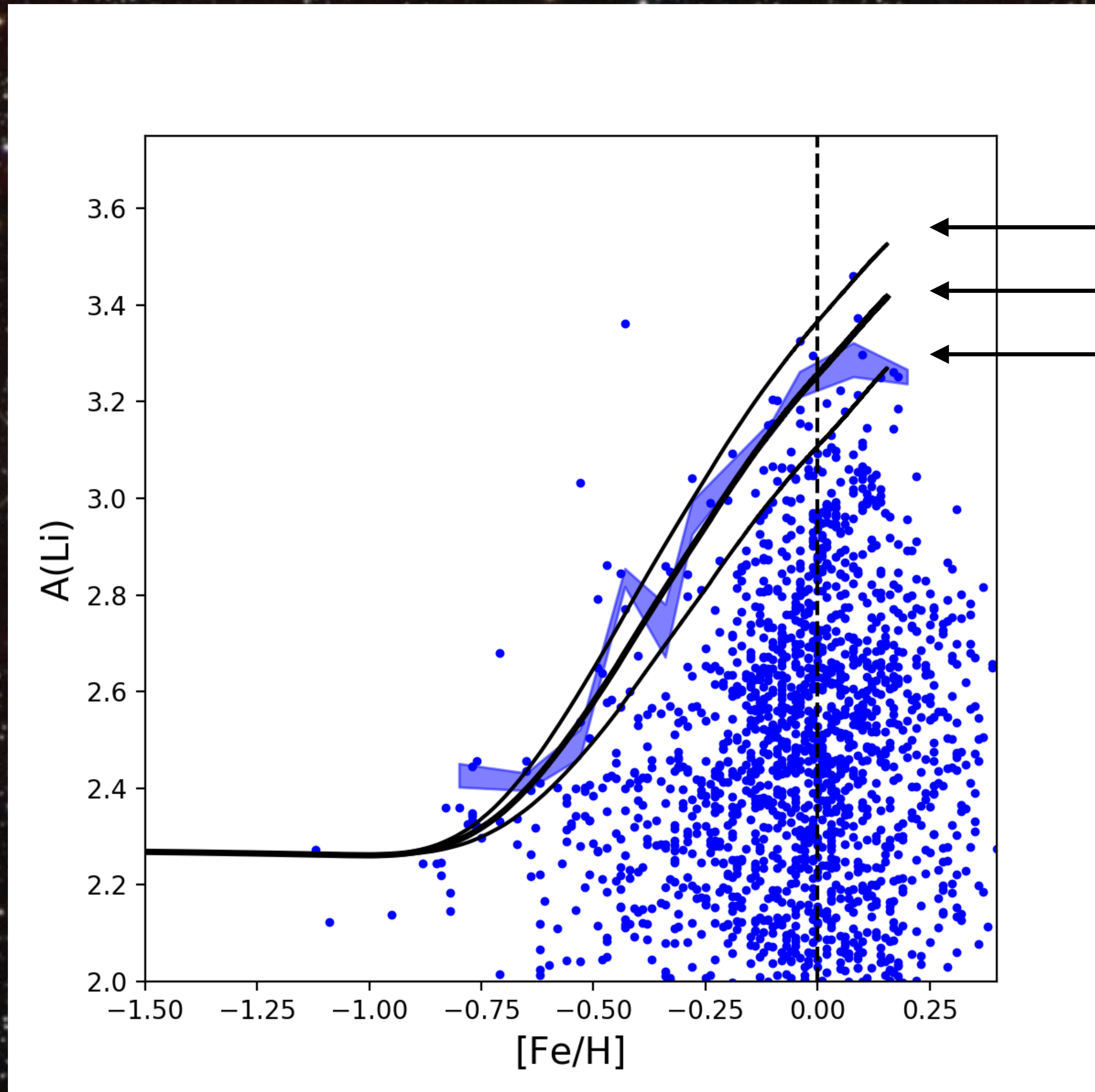
- spallation (scaling Be in disc stars by Smiljanic+09)
- AGB production (Ventura+13)

Main producers of lithium are novae:

- Effective yield of 1.8 10^{-5} Msun
- Fraction of binaries=0.03 (constrained by observed nova rate)
- Delay of 1 Gyr

see also Grisoni+19, Romano+99

CE of Lithium in the thin disc



yields +33%

Best model

yields -33%

AMBRE data
Guiglion+16

Cescutti&Molaro 2019

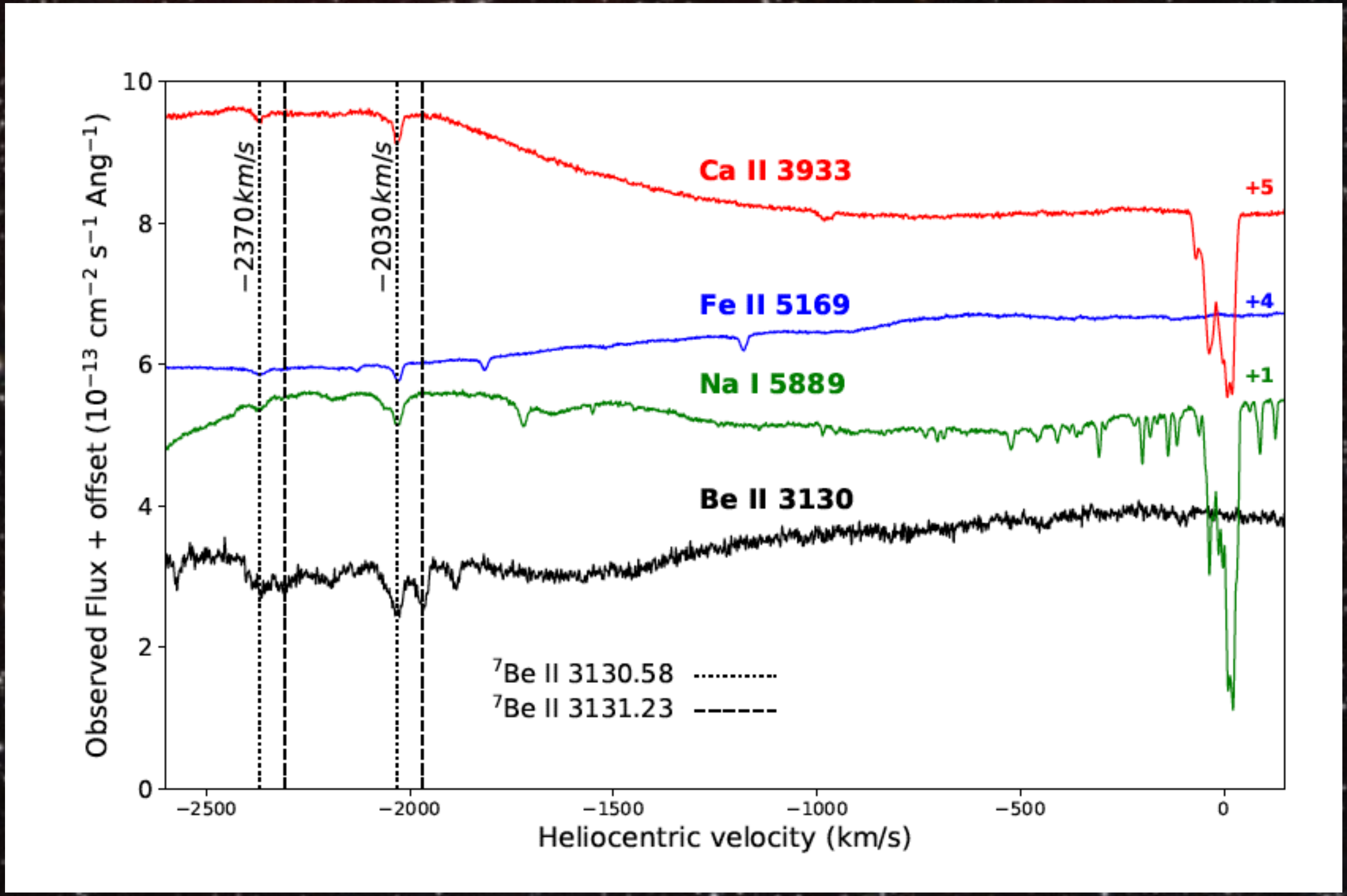
A single burst ejects 1.8 10^{-9} Msun of lithium

(assuming 10'000 bursts)

This is compatible with Be detections in nova spectra

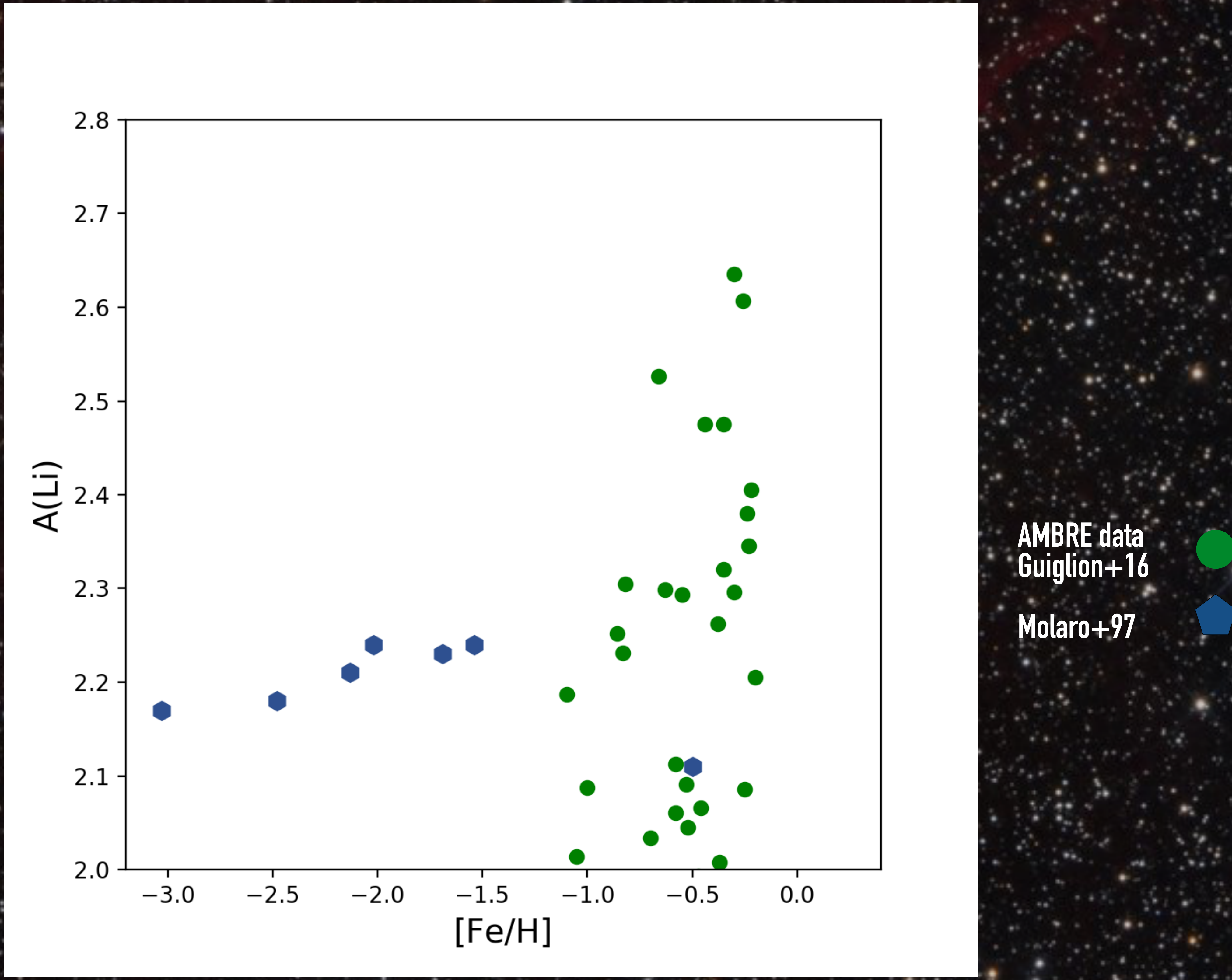
~6 10^{-9}Msun of Be (—> Li)

Tajitsu+15+16, Molaro+15, Izzo +18 and Selvelli+18



Izzo et al. 2018

Lithium in the Thick disc

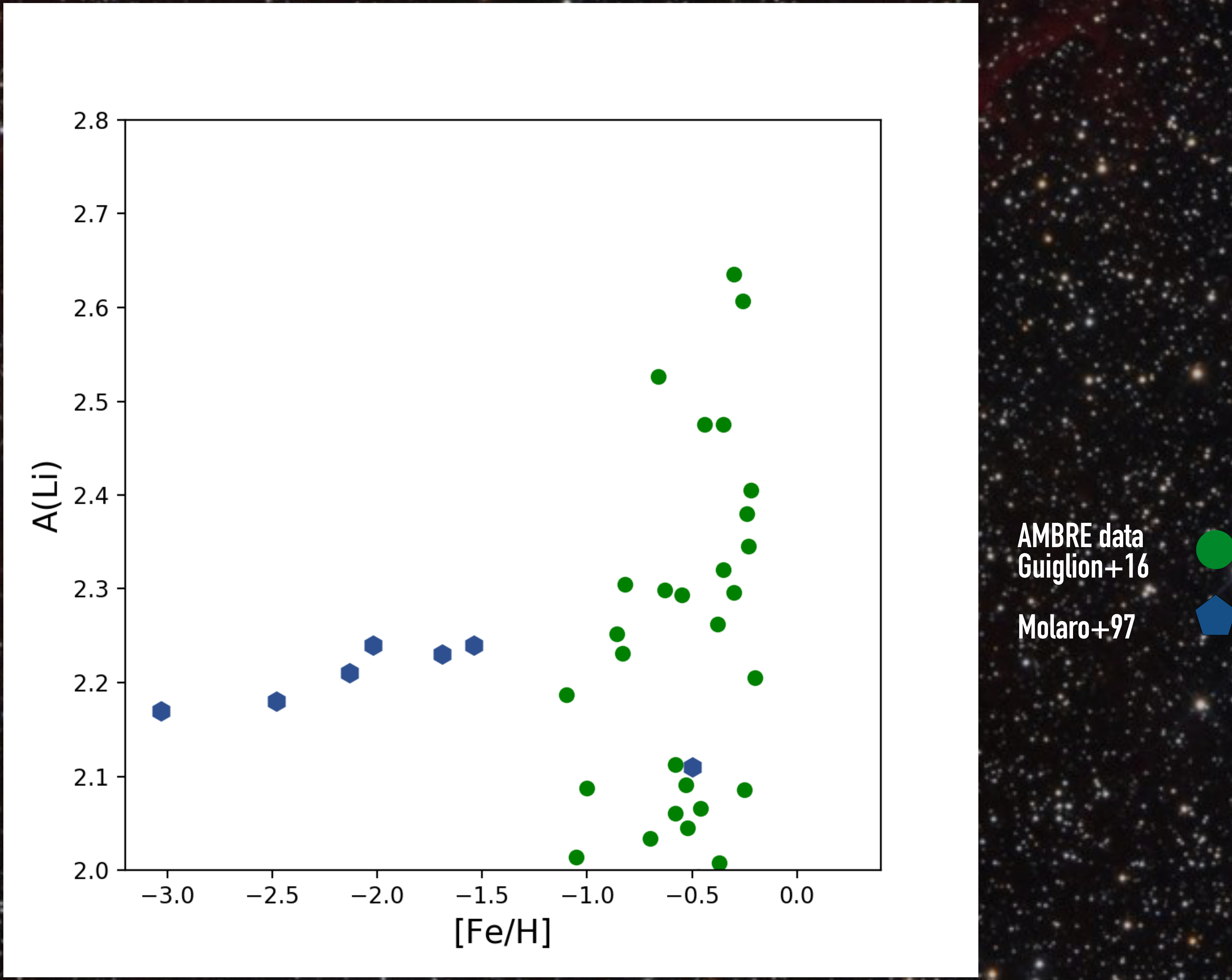


Cescutti&Molaro 2019

CEM of the Thick disc

Compared to
the thin disc
shorter time scale
higher efficiency (x 3)

similar to the oldest mono-age populations scenario presented in Minchev+17
see also Grisoni +17



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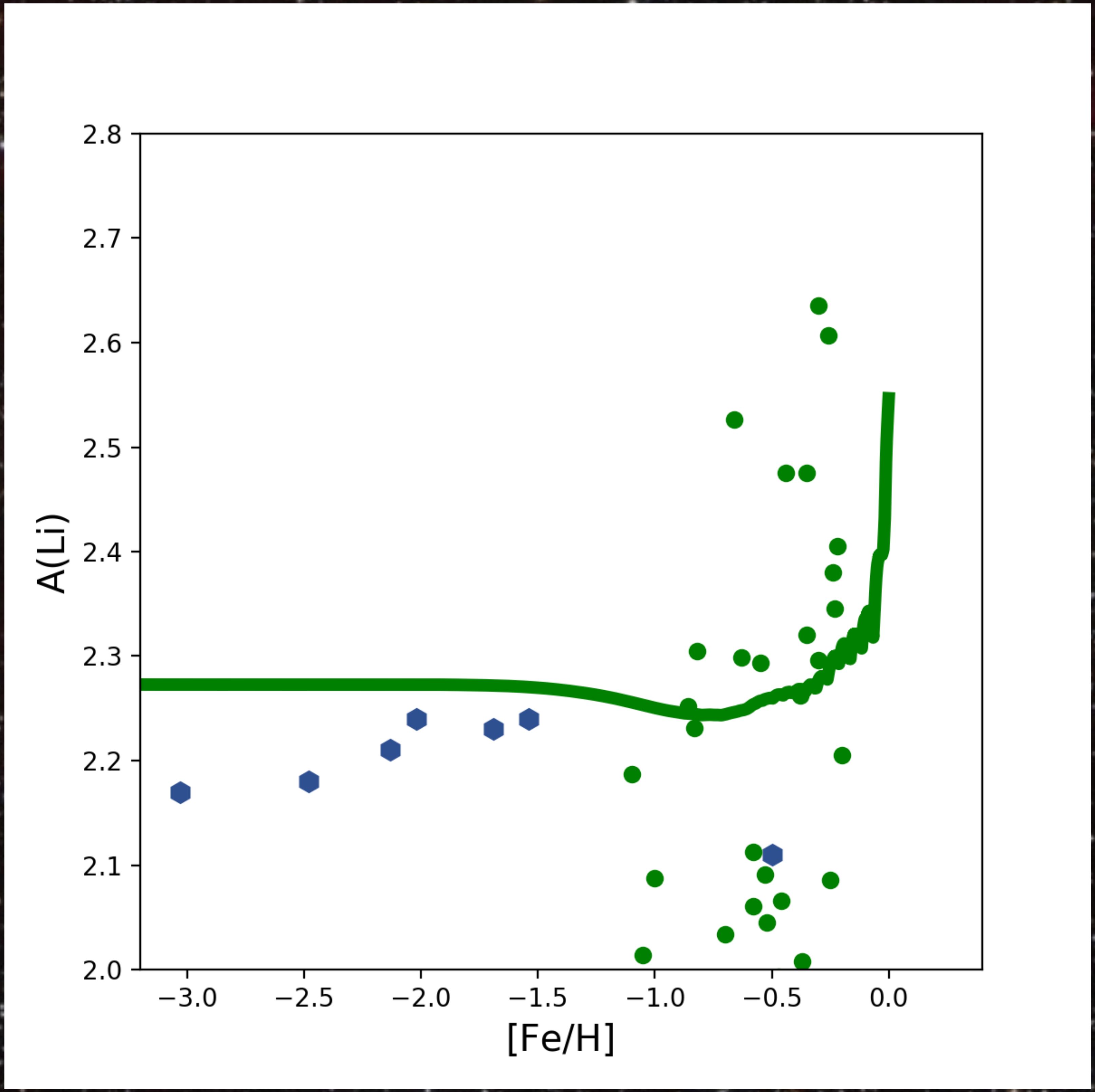

AMBRE data
Guiglion+16

Molaro+97

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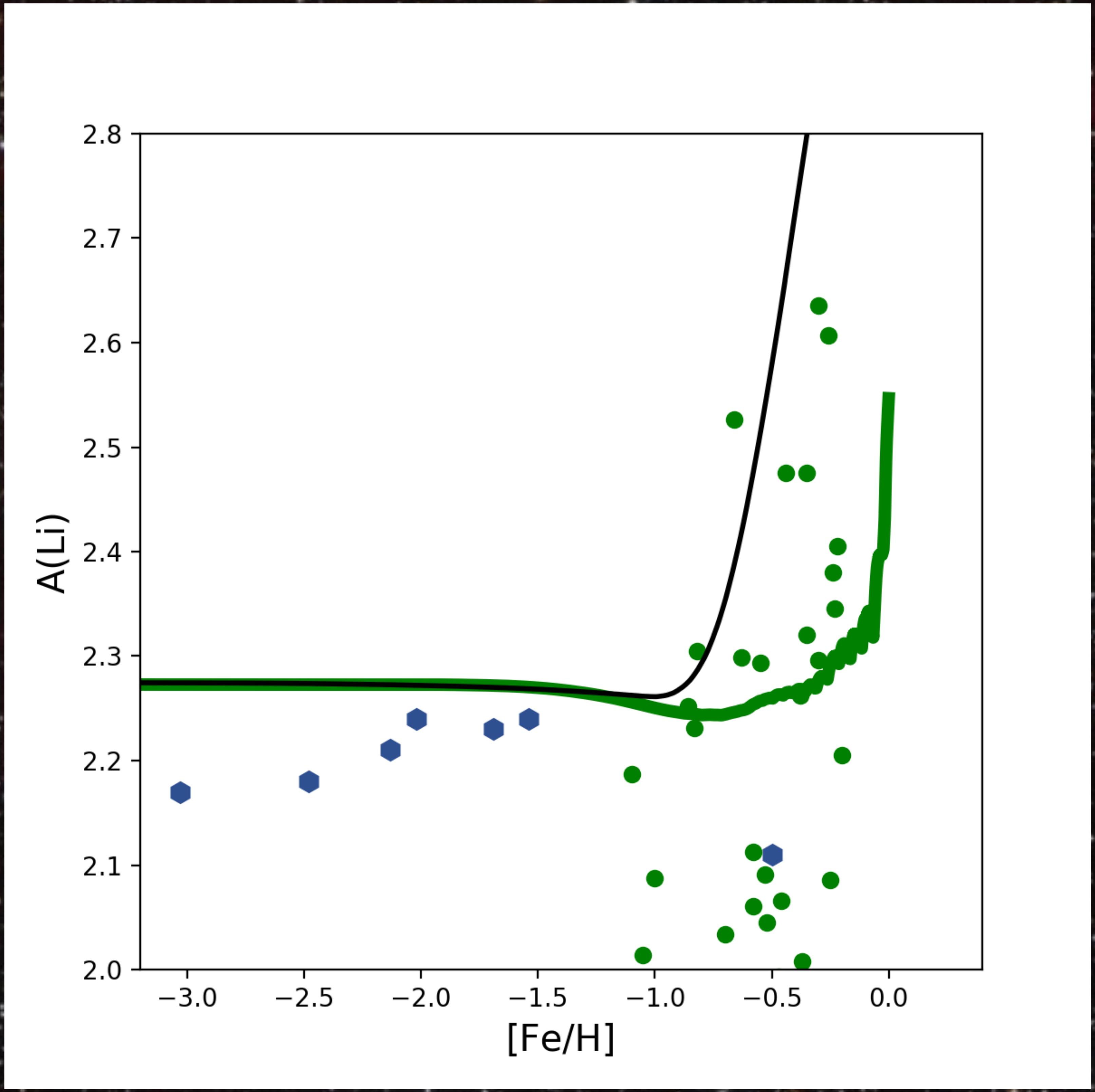

AMBRE data Guiglion+16

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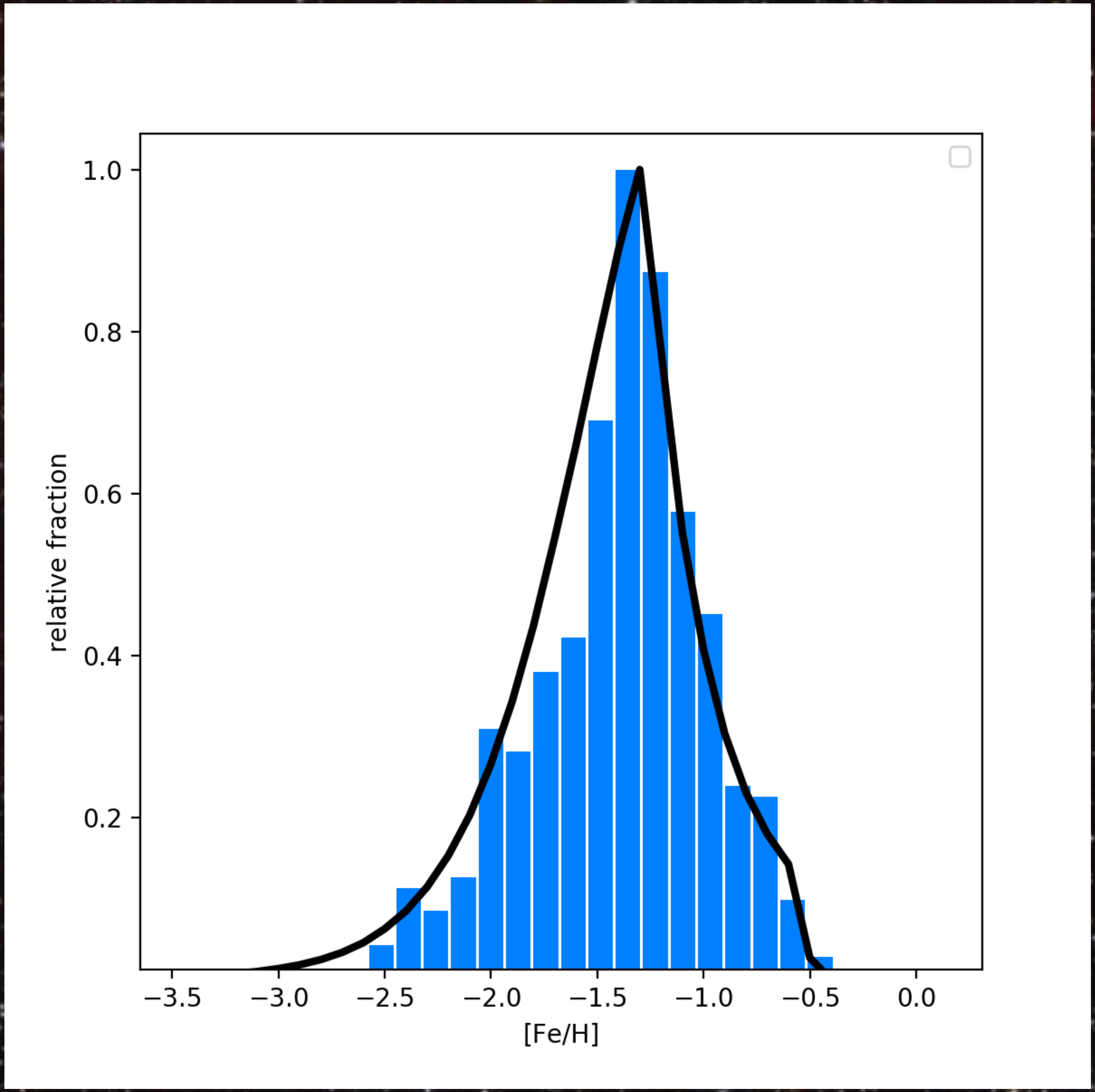
Cescutti&Molaro 2019

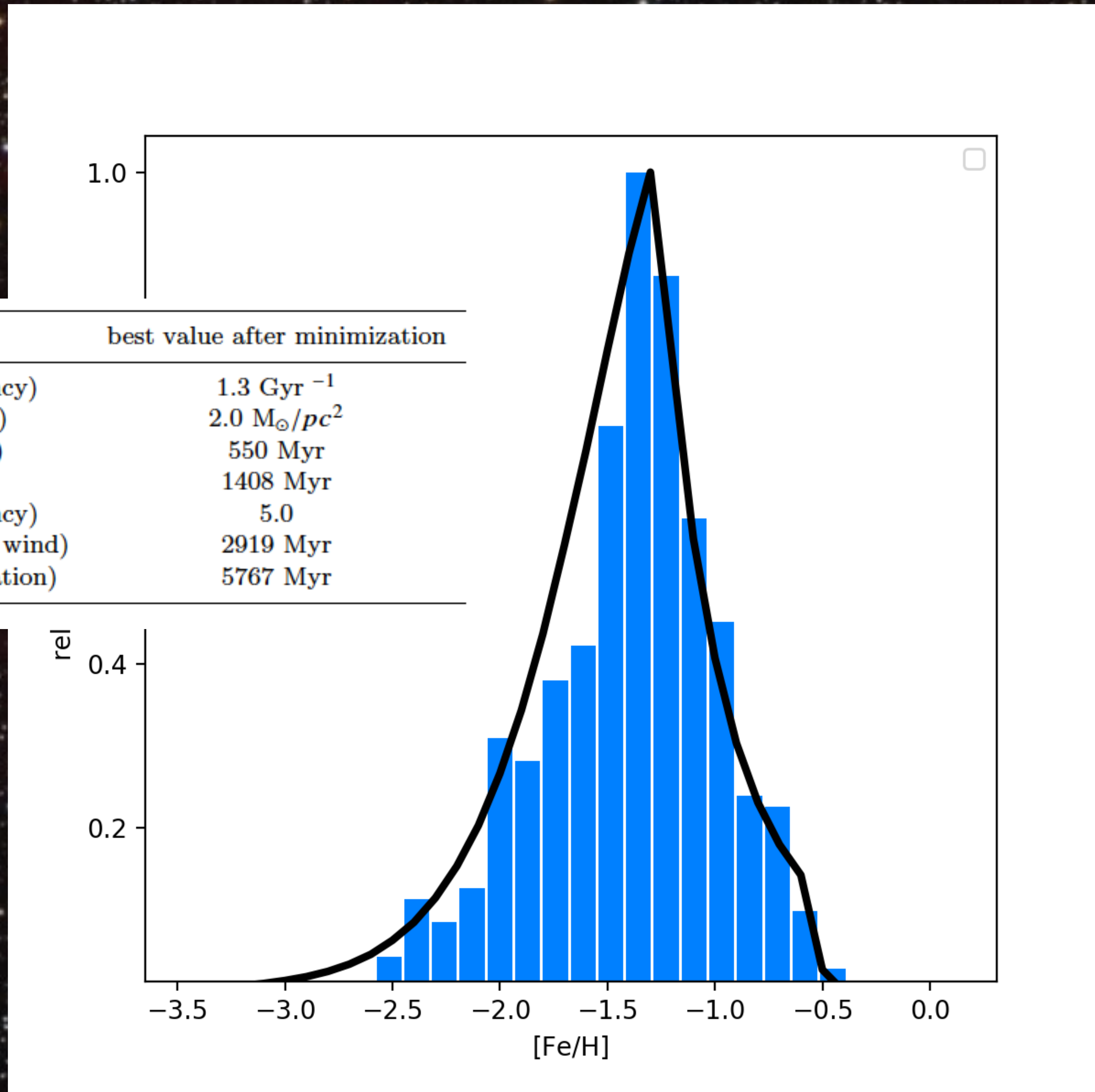
New CEM for Gaia Enceladus



Minimisation approach based on the MDF!

Cescutti et al. 2020

New CEM for Gaia Enceladus



parameter	best value after minimization
ν_{Enc} (star formation efficiency)	1.3 Gyr $^{-1}$
M_{Enc} (surface mass density)	2.0 $M_{\odot}/pc^2$
τ_{Enc} (peak of the infall law)	550 Myr
σ_{Enc} (SD of the infall law)	1408 Myr
ν^{wind}_{Enc} (galactic wind efficiency)	5.0
T^{wind}_{Enc} (start of the galactic wind)	2919 Myr
T_{Enc} (end of the star formation)	5767 Myr

Minimisation approach based on the MDF!

Cescutti et al. 2020

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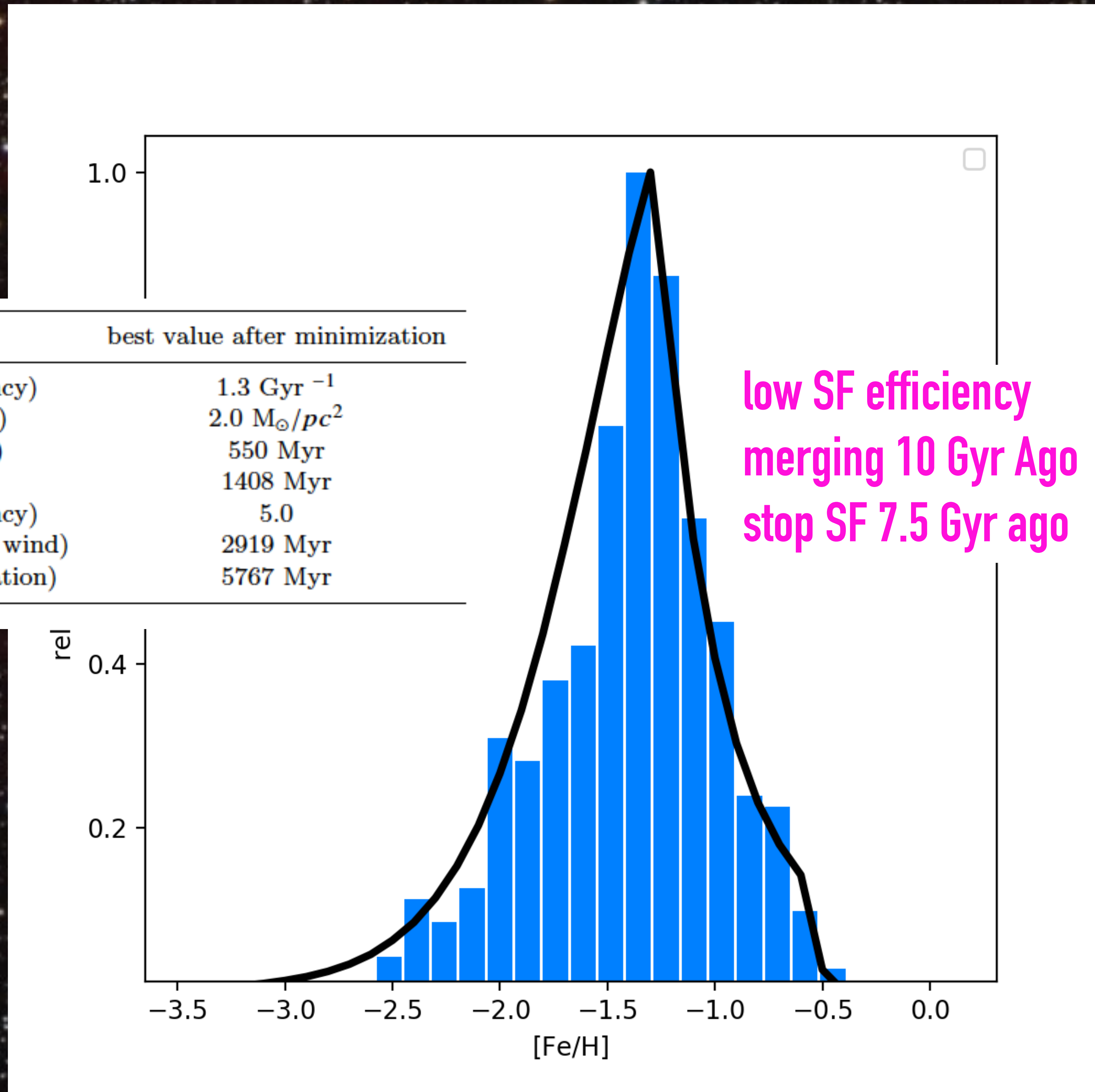

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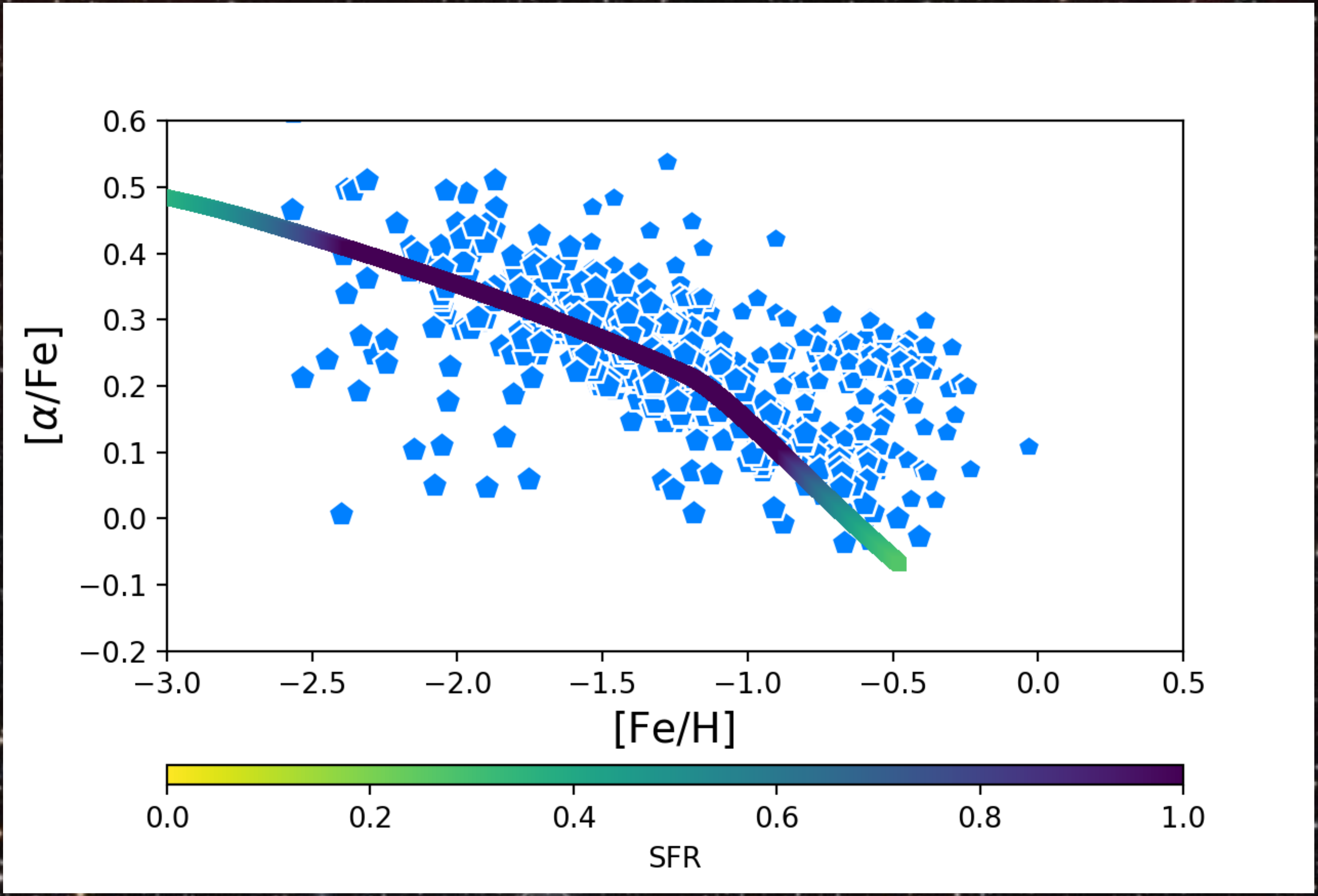
low SF efficiency
merging 10 Gyr Ago
stop SF 7.5 Gyr ago

Minimisation approach based on the MDF!

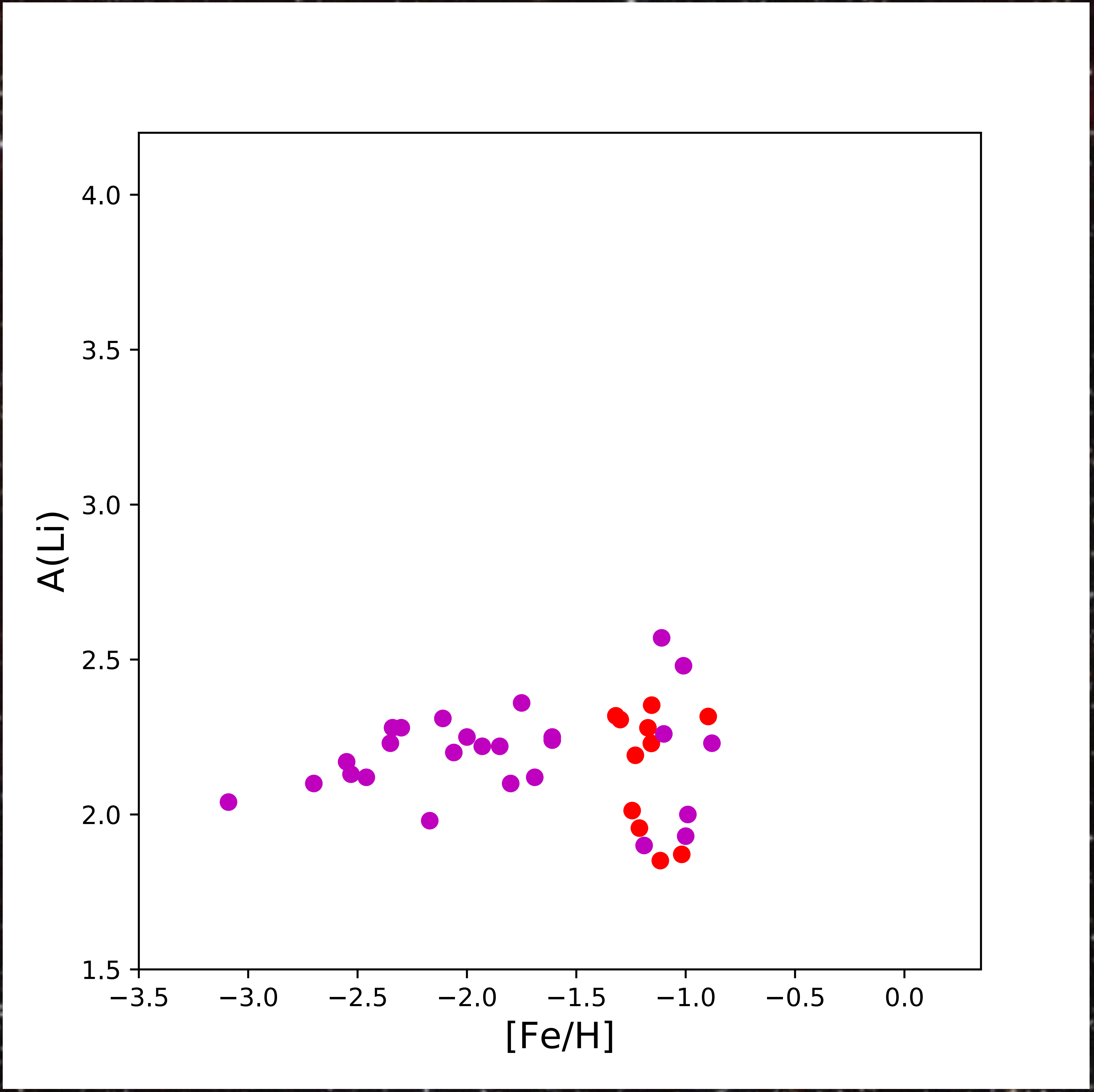
Cescutti et al. 2020

CE of $\alpha-$elements in Enceladus



Cescutti et al. 2020

Observational data of Lithium in Enceladus



dwarf stars
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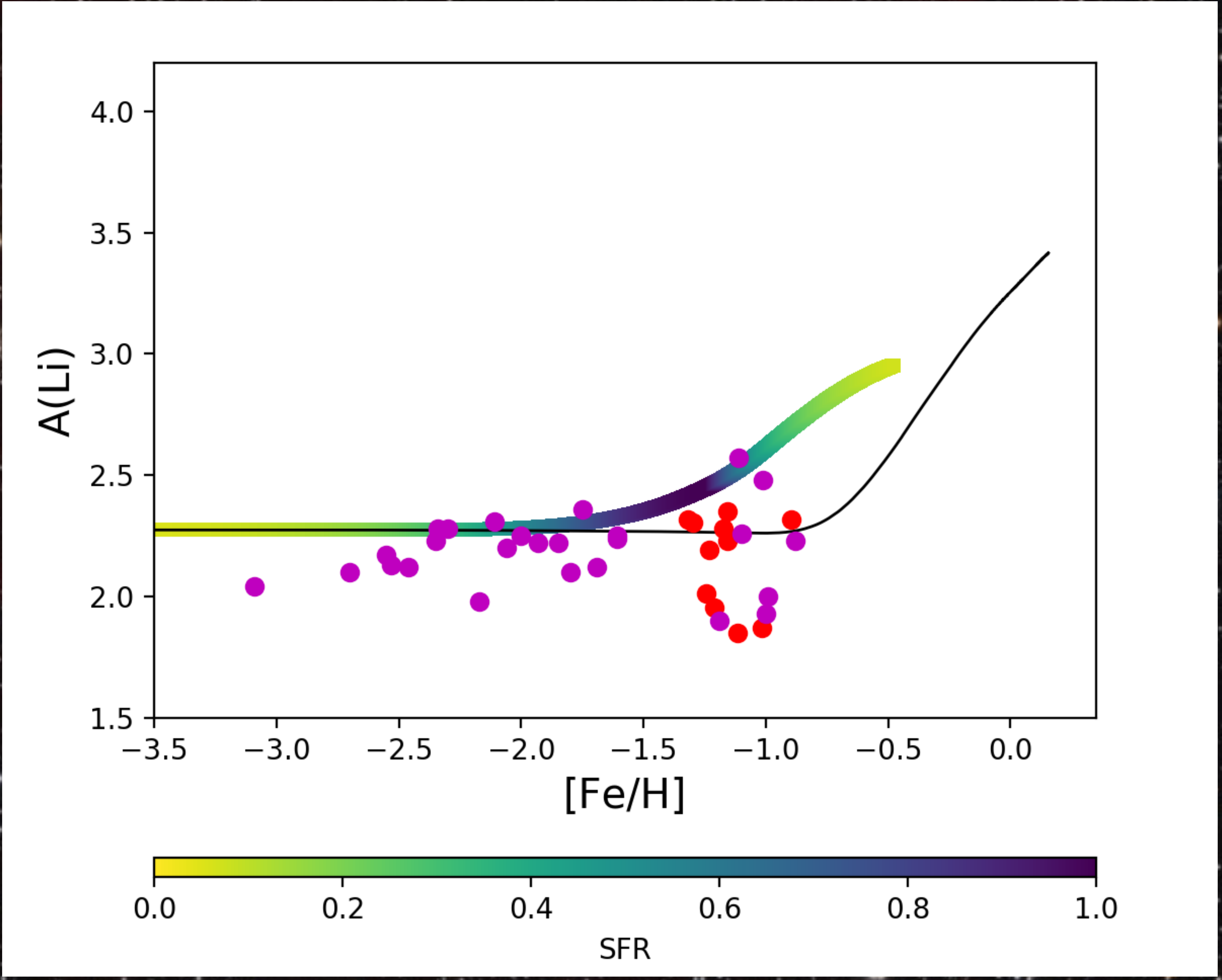
Enceladus members

Cescutti et al. 2020

CEM of GAIA-Enceladus

Cescutti et al. 2020



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Conclusions for Gaia-Enceladus

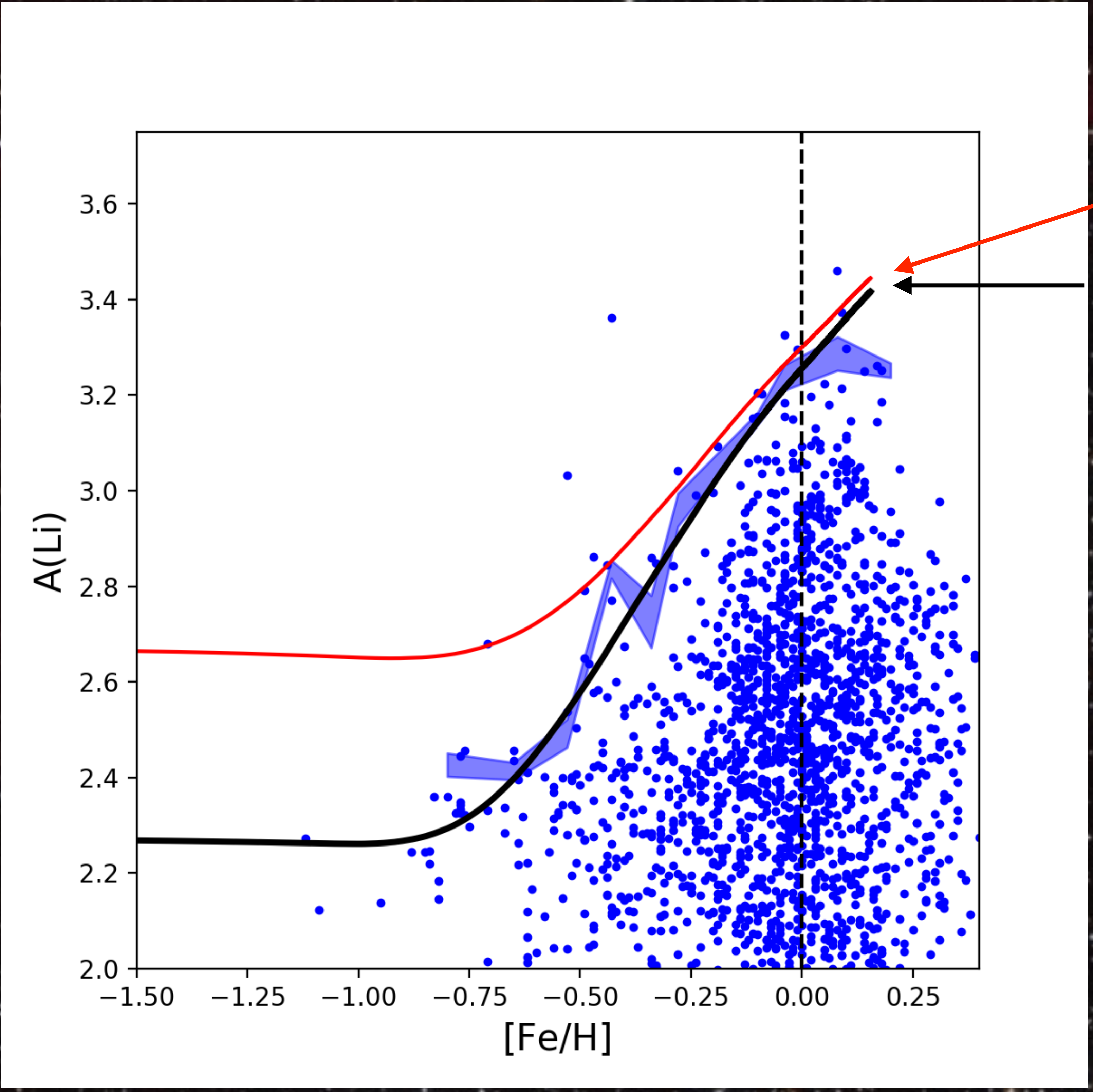
The Lithium plateau is at the same level as in the Milky Way

We predict an upturn at metallicity [Fe/H]=-1.7

Future spectroscopical follows-up will produce a statistical sample and firmer conclusions can be drawn.

EXTRA slides

CE of Lithium in the thin disc



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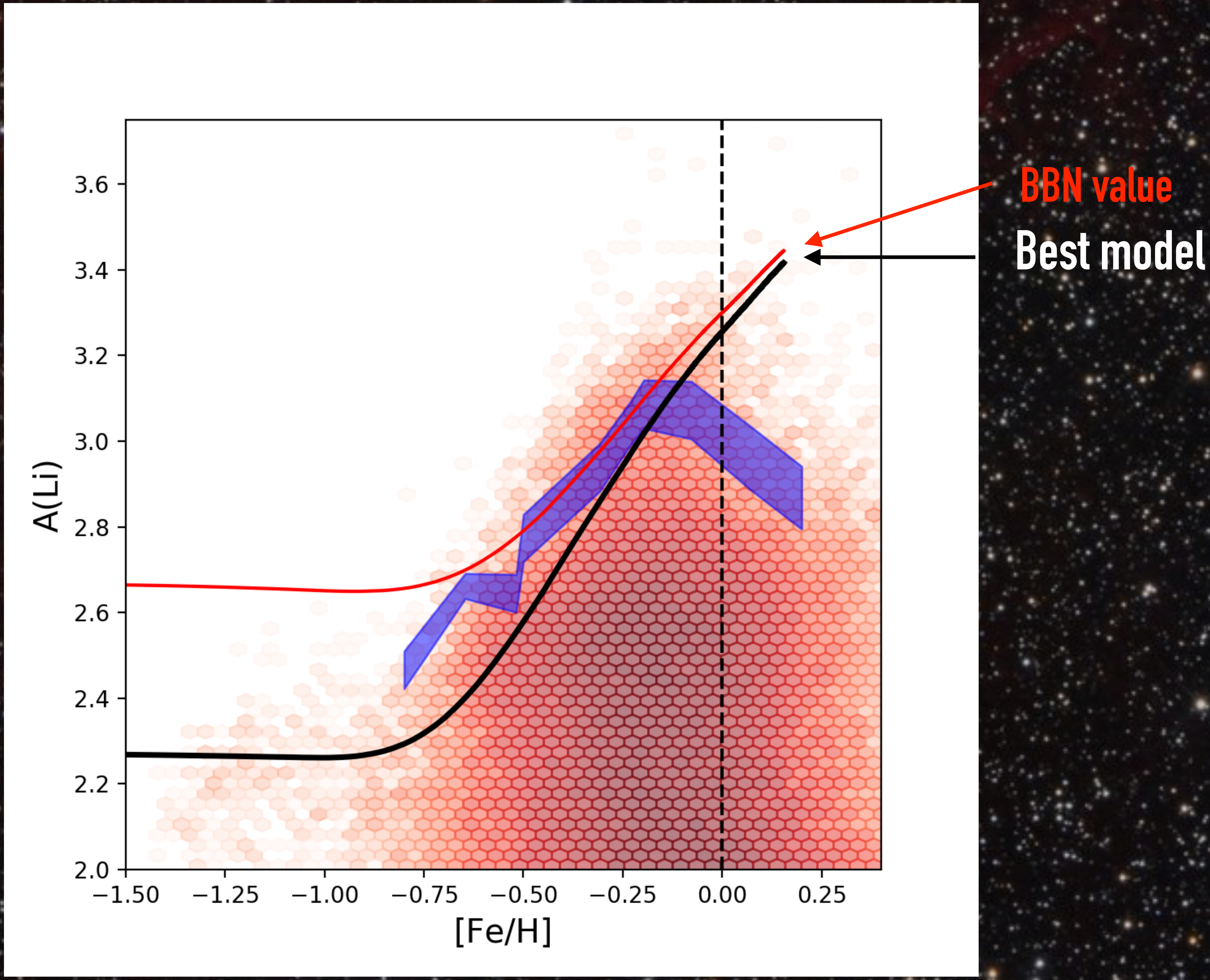

Cescutti&Molaro 2019

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