GCE with Chempy:

transforming stellar physics into

elemental abundances and vice versa

Jan Rybizki – MPIA

11/29/18 – CENAG Heidelberg

Fast and flexible GCE: Chempy

github.com/jan-rybizki/Chempy

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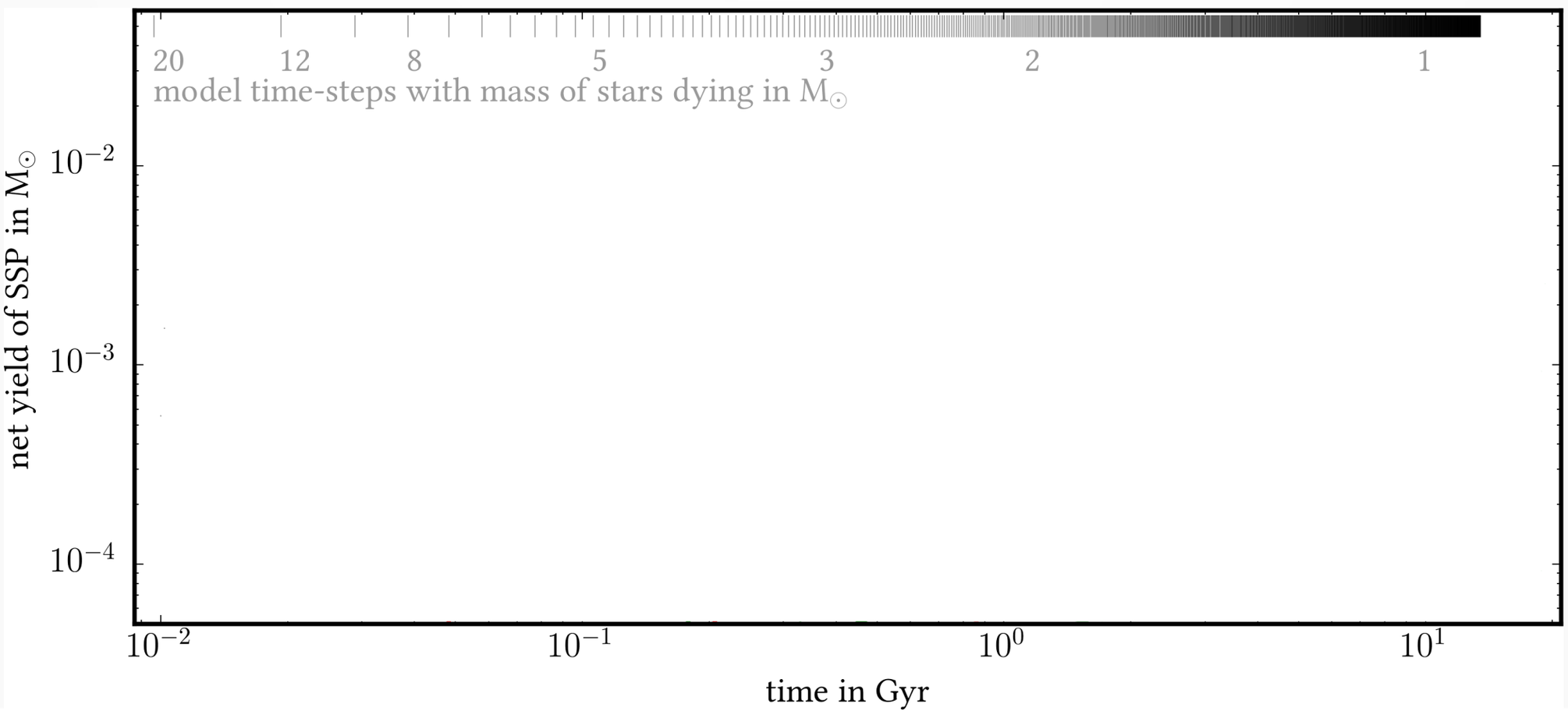

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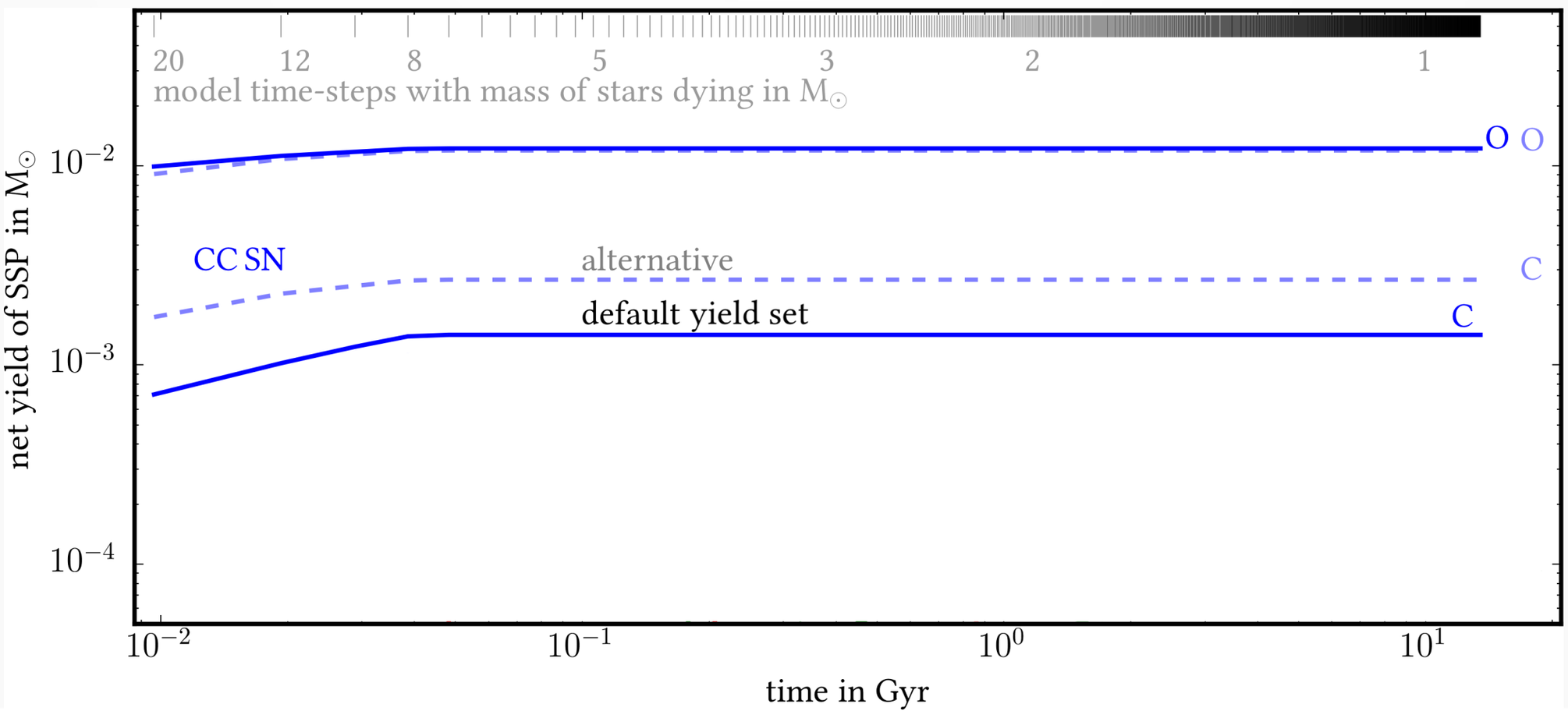

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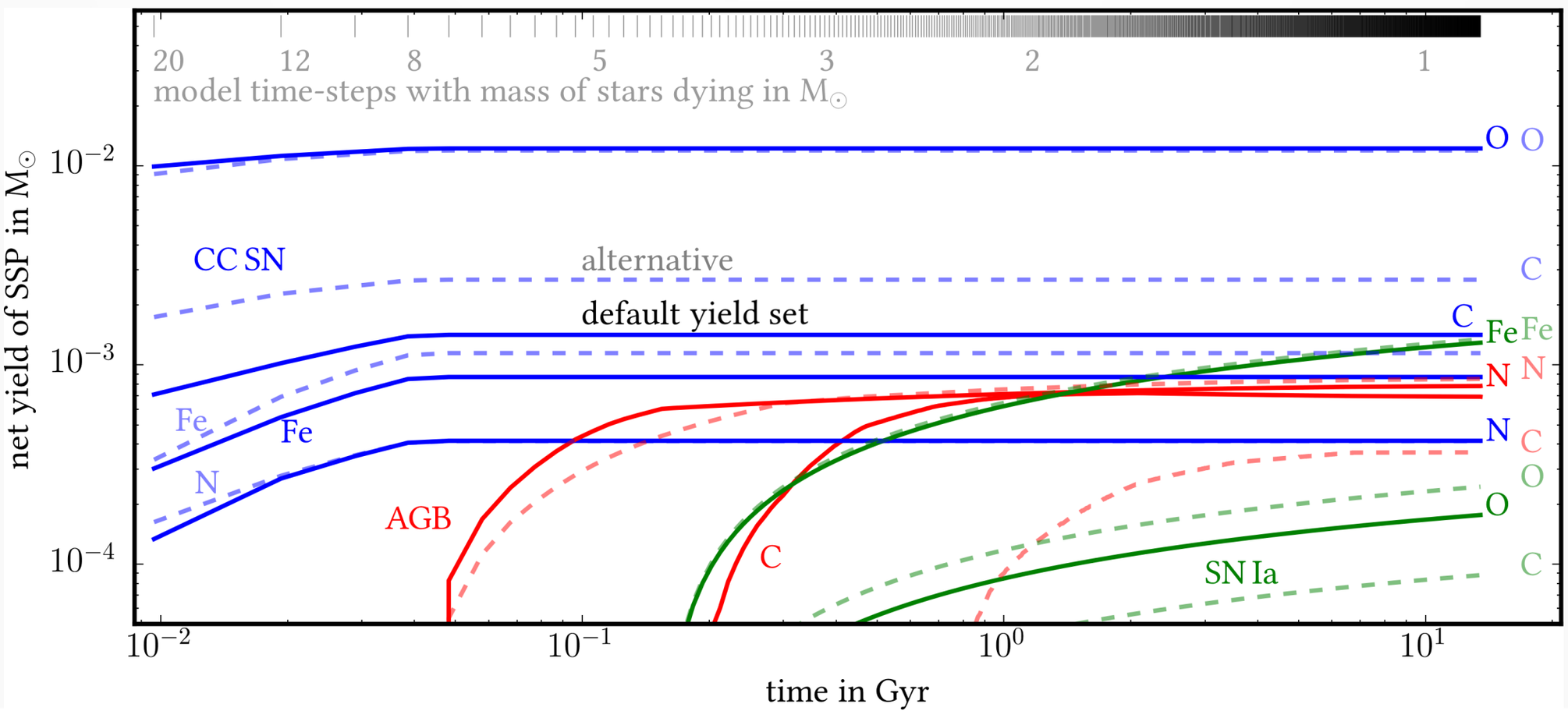

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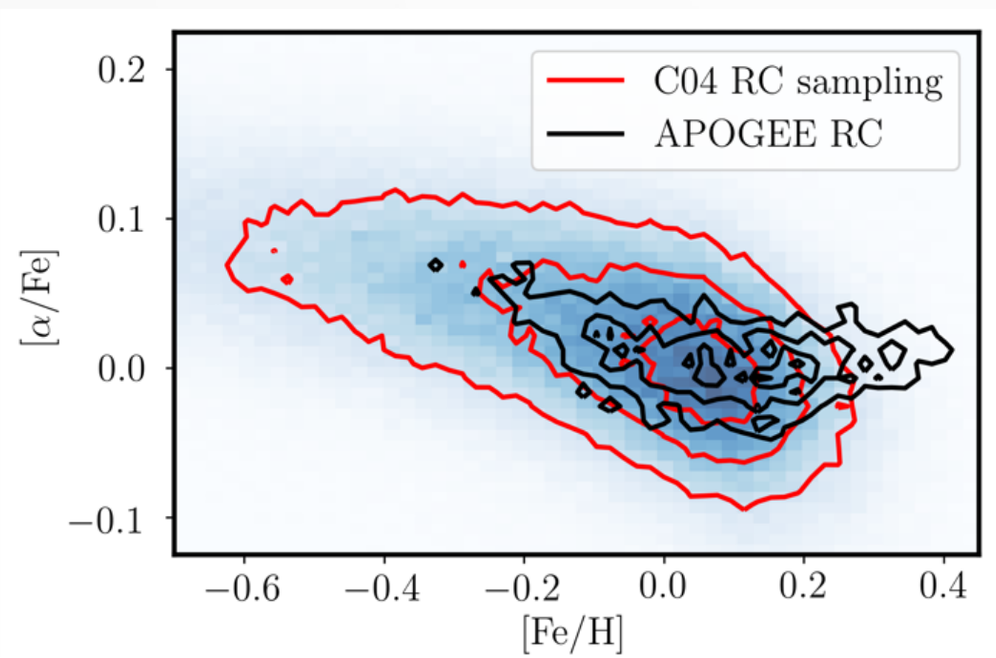

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  - no fiducial model, give your data → get GCE parameters

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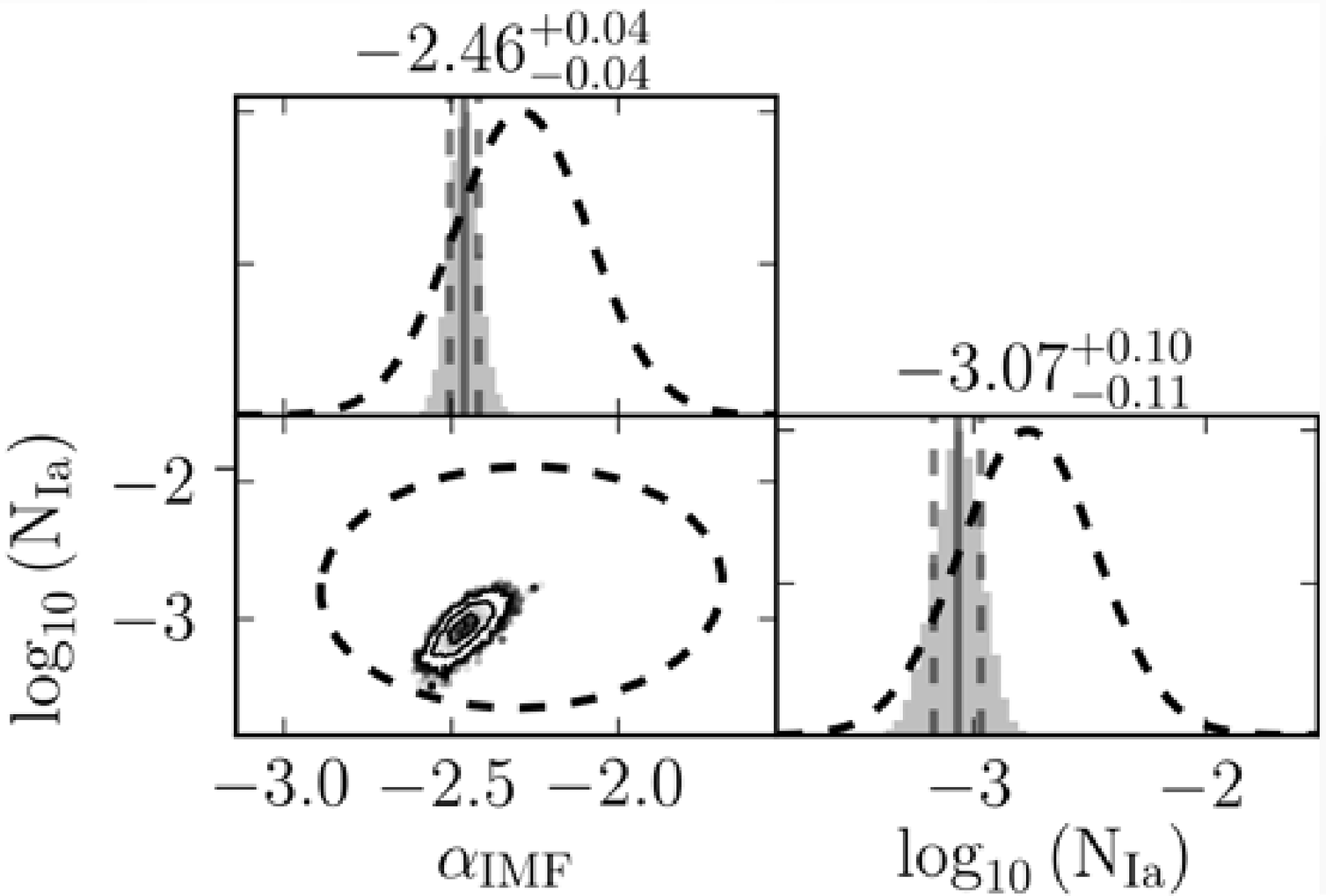

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  - 0.5 – 1.4 SNIa per 1000 Msun

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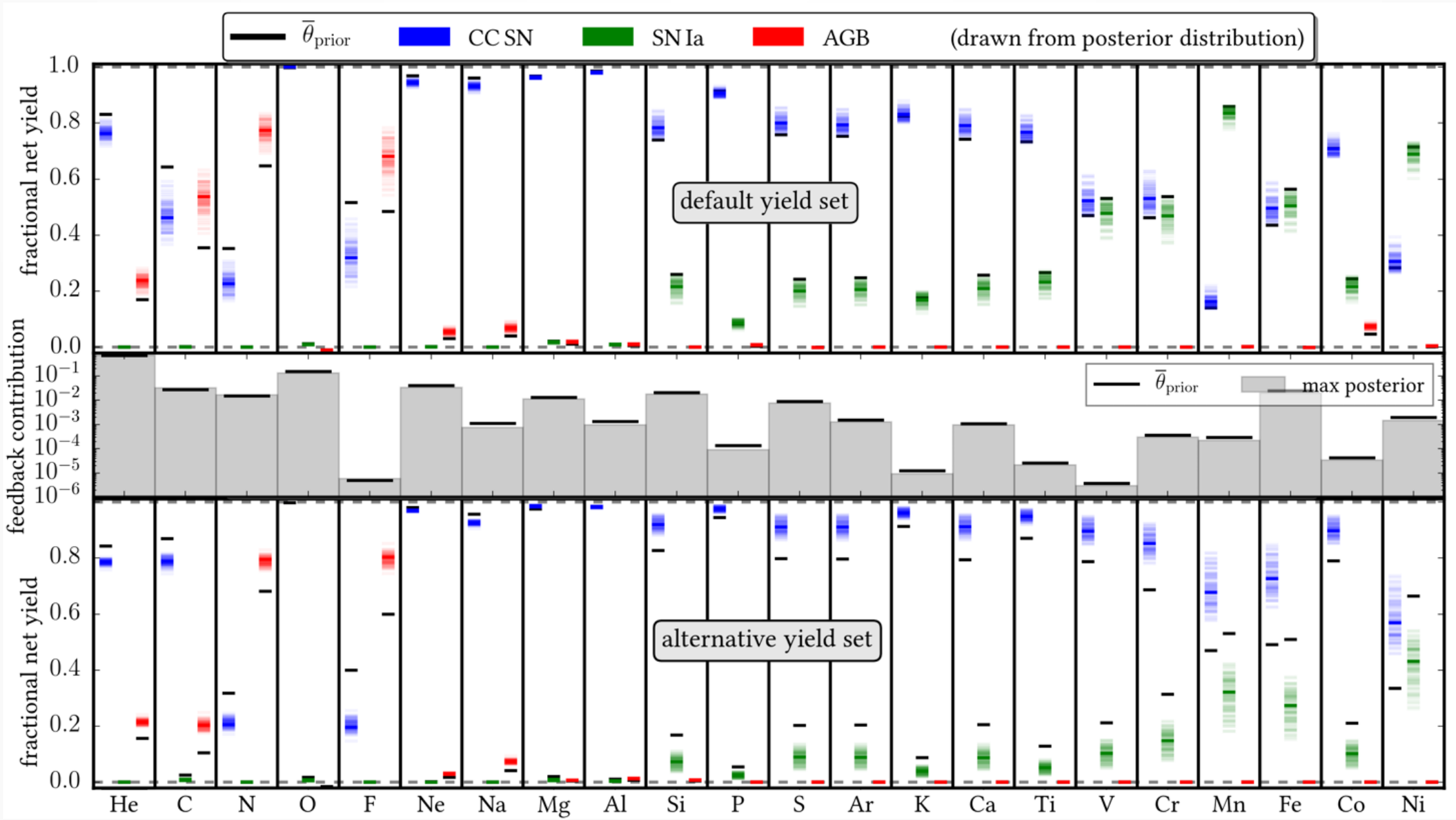
- Not able to reproduce all elements

Favorite plot: Channel contribution



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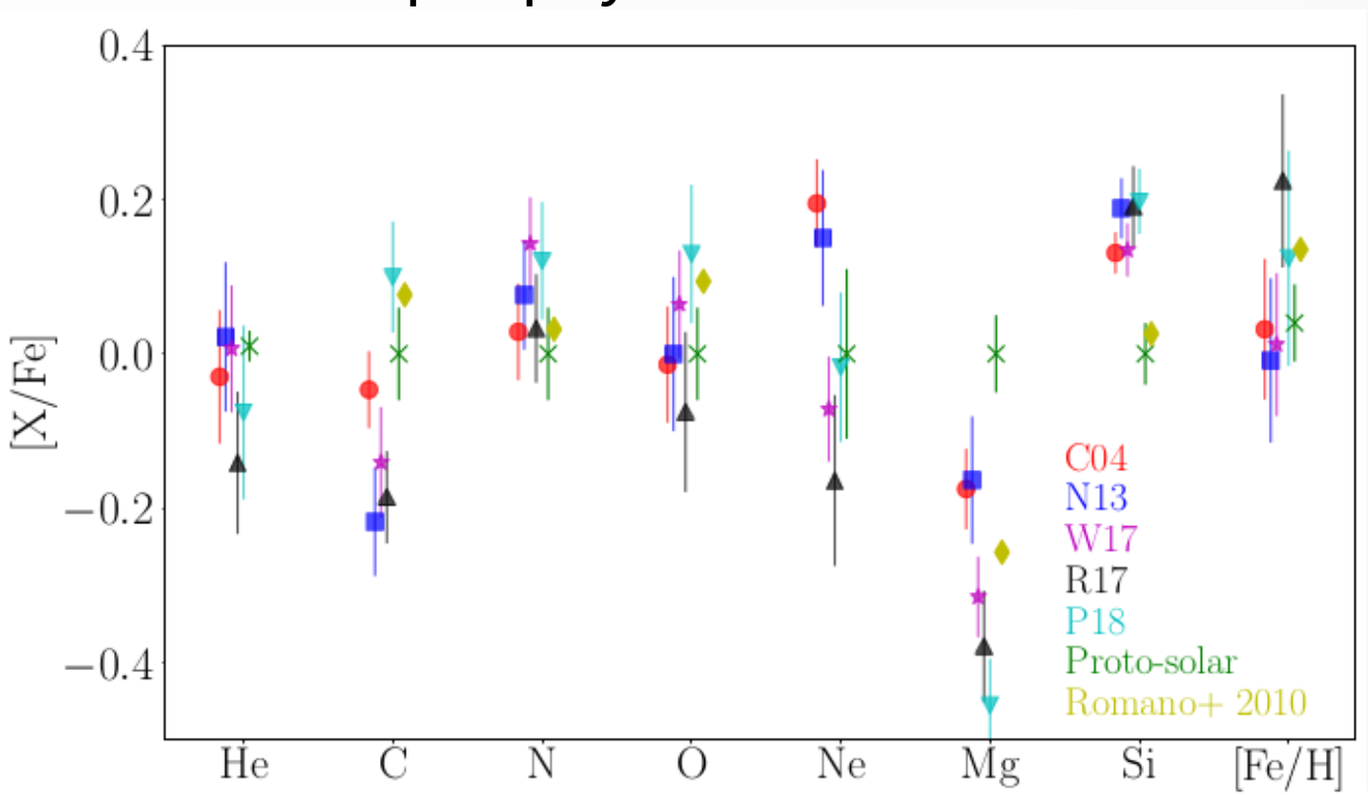

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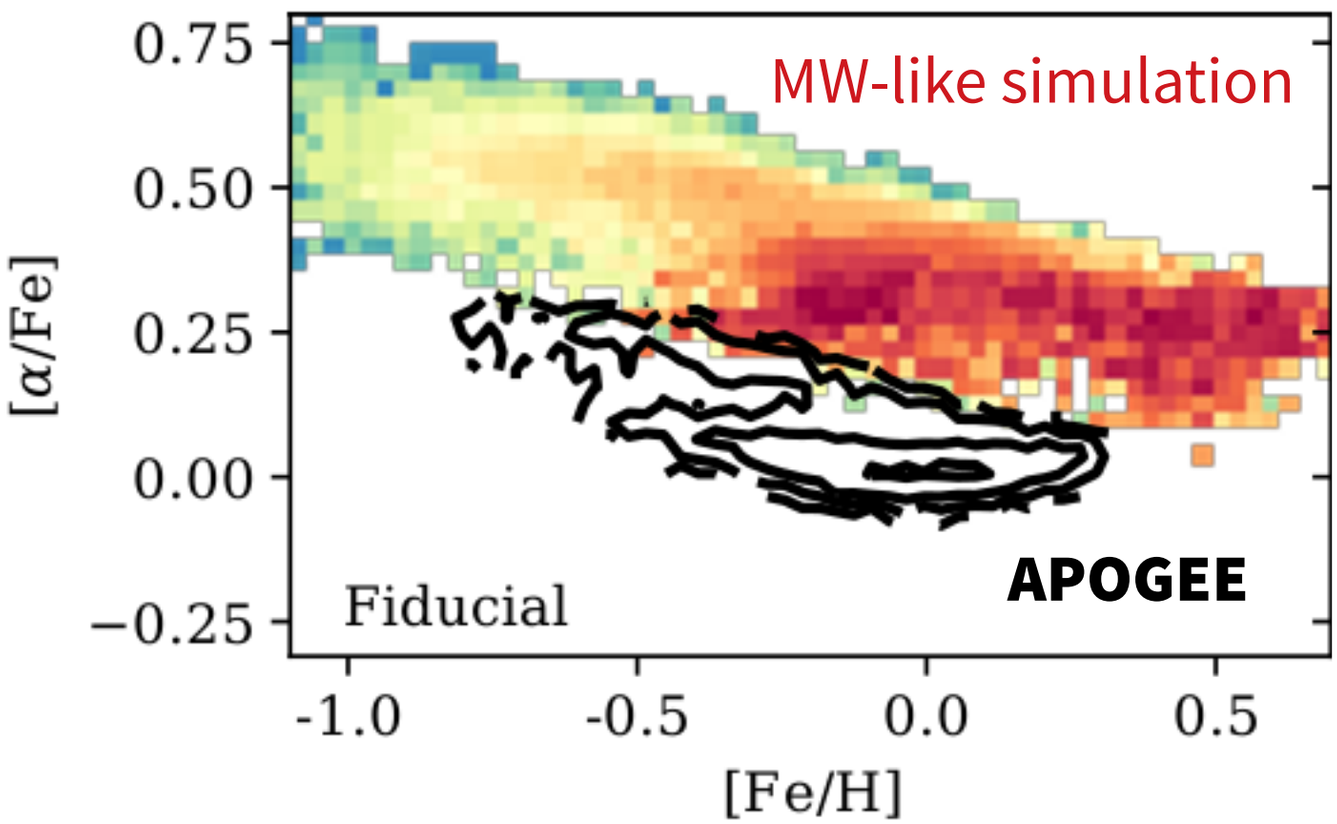

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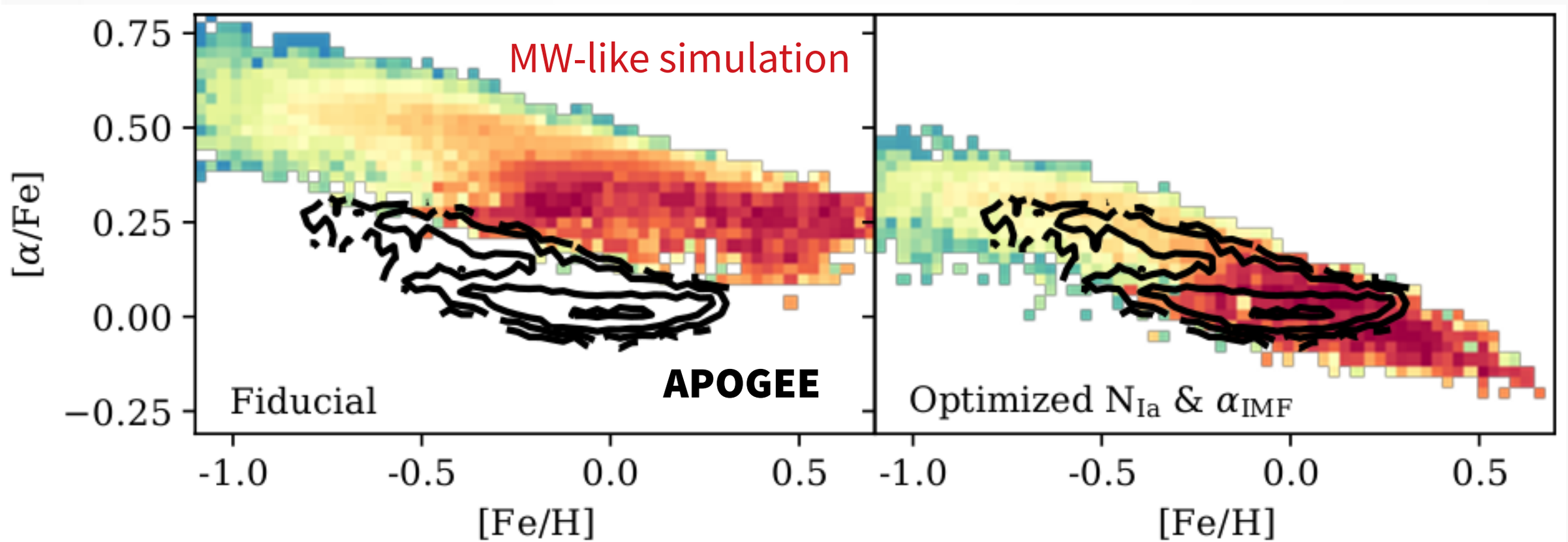
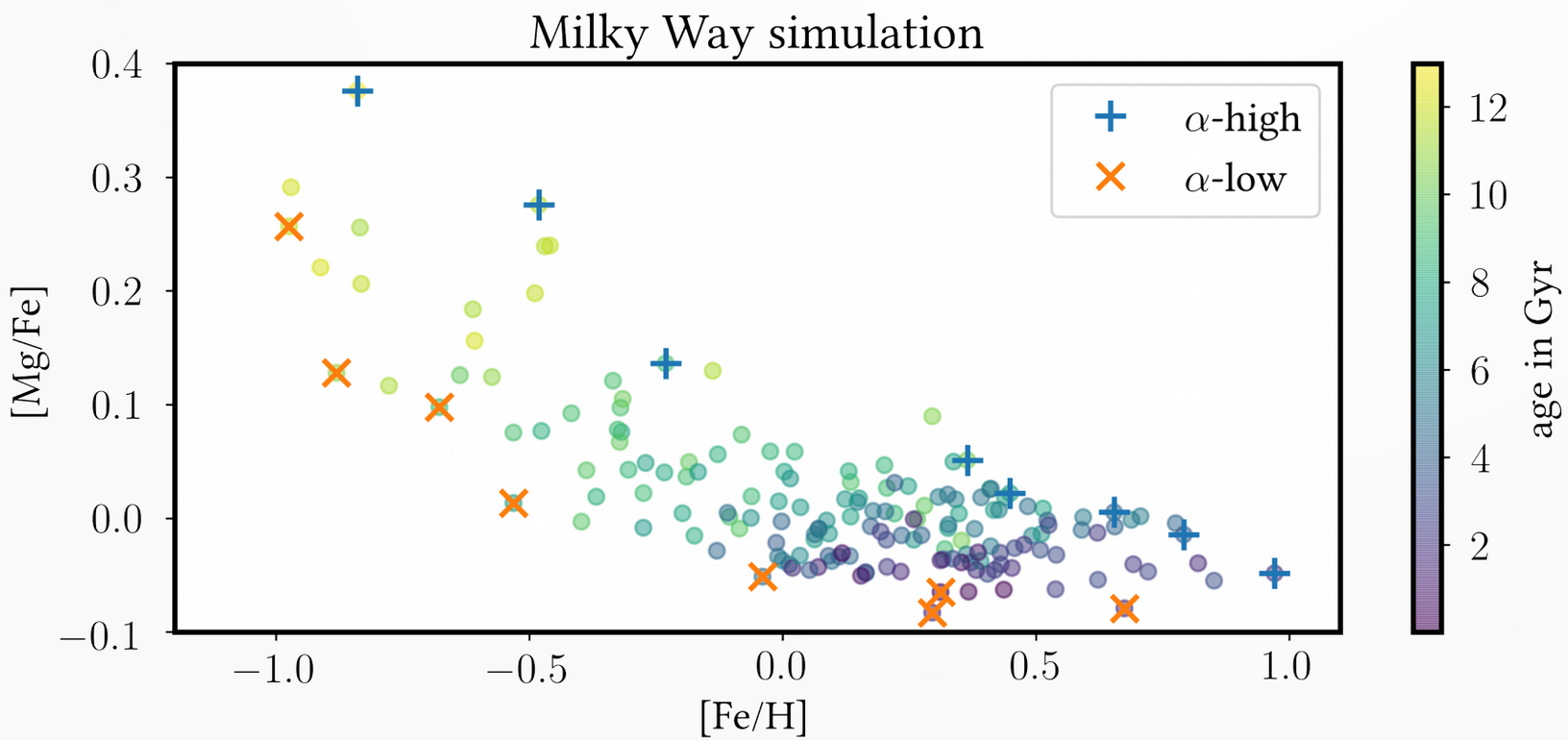
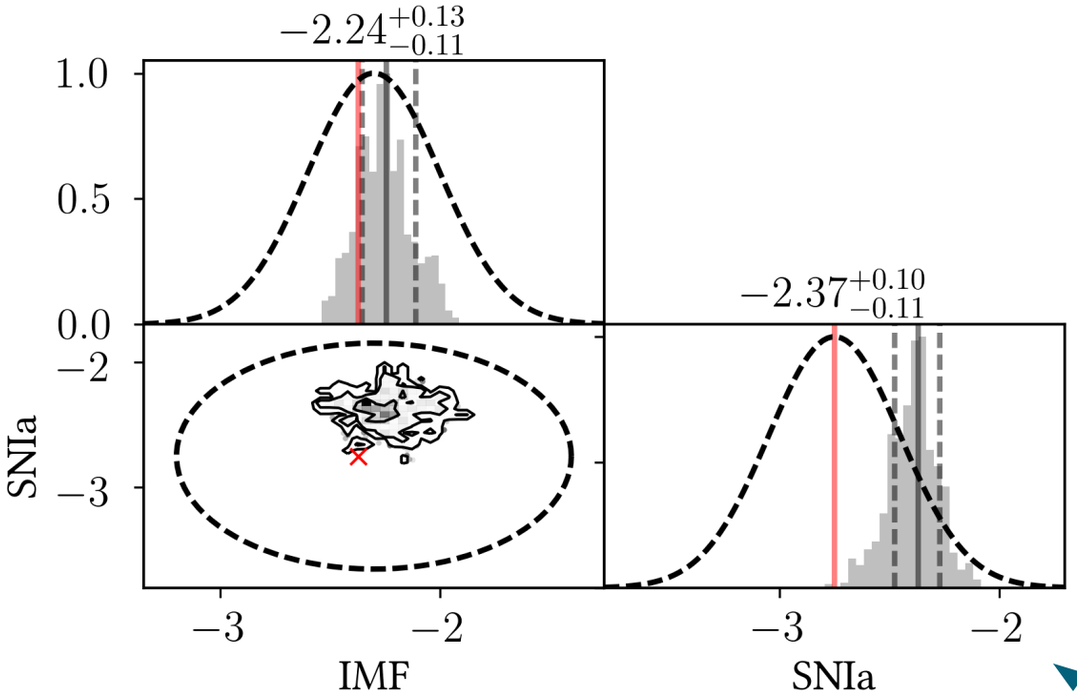
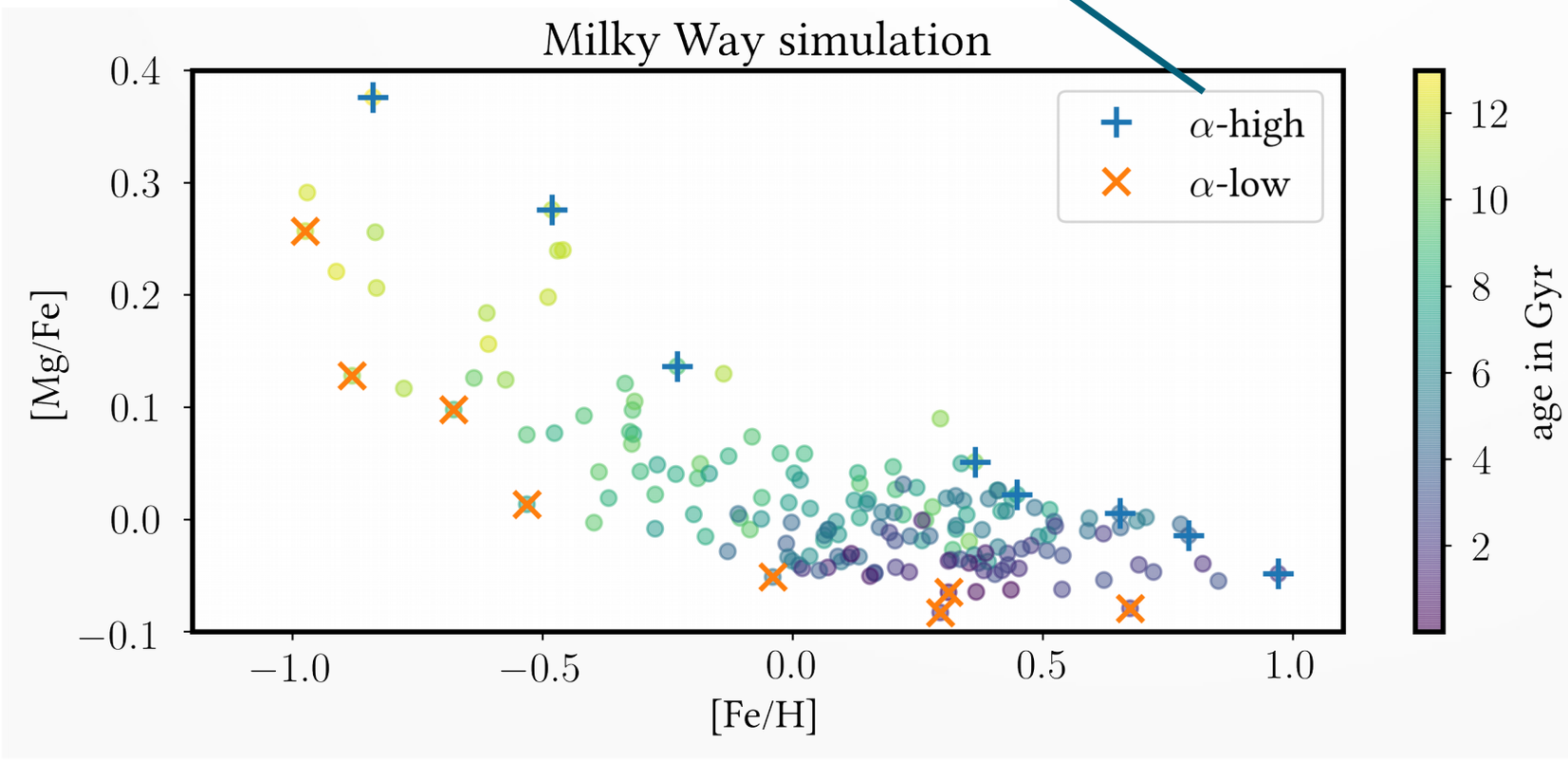


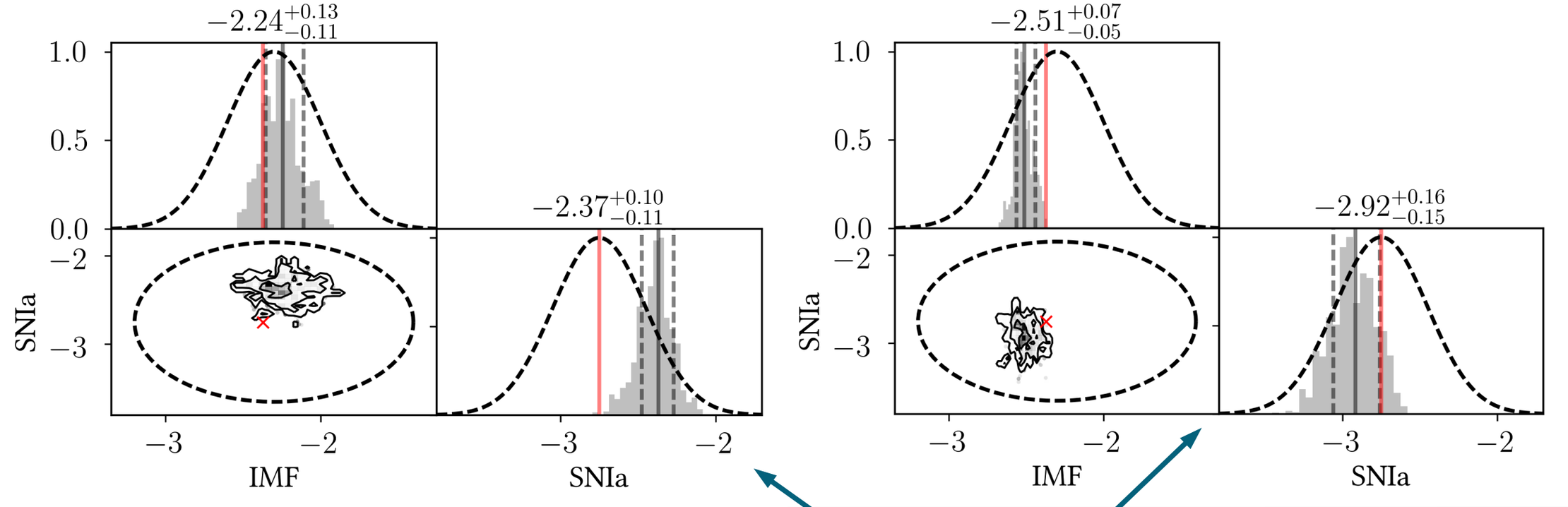
Many star inference



nce


$-2.24^{+0.13}_{-0.11}$
$-2.37^{+0.10}_{-0.11}$
SNIa
IMF
SNIa


Milky Way simulation
α-high
α-low
[Mg/Fe]
[Fe/H]
age in Gyr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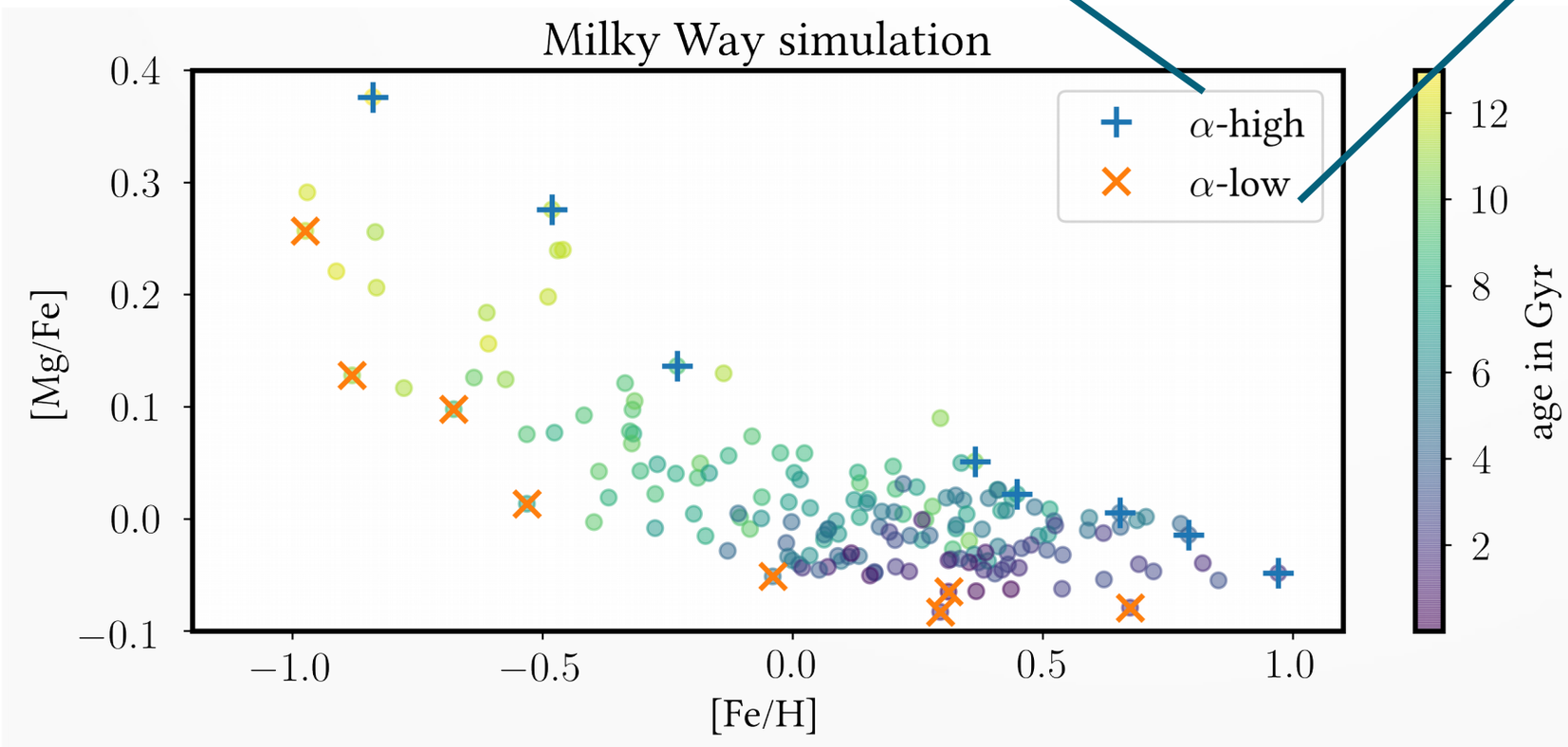
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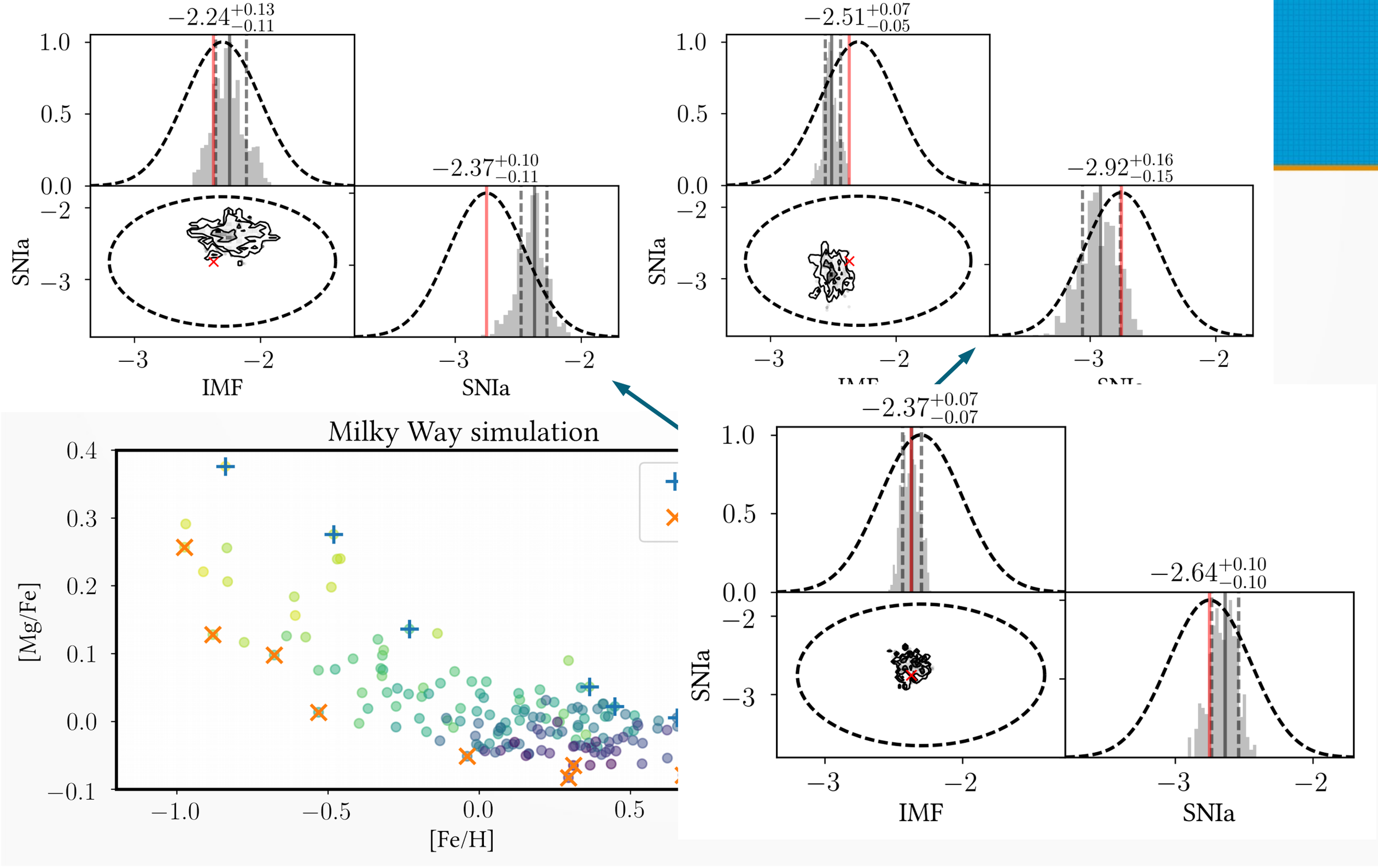
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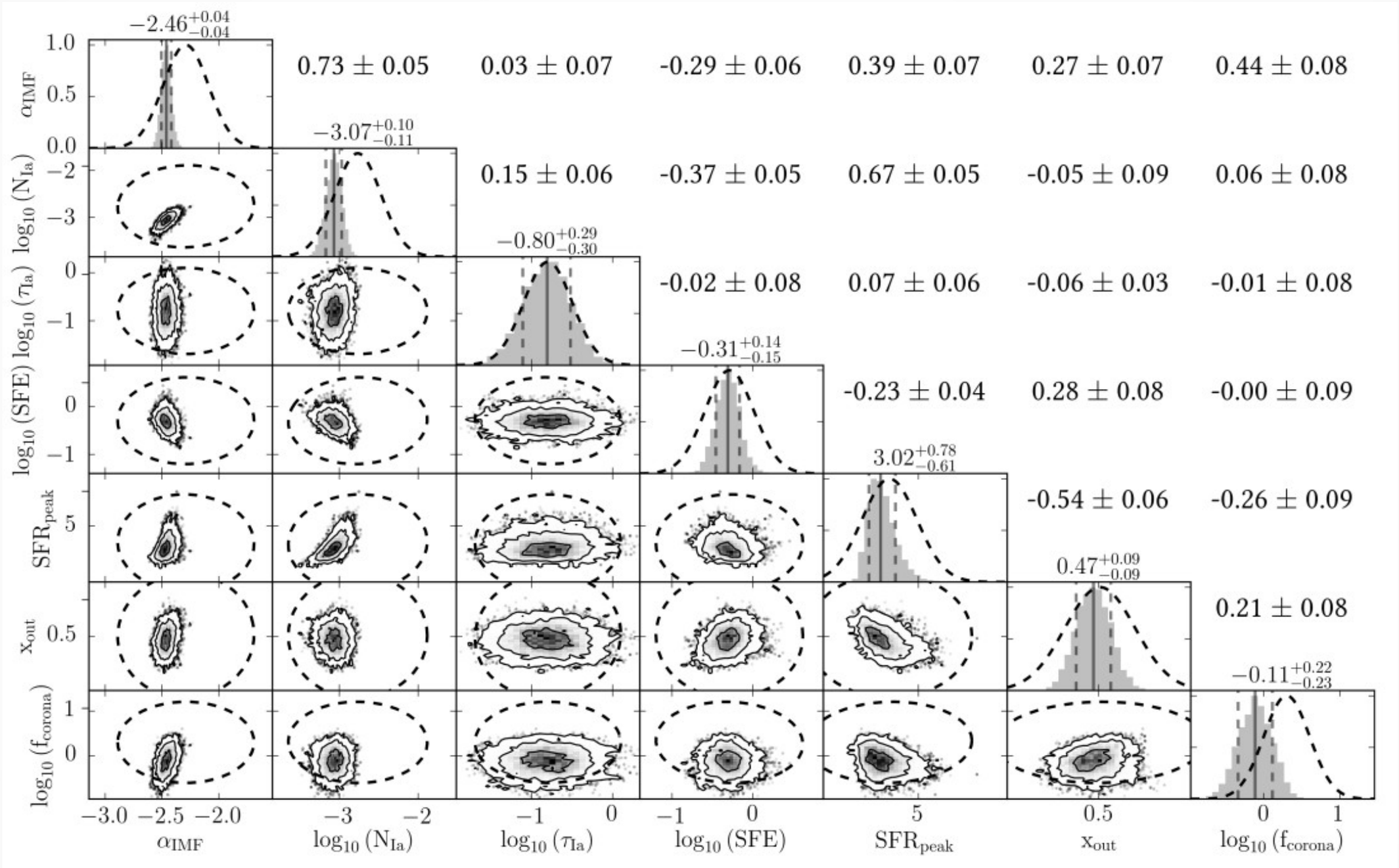
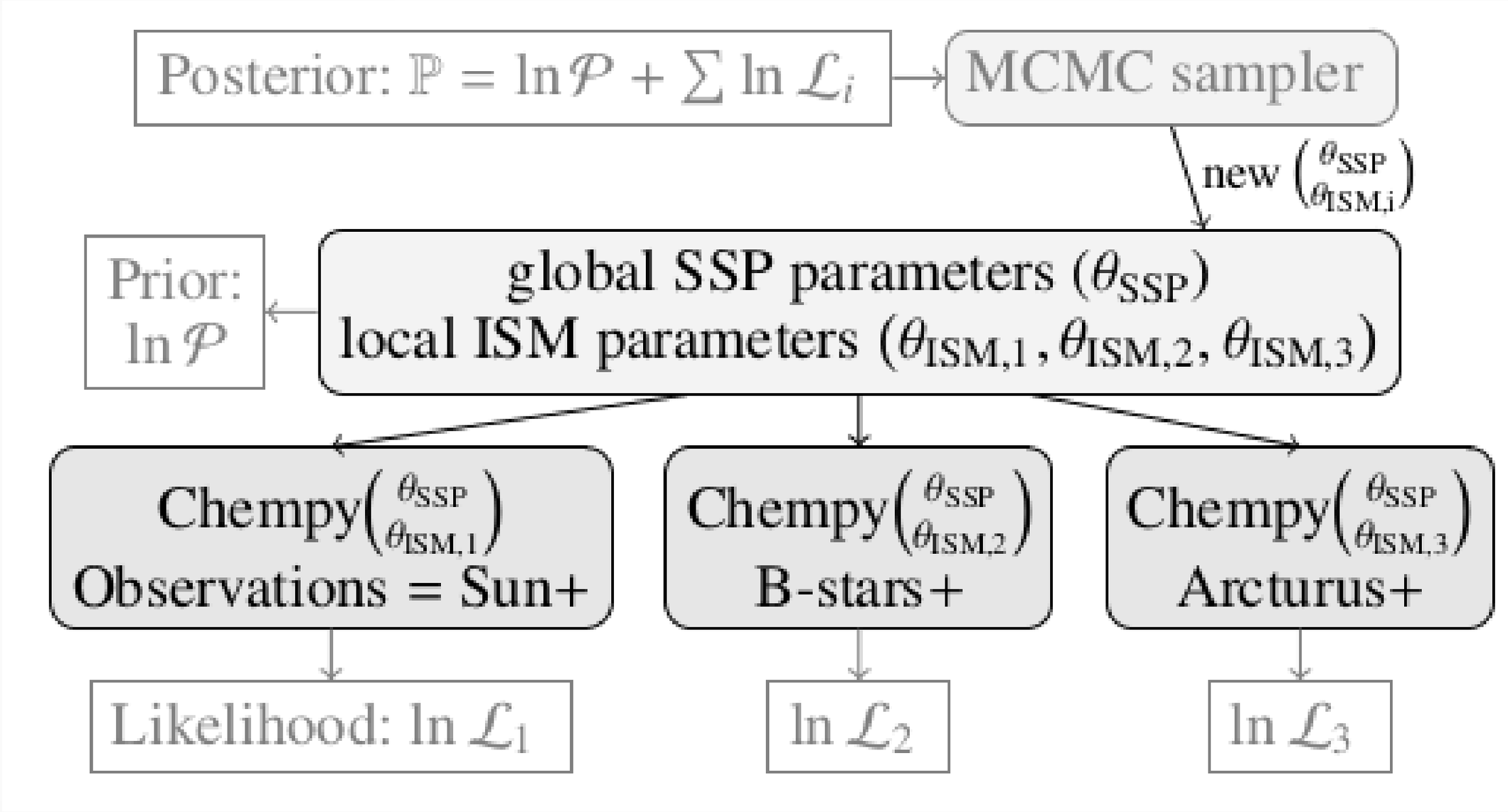
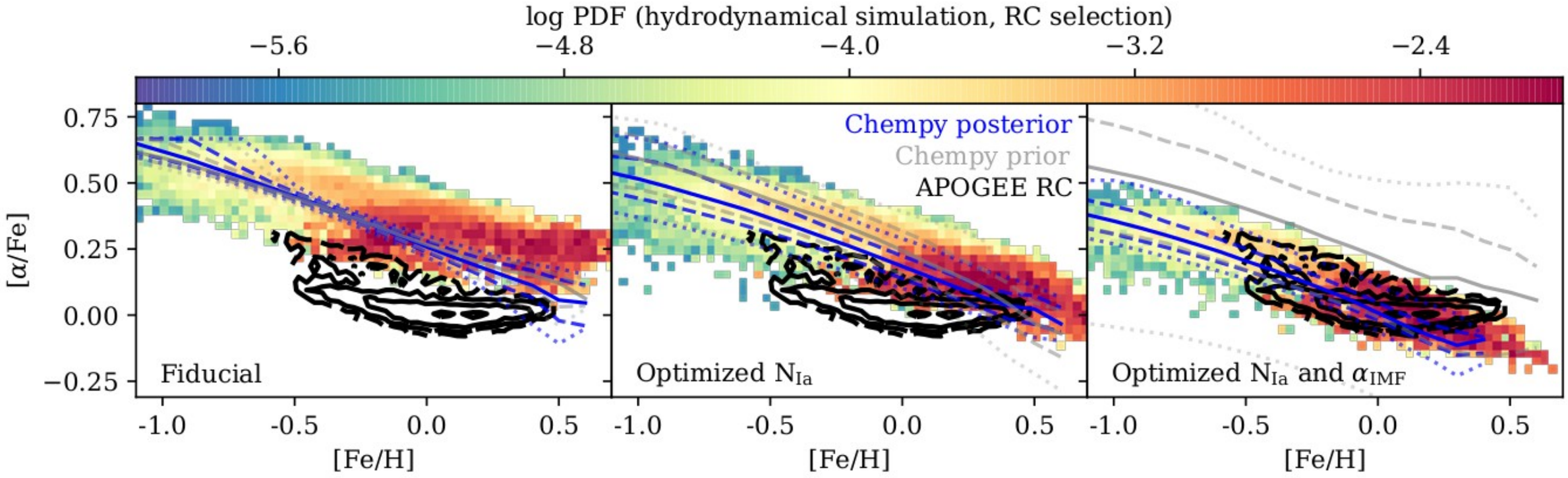
  - infer complex empirical yield tables for different nucleosynthetic channels

Thank you for your attention


$-2.46^{+0.04}_{-0.04}$
0.73 ± 0.05
0.03 ± 0.07
-0.29 ± 0.06
0.39 ± 0.07
0.27 ± 0.07
0.44 ± 0.08
$-3.07^{+0.10}_{-0.11}$
0.15 ± 0.06
-0.37 ± 0.05
0.67 ± 0.05
-0.05 ± 0.09
0.06 ± 0.08
$-0.80^{+0.29}_{-0.30}$
-0.02 ± 0.08
0.07 ± 0.06
-0.06 ± 0.03
-0.01 ± 0.08
$-0.31^{+0.14}_{-0.15}$
-0.23 ± 0.04
0.28 ± 0.08
-0.00 ± 0.09
$3.02^{+0.78}_{-0.61}$
-0.54 ± 0.06
-0.26 ± 0.09
$0.47^{+0.09}_{-0.09}$
0.21 ± 0.08
$-0.11^{+0.22}_{-0.23}$
$\alpha_{\rm IMF}$
$\log_{10}(N_{\rm Ia})$
$\log_{10}(\tau_{\rm Ia})$
$\log_{10}({\rm SFE})$
${\rm SFR}_{\rm peak}$
$x_{\rm out}$
$\log_{10}(f_{\rm corona})$


Posterior: $\mathbb{P} = \ln\mathcal{P} + \sum \ln\mathcal{L}_i$
MCMC sampler
new $\begin{pmatrix}\theta_{SSP}\\ \theta_{ISM,i}\end{pmatrix}$
Prior: $\ln\mathcal{P}$
global SSP parameters (θ_{SSP})
local ISM parameters ($\theta_{ISM,1}$, $\theta_{ISM,2}$, $\theta_{ISM,3}$)
Chempy$\begin{pmatrix}\theta_{SSP}\\ \theta_{ISM,1}\end{pmatrix}$
Observations = Sun+
Chempy$\begin{pmatrix}\theta_{SSP}\\ \theta_{ISM,2}\end{pmatrix}$
B-stars+
Chempy$\begin{pmatrix}\theta_{SSP}\\ \theta_{ISM,3}\end{pmatrix}$
Arcturus+
Likelihood: $\ln\mathcal{L}_1$
$\ln\mathcal{L}_2$
$\ln\mathcal{L}_3$


log PDF (hydrodynamical simulation, RC selection)
−5.6
−4.8
−4.0
−3.2
−2.4
Chempy posterior
Chempy prior
APOGEE RC
Fiducial
Optimized N_Ia
Optimized N_Ia and α_IMF
[α/Fe]
0.75
0.50
0.25
0.00
−0.25
-1.0
-0.5
0.0
0.5
[Fe/H]