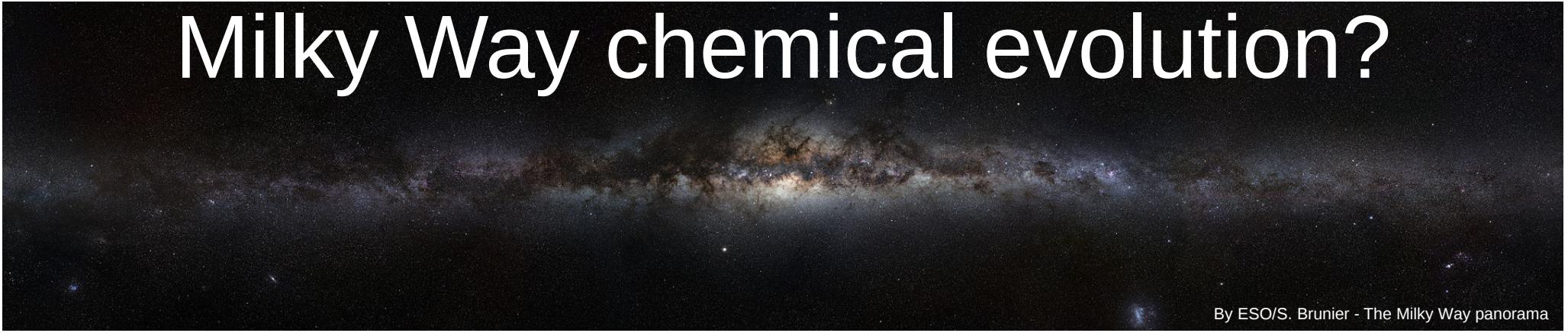


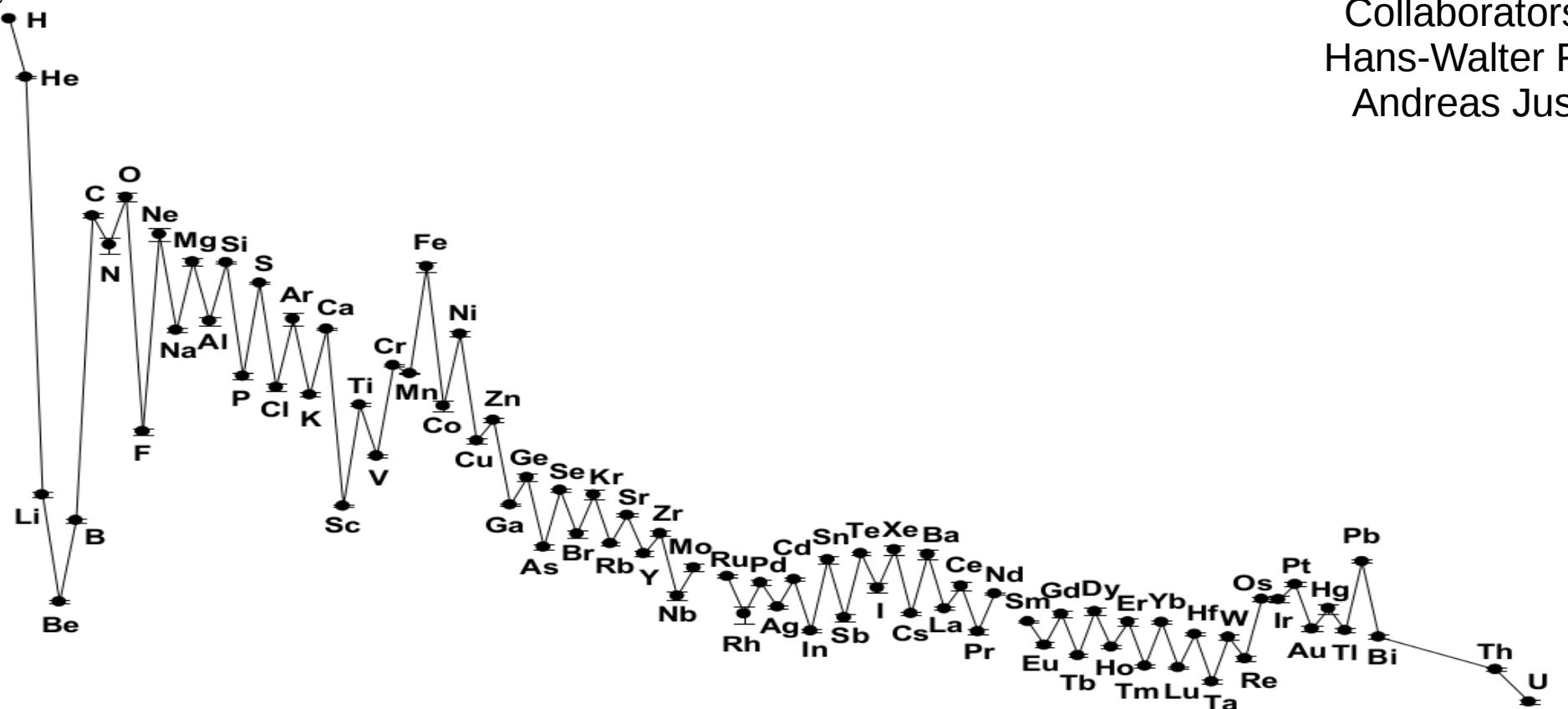
Collaborators:
Hans-Walter Rix
Andreas Just

What does the Sun tell us about the Milky Way chemical evolution?



By ESO/S. Brunier - The Milky Way panorama

ARI Institute Colloquium – 4.5.2017 – Jan Rybizki



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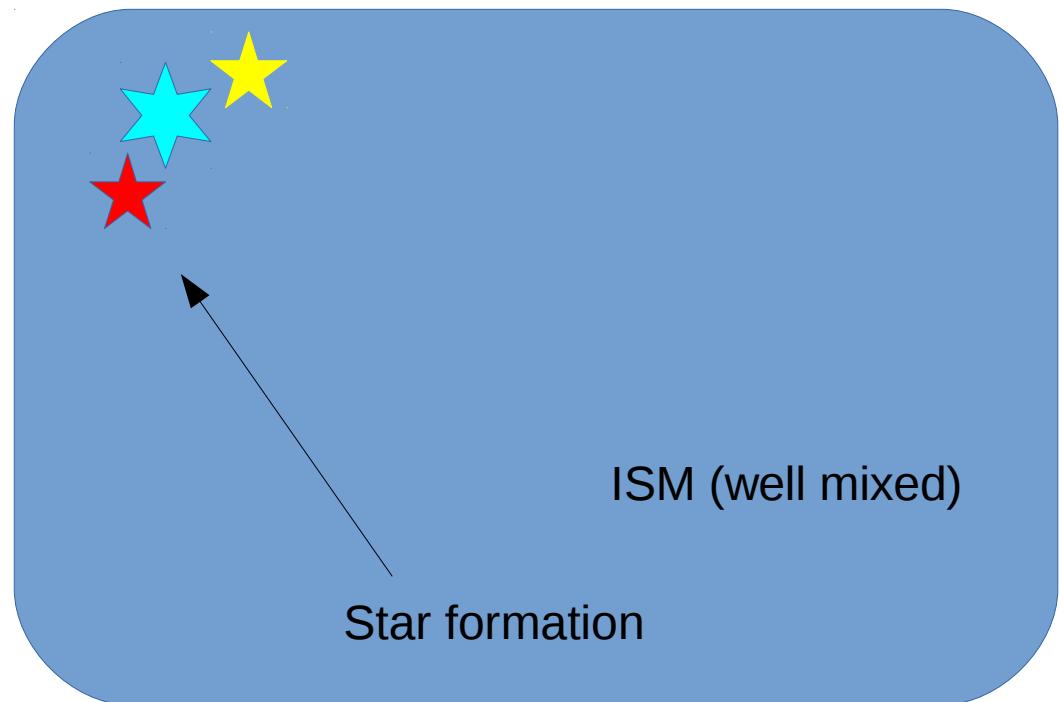
1. Chempy – fast & flexible Galactic chemical evolution (GCE)

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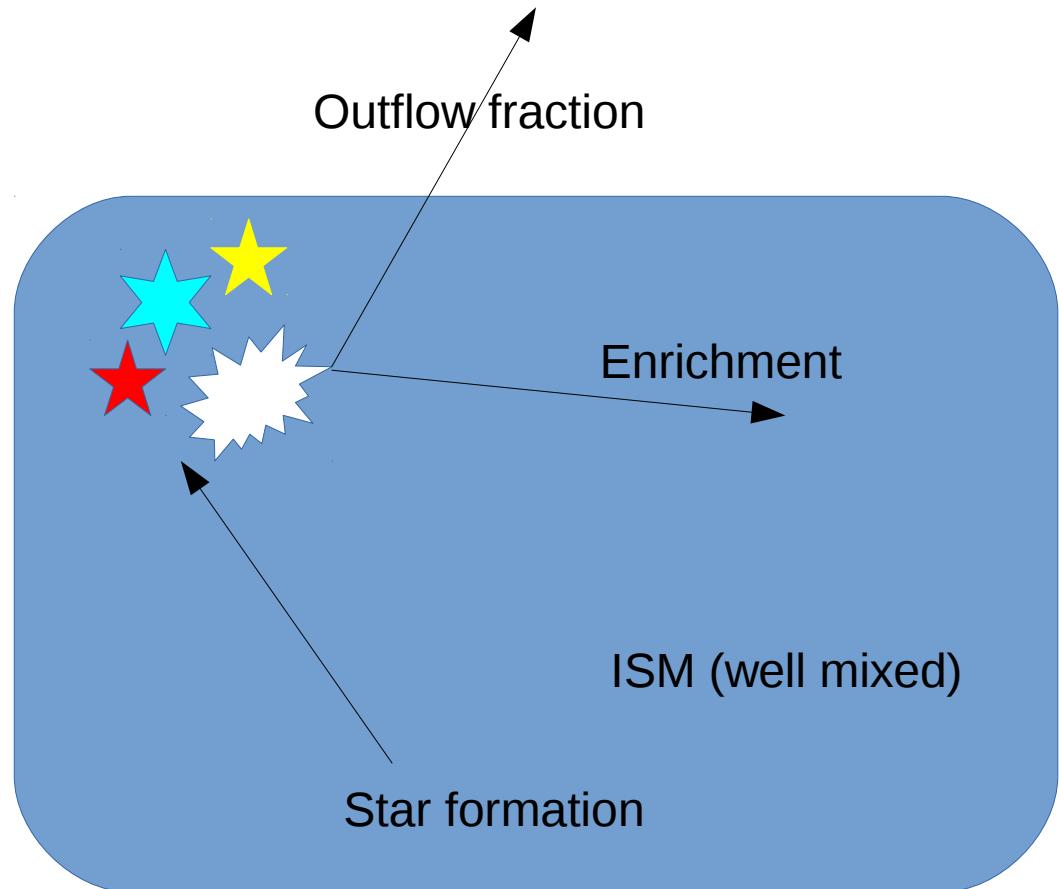
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- Star formation
 - SFR & IMF



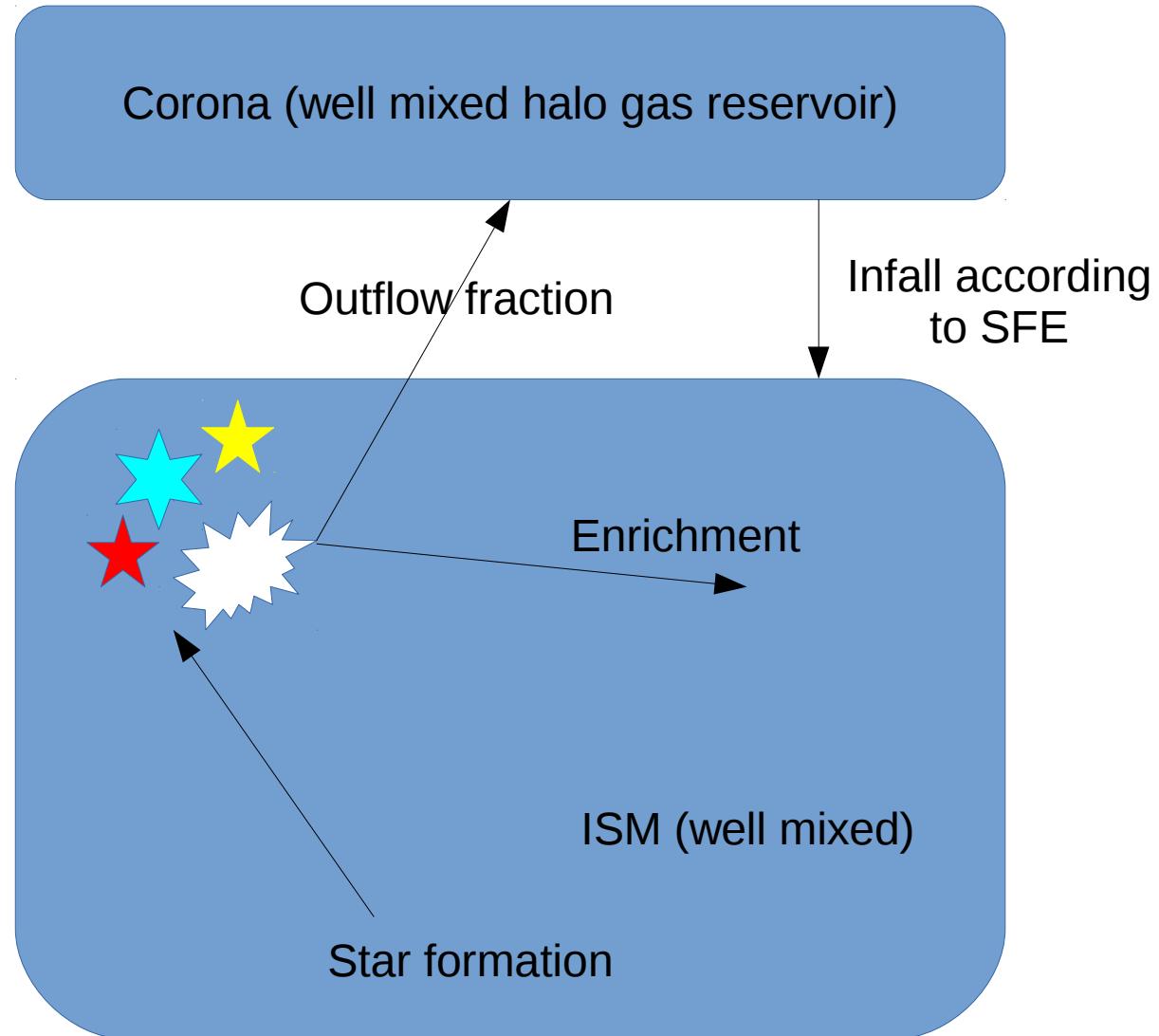
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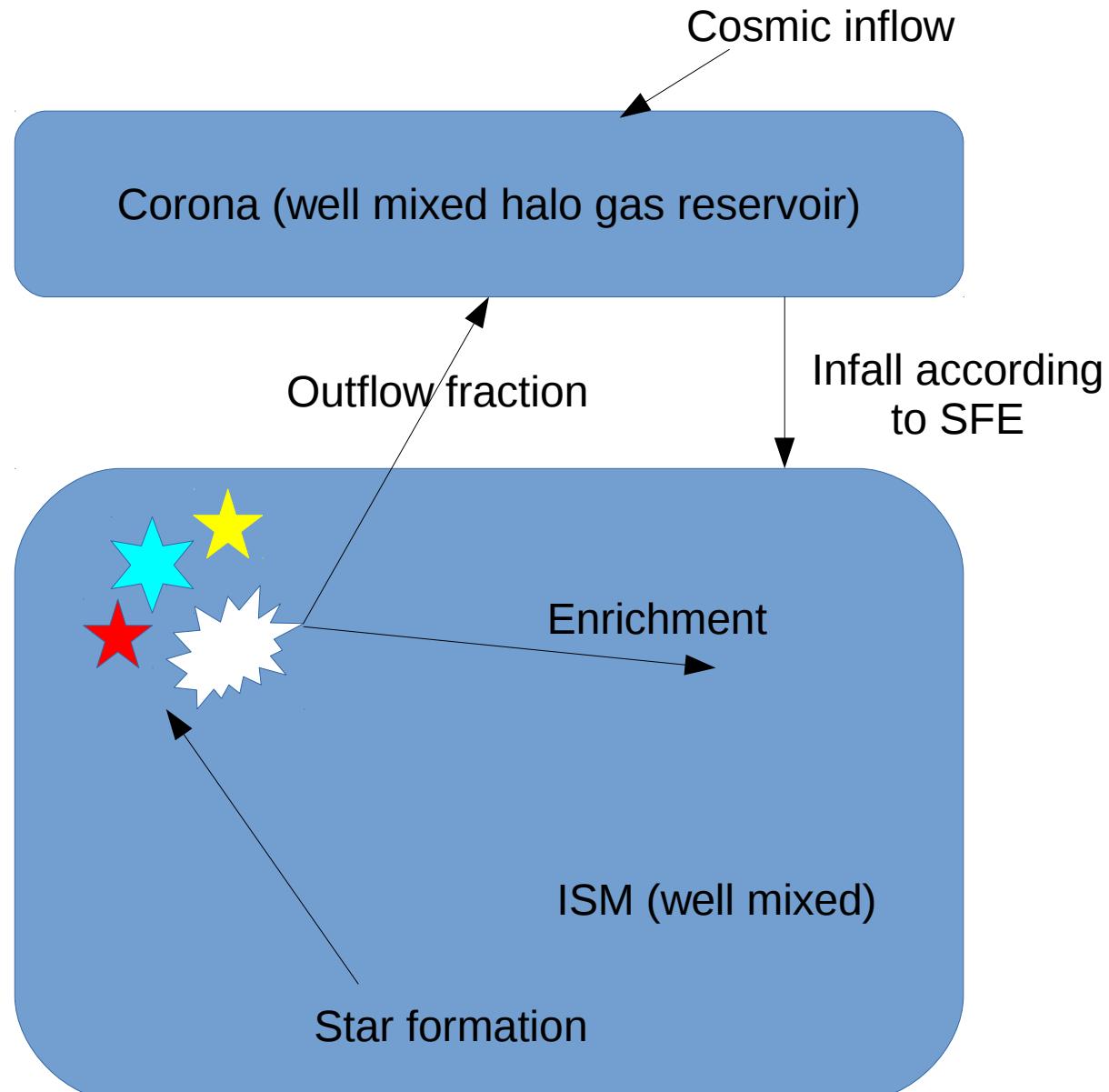
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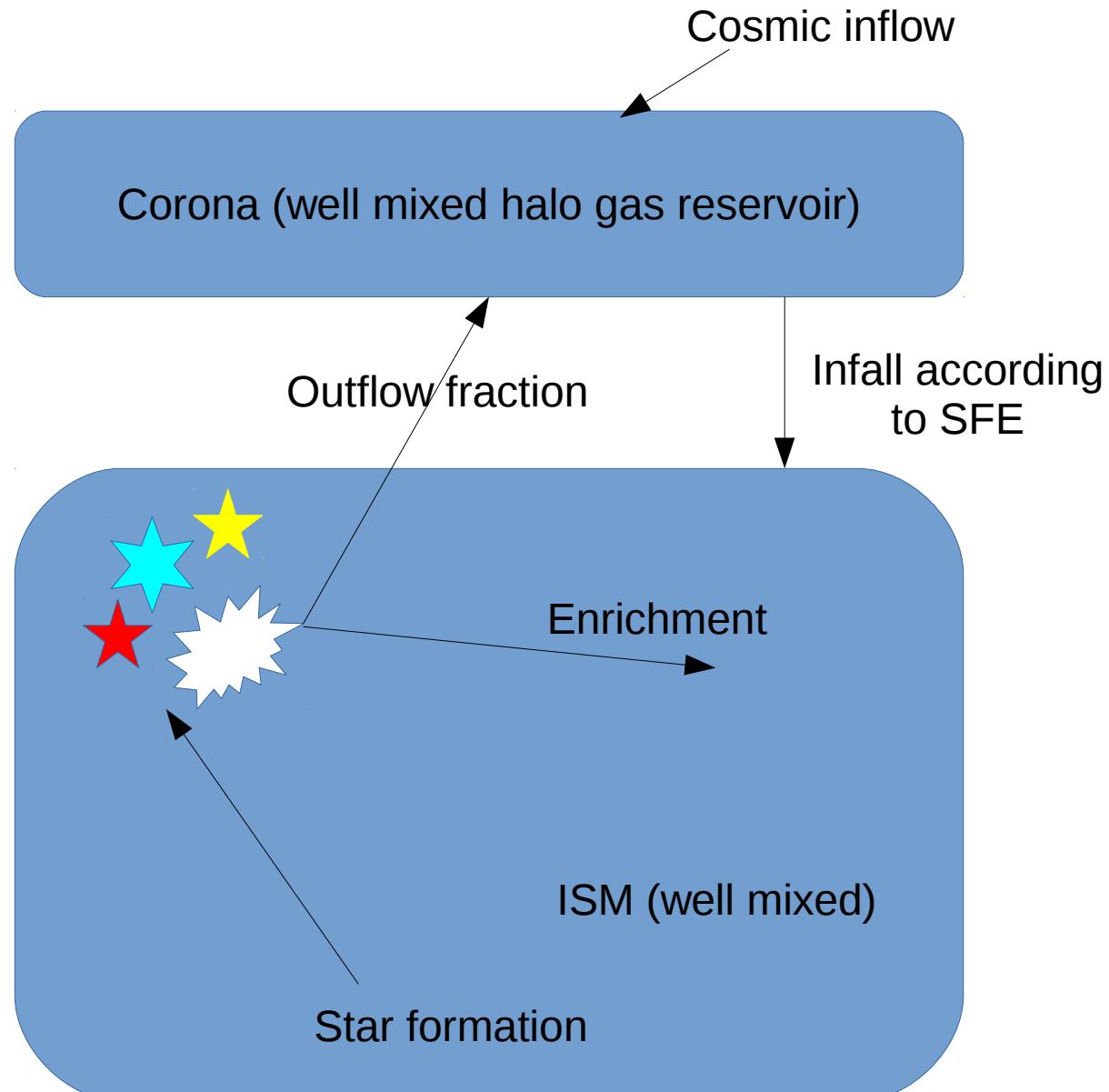
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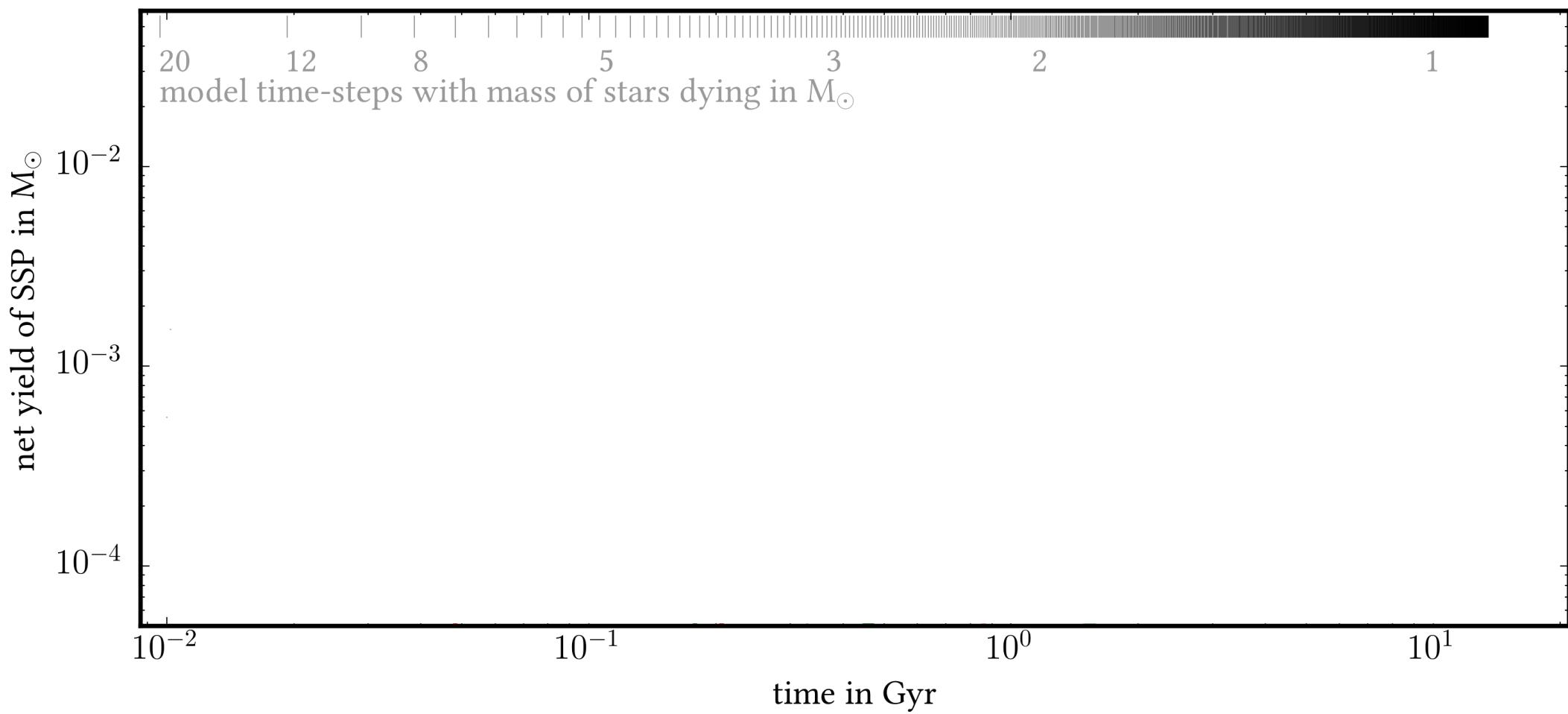


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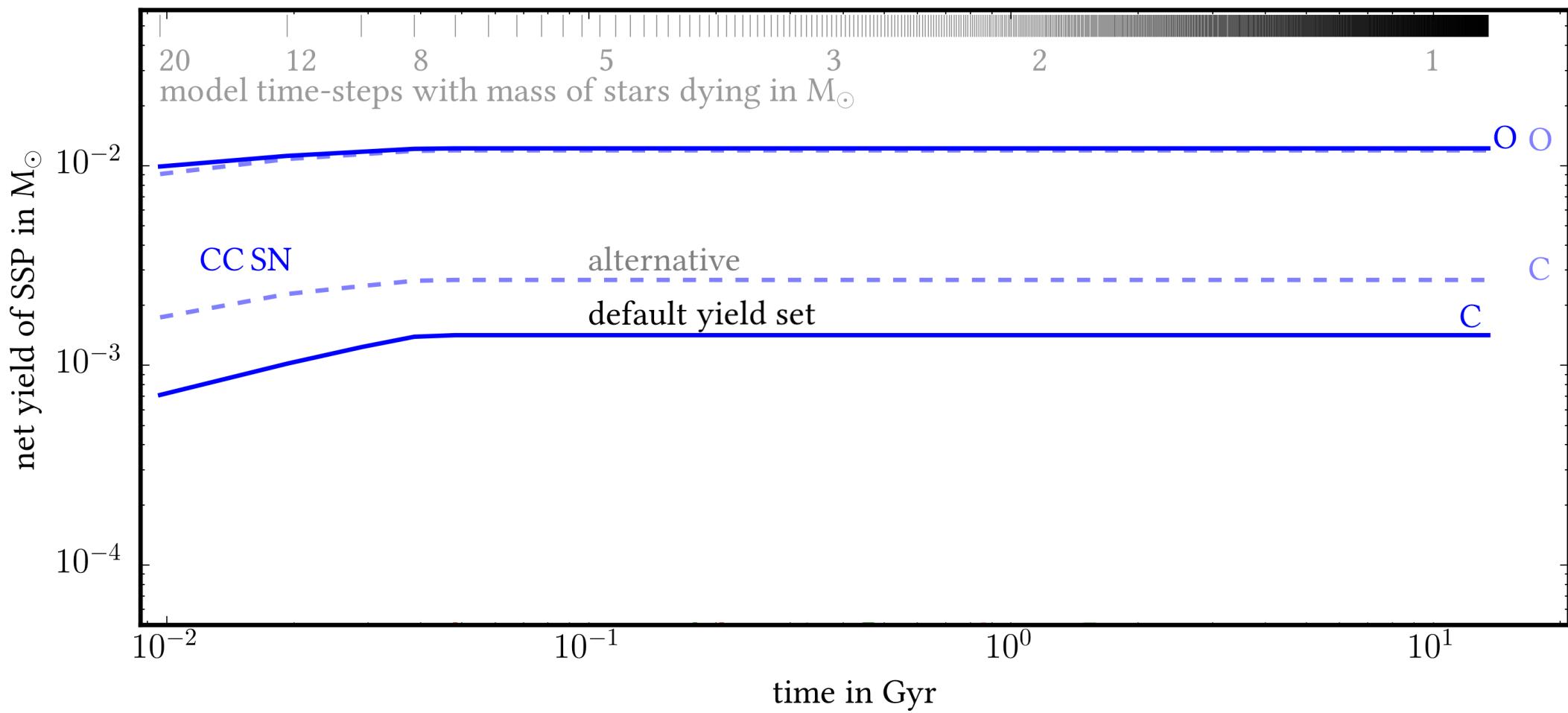
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 - Gas flows
- one-zone open-box model



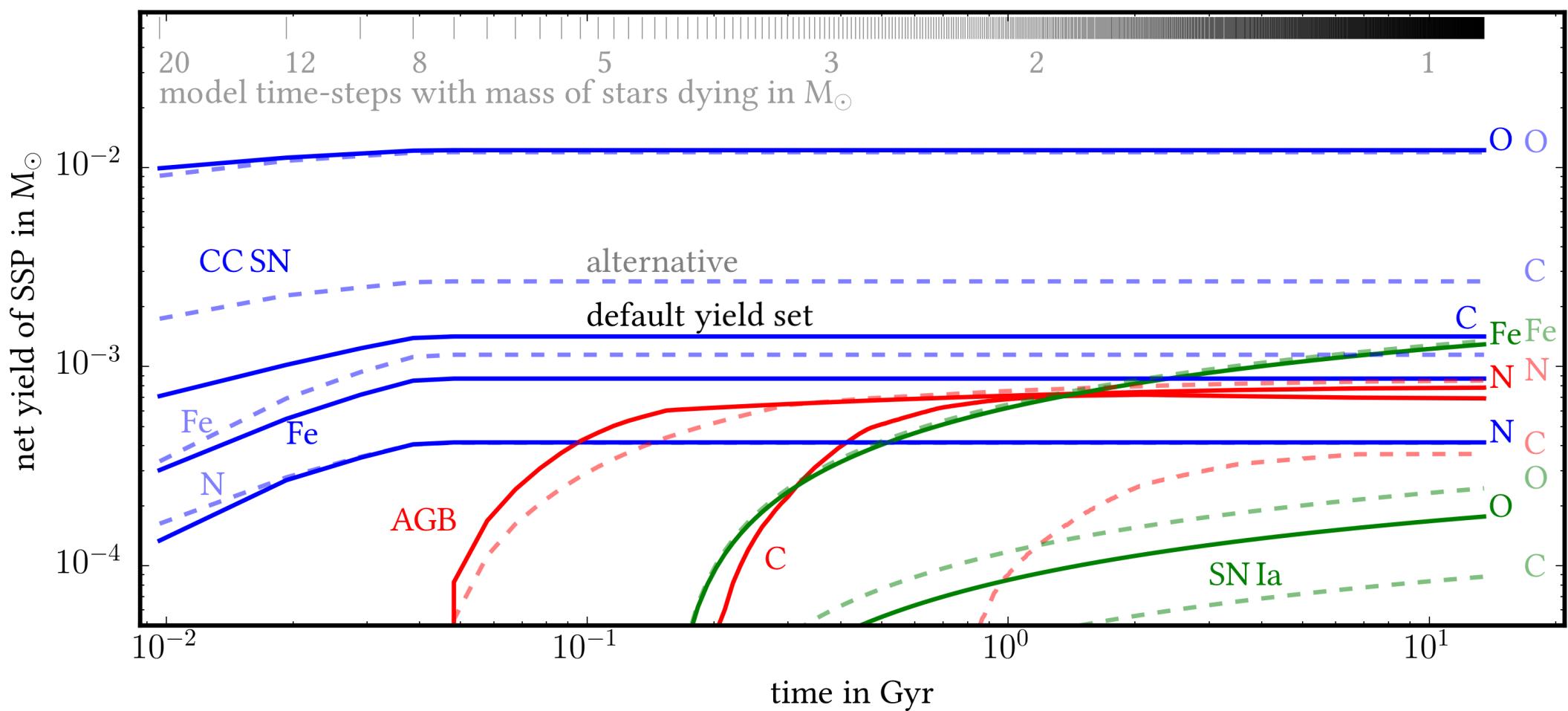
2. Enrichment from single starburst



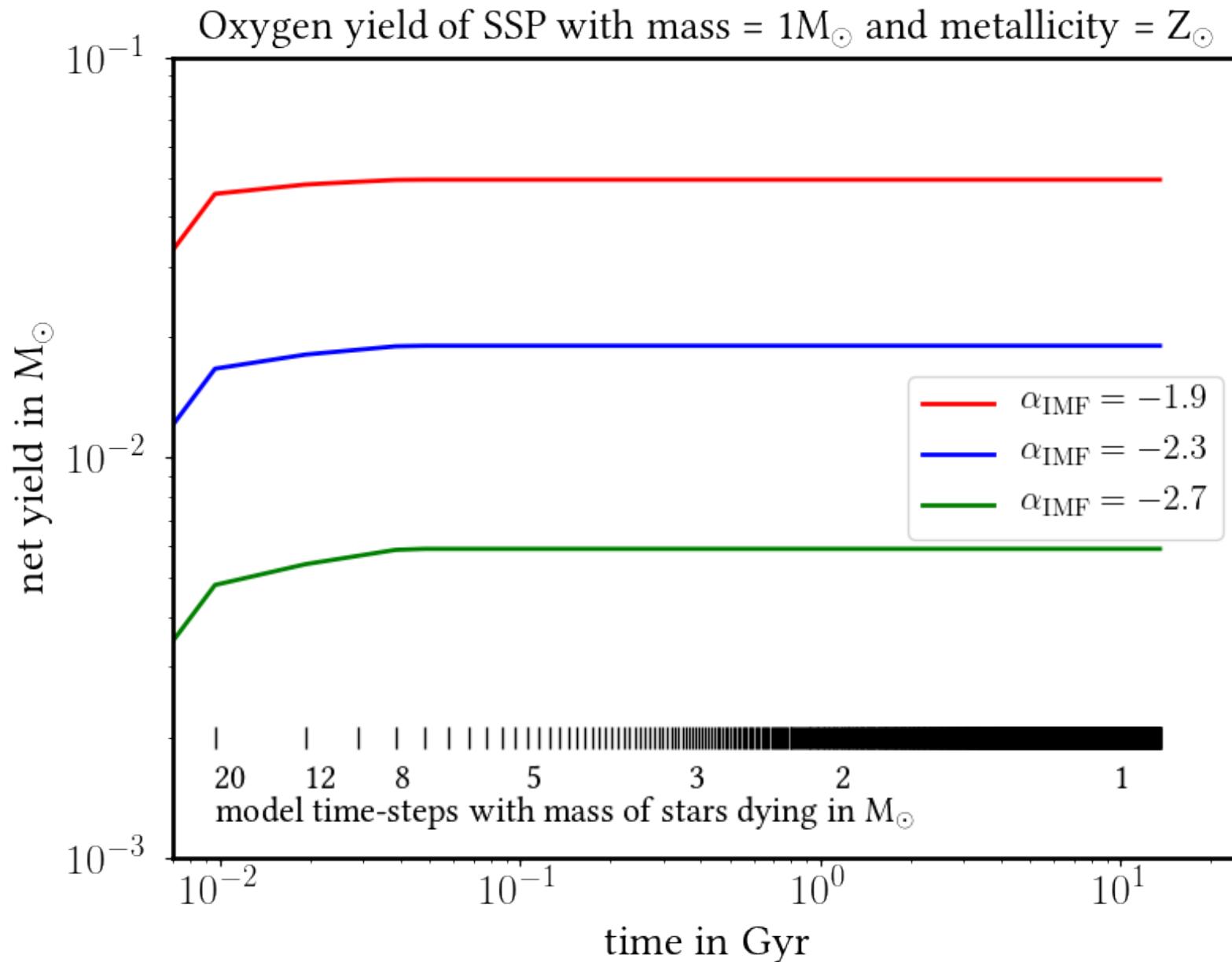
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3. Parameter inference

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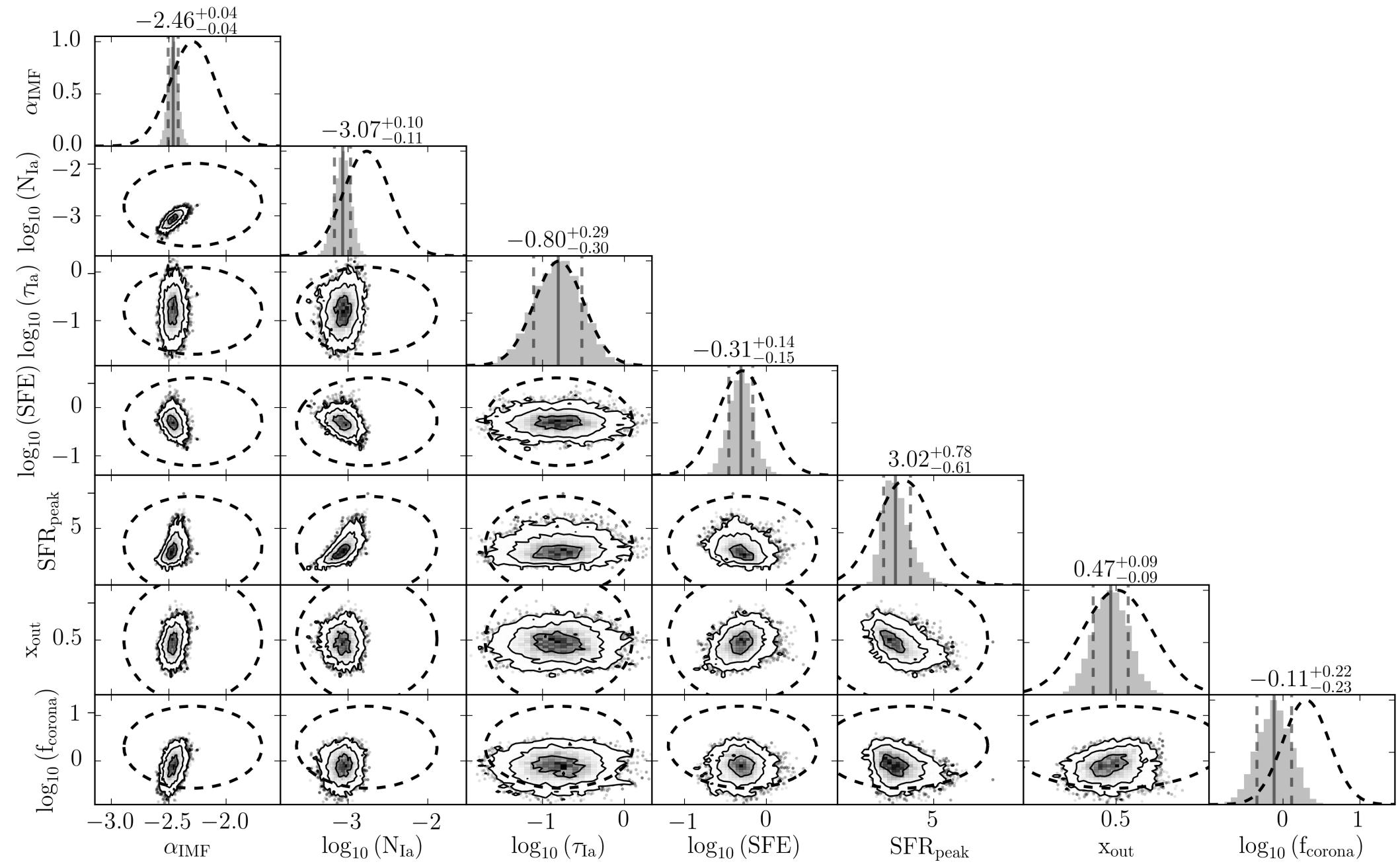
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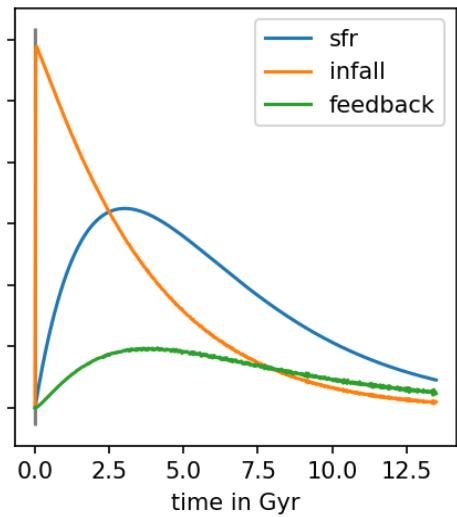
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- Bayesian inference
 - MCMC sampling of the posterior

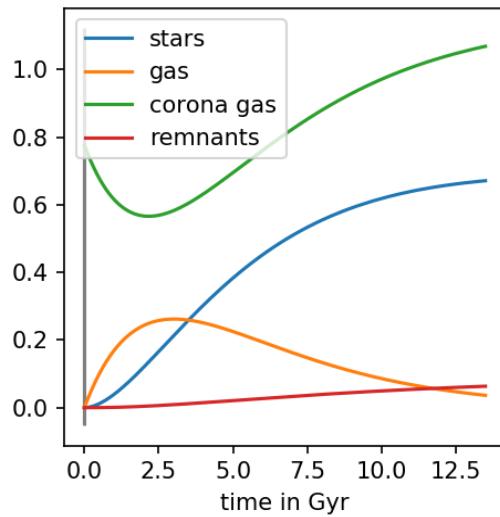
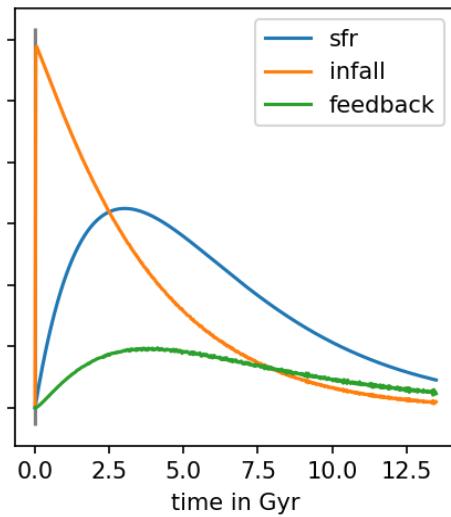
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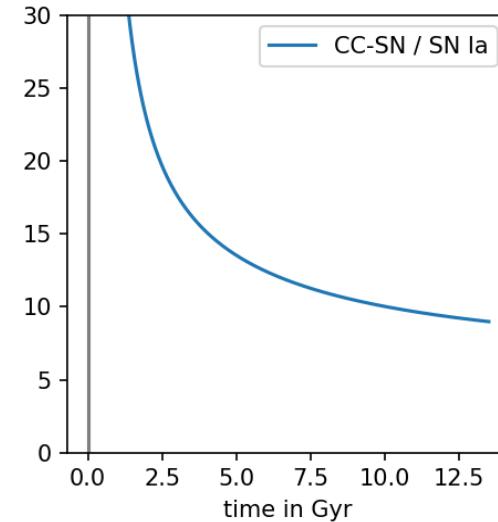
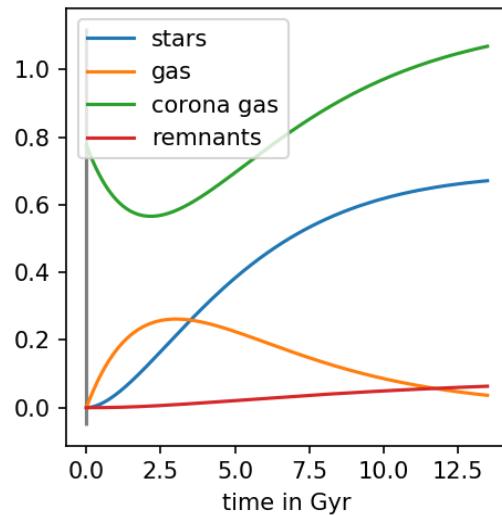
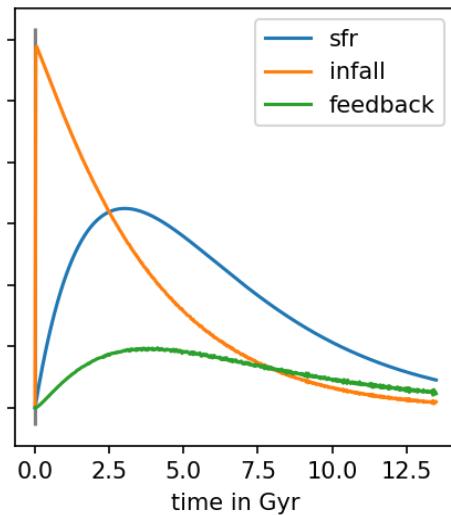
4. What does the model look like?



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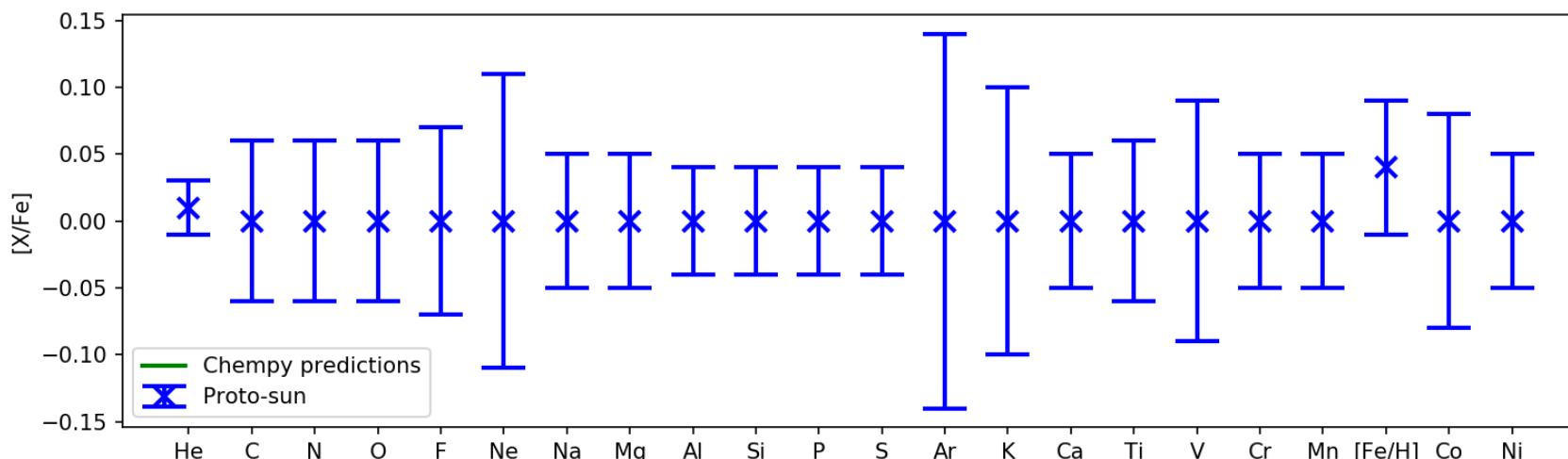
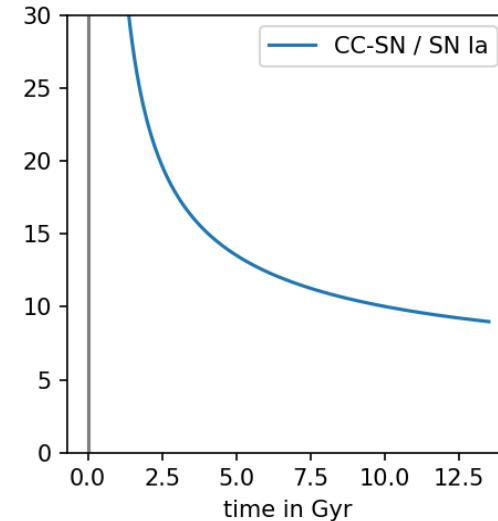
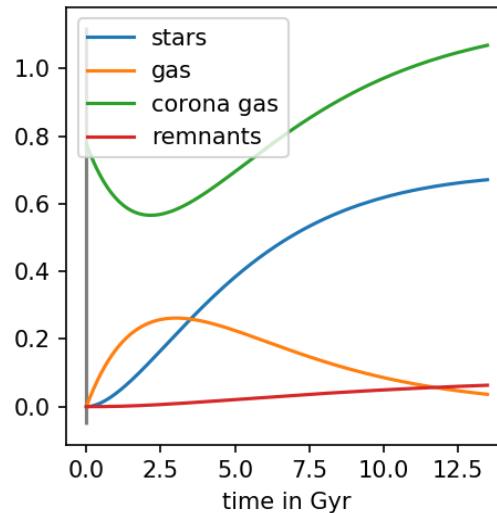
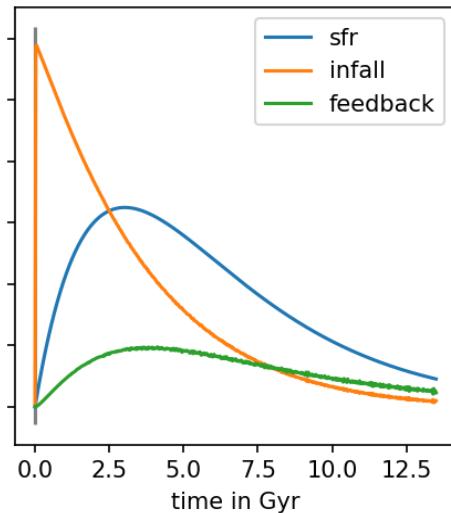


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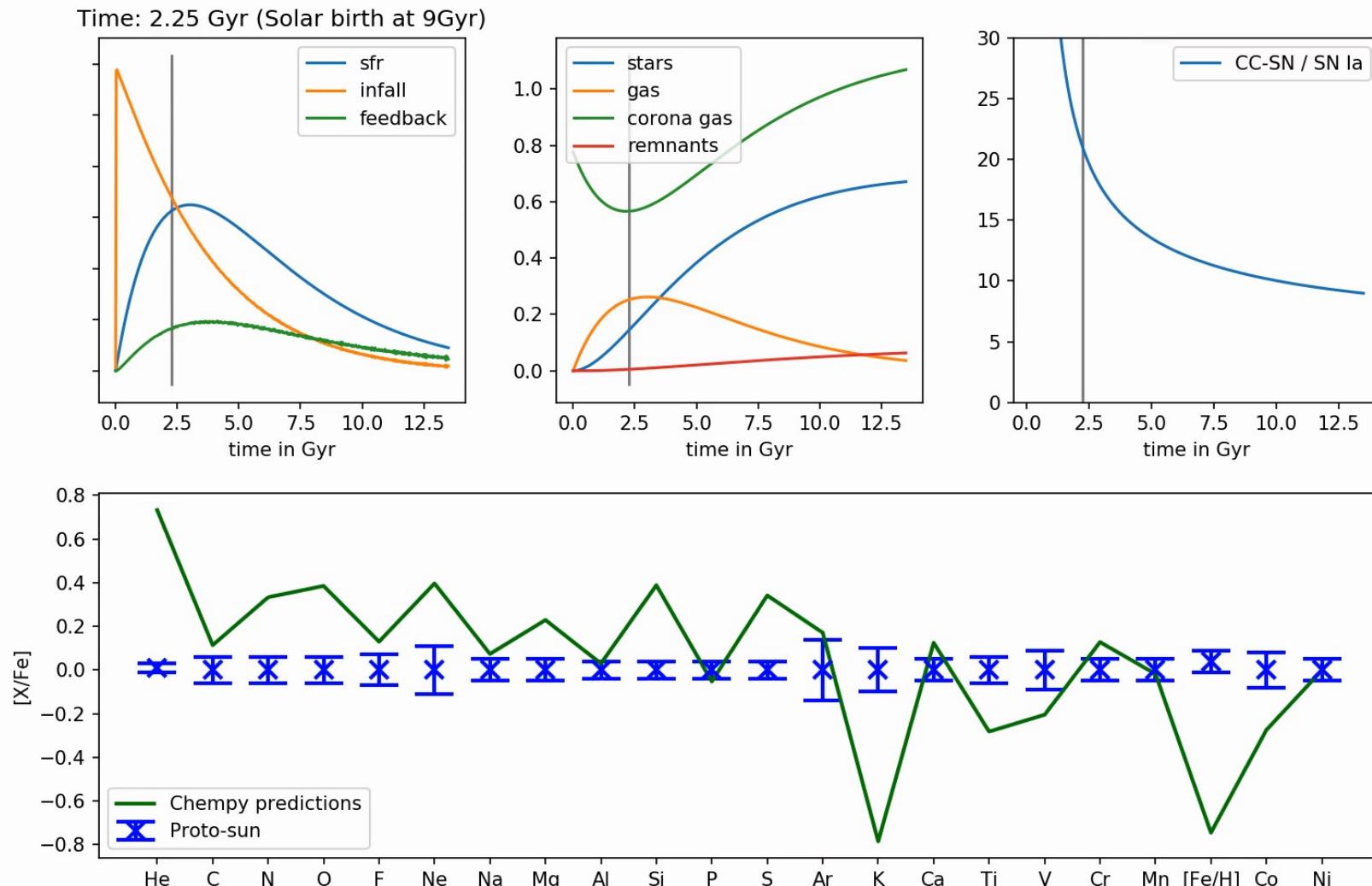


4. What does the model look like?

Time: 0.00 Gyr (Solar birth at 9Gyr)

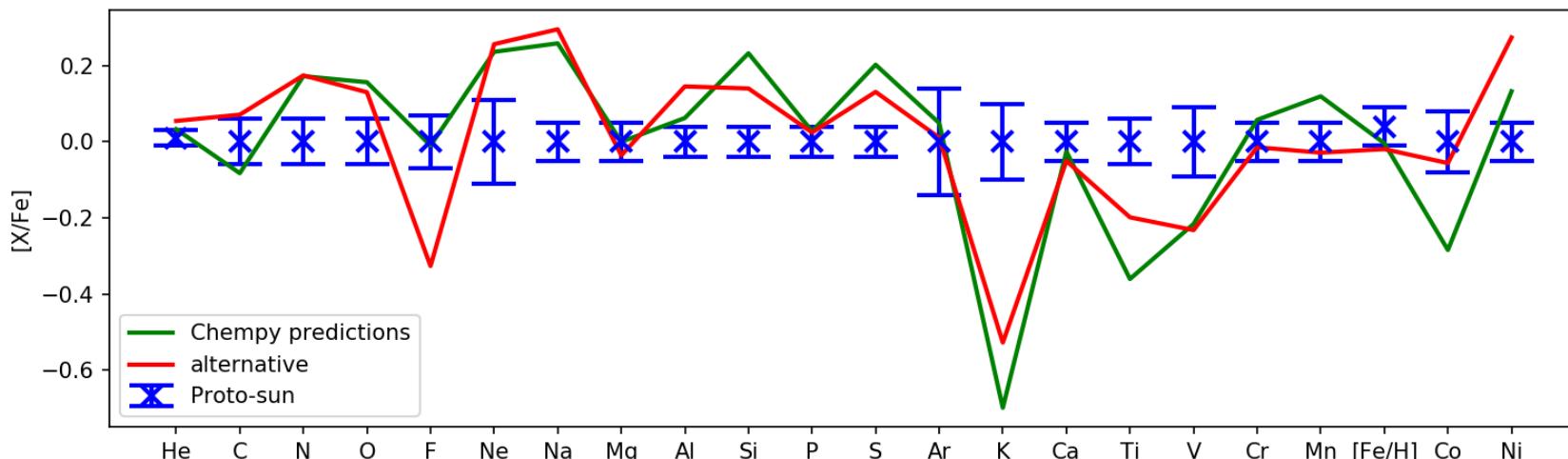
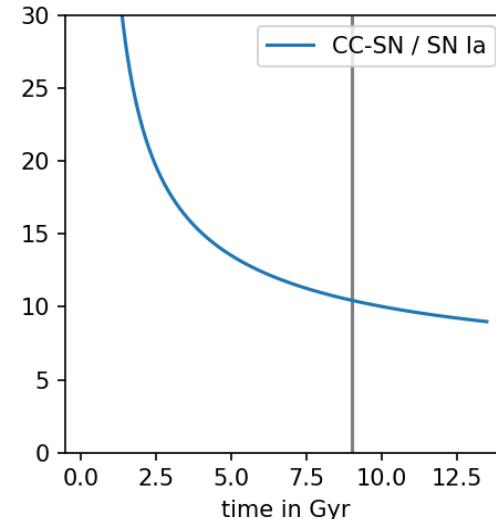
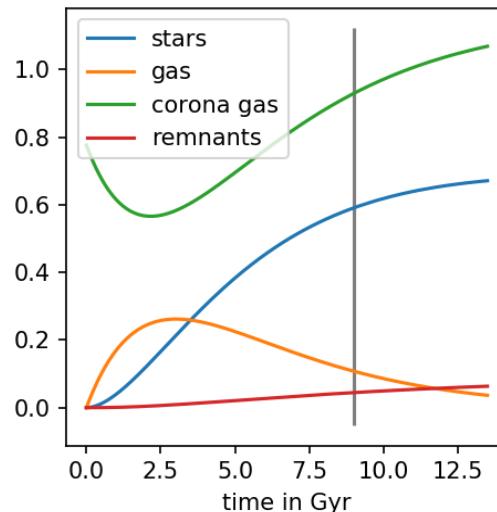
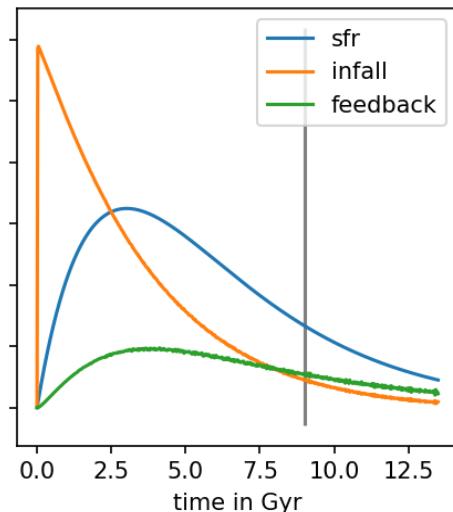


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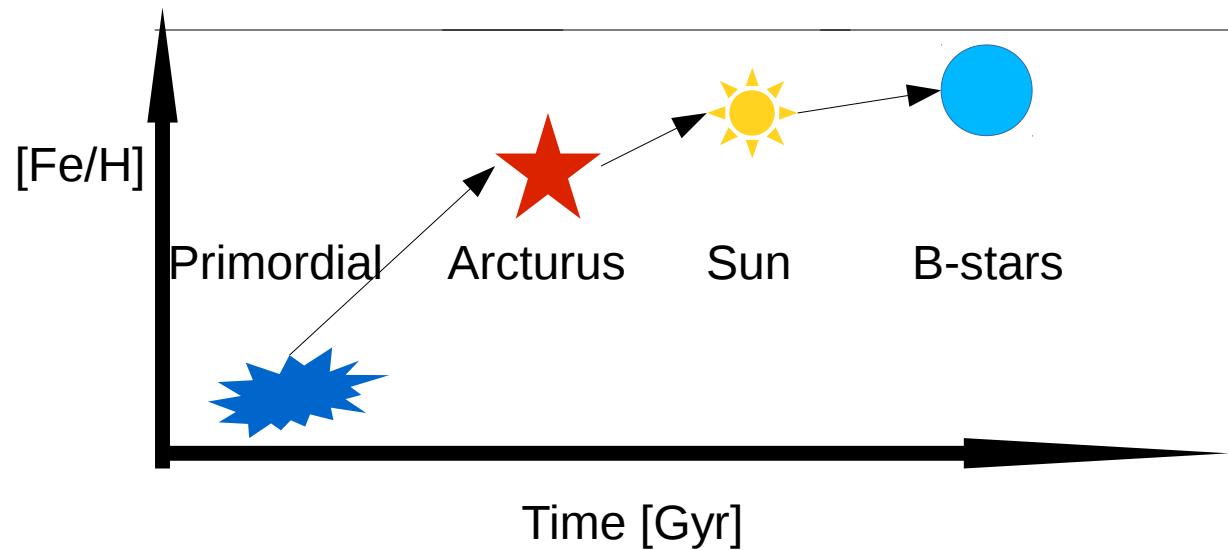
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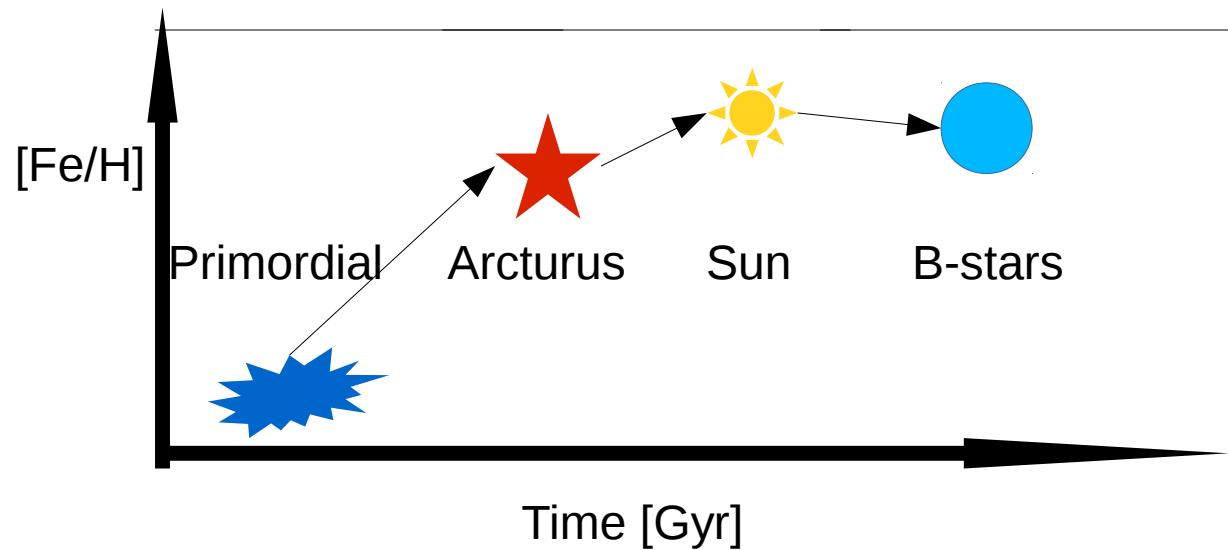
5. More data / multi-zone extension



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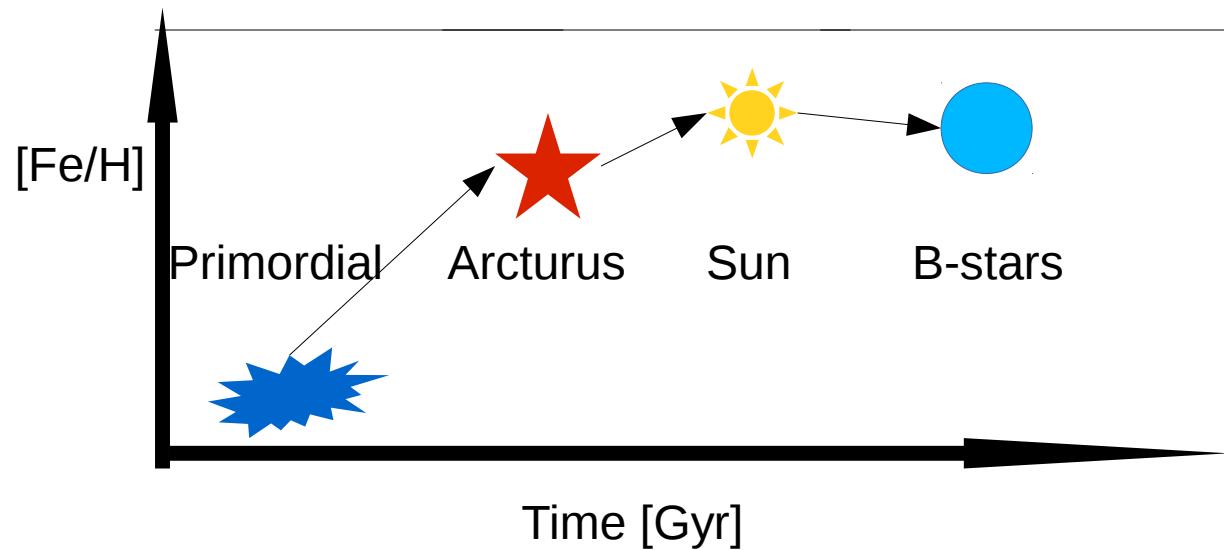


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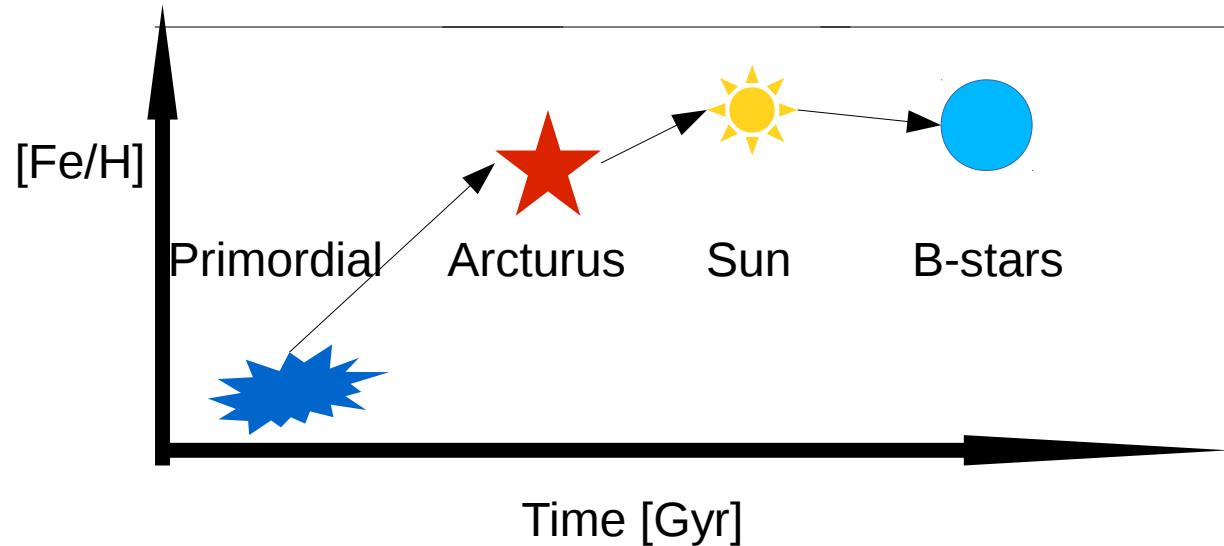
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Unrealistic: Single-zone

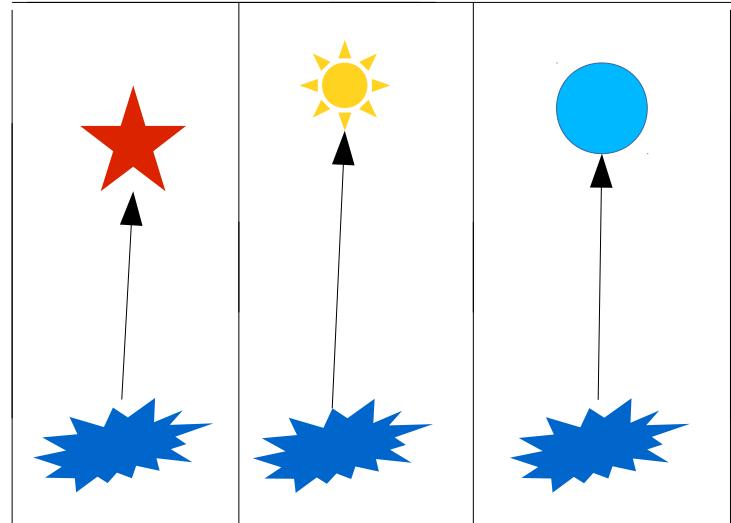


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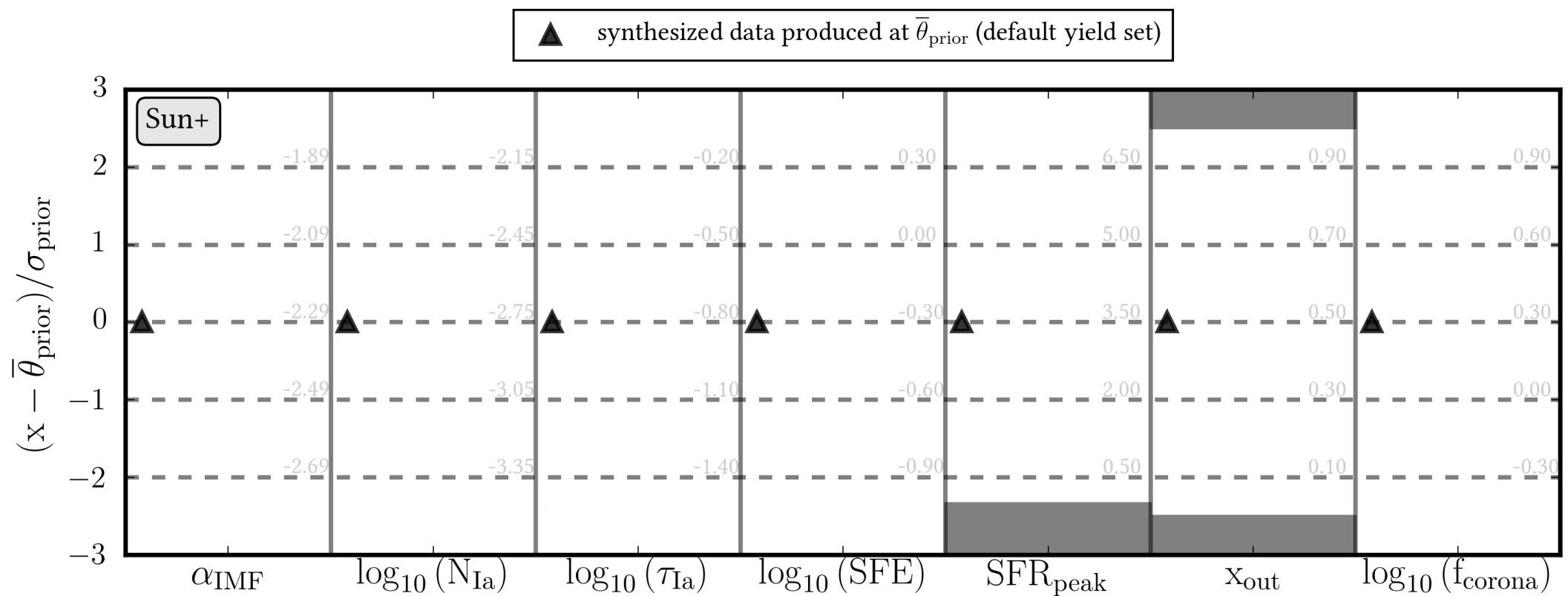
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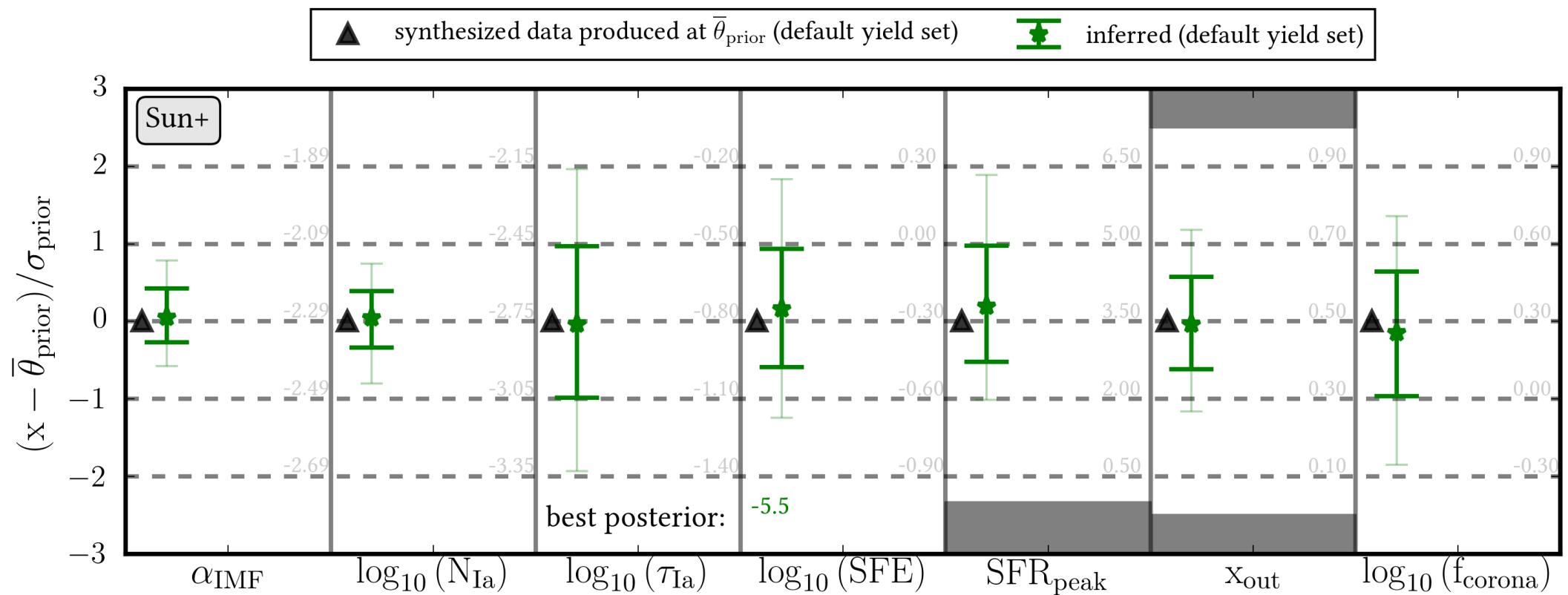
Slightly less unrealistic: Multi-zone
(Each zone having its own ISM history)



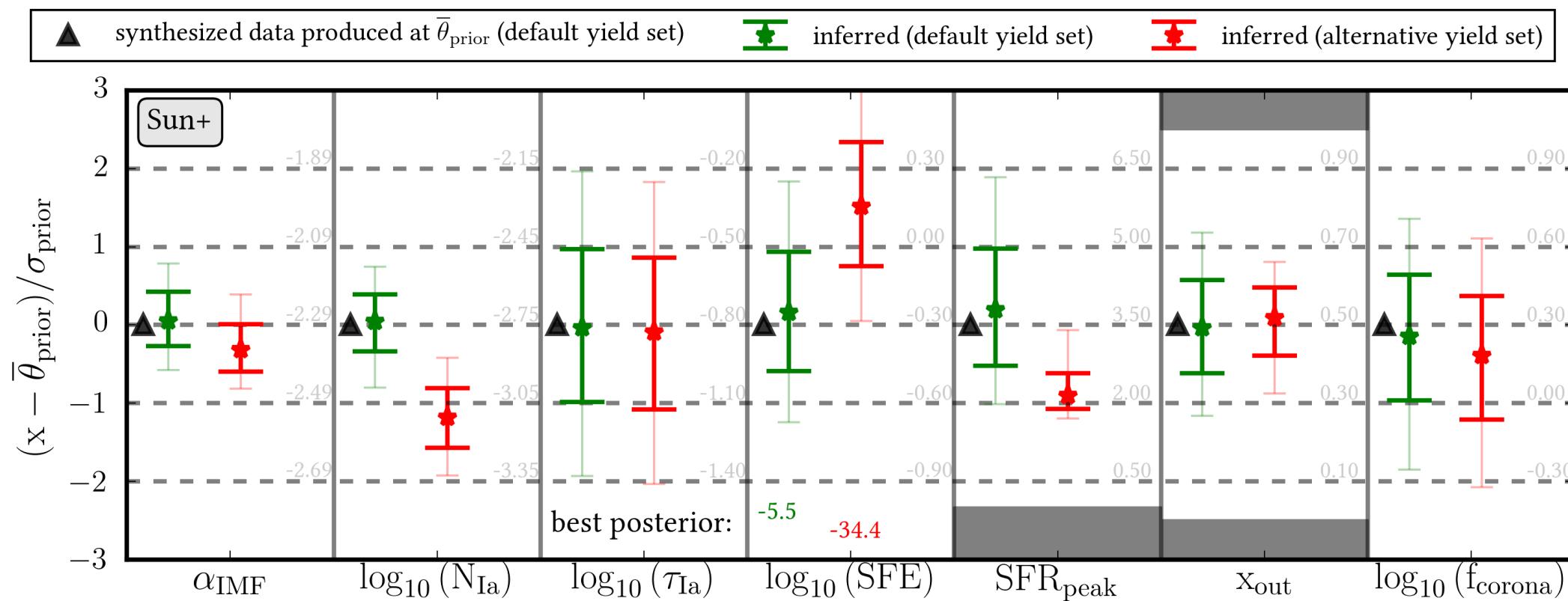
5.1 Mock data test



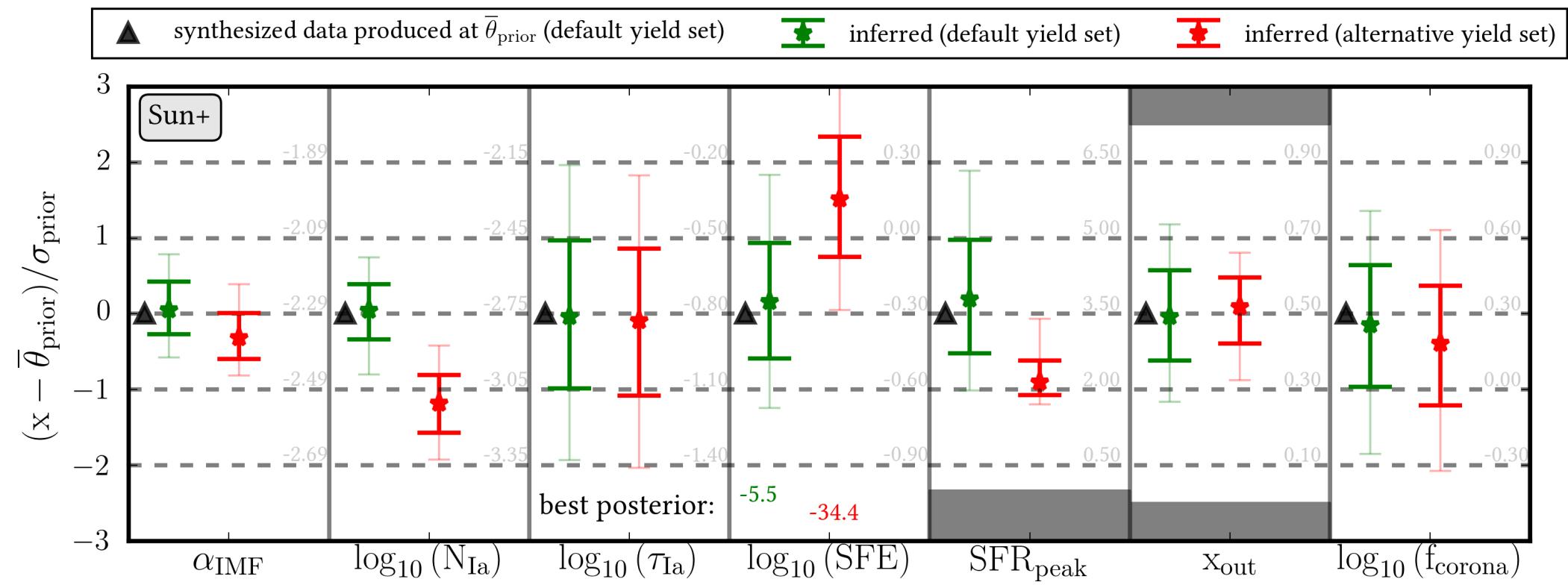
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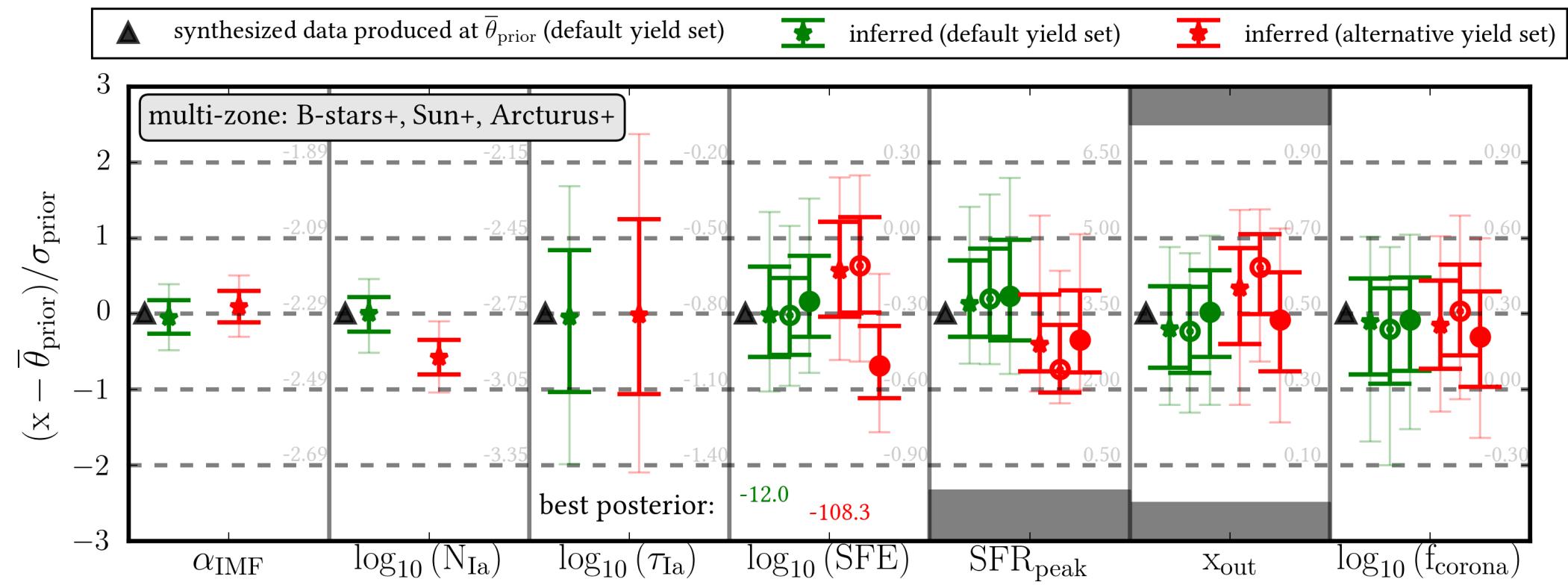
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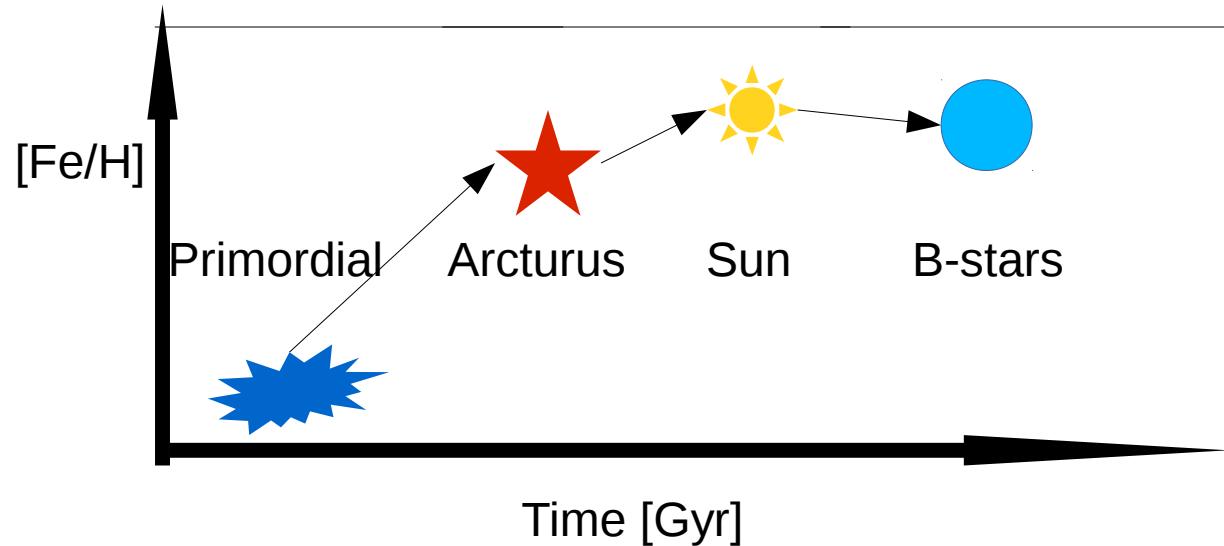


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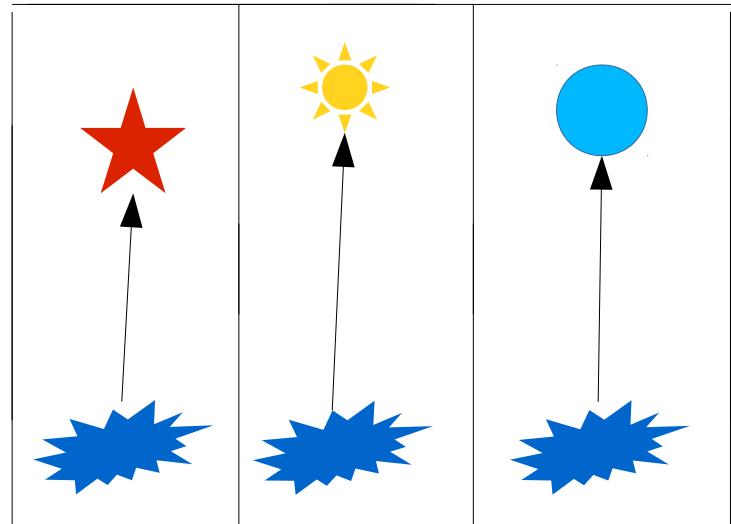


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5. More data / multi-zone extension

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- Common uncertainty range for both yield sets
 - IMF high-mass index $\alpha = -2.42 \pm 0.05$
 - Fraction of mass going CC-SN: 10.0 – 13.7 %
 - 0.5 – 1.4 SN Ia per 1000 Msun
 - The individual ISM parameters seem to fit to Galactic component star is coming from

Summary

- Chempy:
flexible elemental abundance fitting tool

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flexible elemental abundance fitting tool
- Few stellar abundances pose strong constraints
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- With more stellar abundances...
 - Introduce metallicity dependent parameters
 - Infer detailed SFH per Galactic component

- Try Chempy and the chemical evolution tutorial:
github.com/jan-rybizki/Chempy

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Thank you for your attention

(if time permits) 6. Net vs. total yield

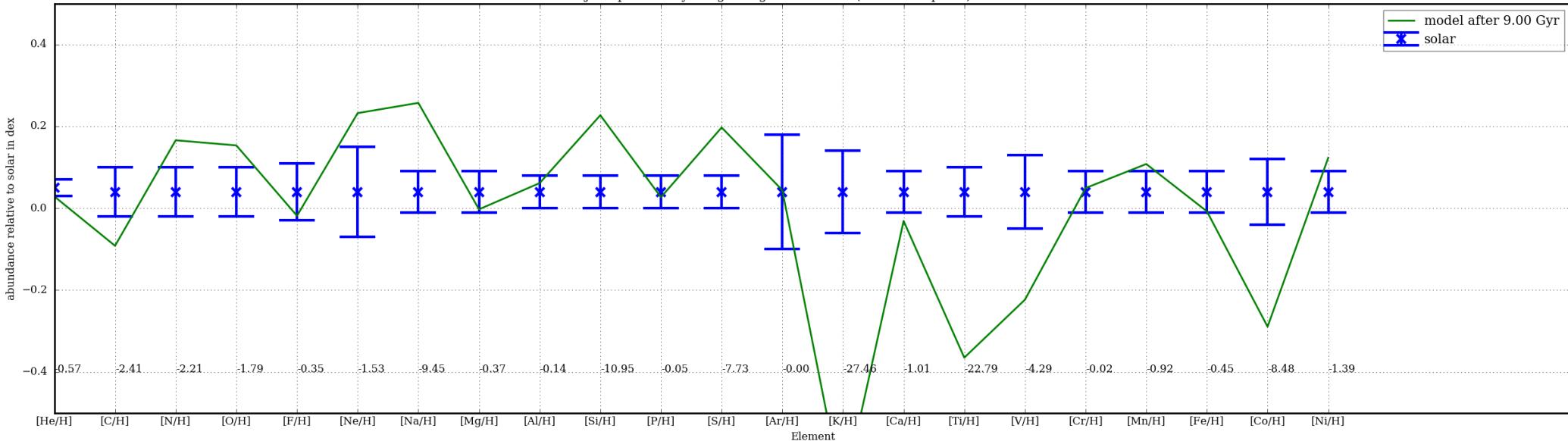
- Yield tables are given as:
 - newly produced material expelled to the ISM
 - total material expelled into the ISM

The latter includes 'unprocessed material' which is set by the author of the yield table and will usually not be consistent with your chemical evolution

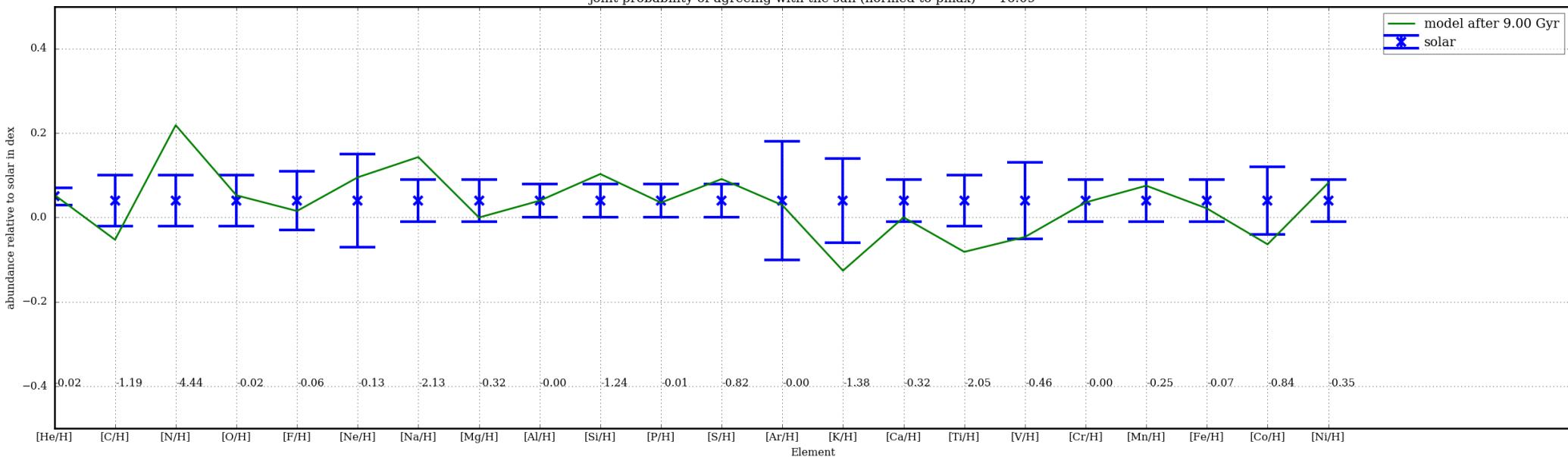
- Widely used: solar-scaled material
 - e.g. Chieffi & Limongi 2004

(if time permits) 6. Net vs. total yield

joint probability of agreeing with the sun (normed to pmax) = -104.35

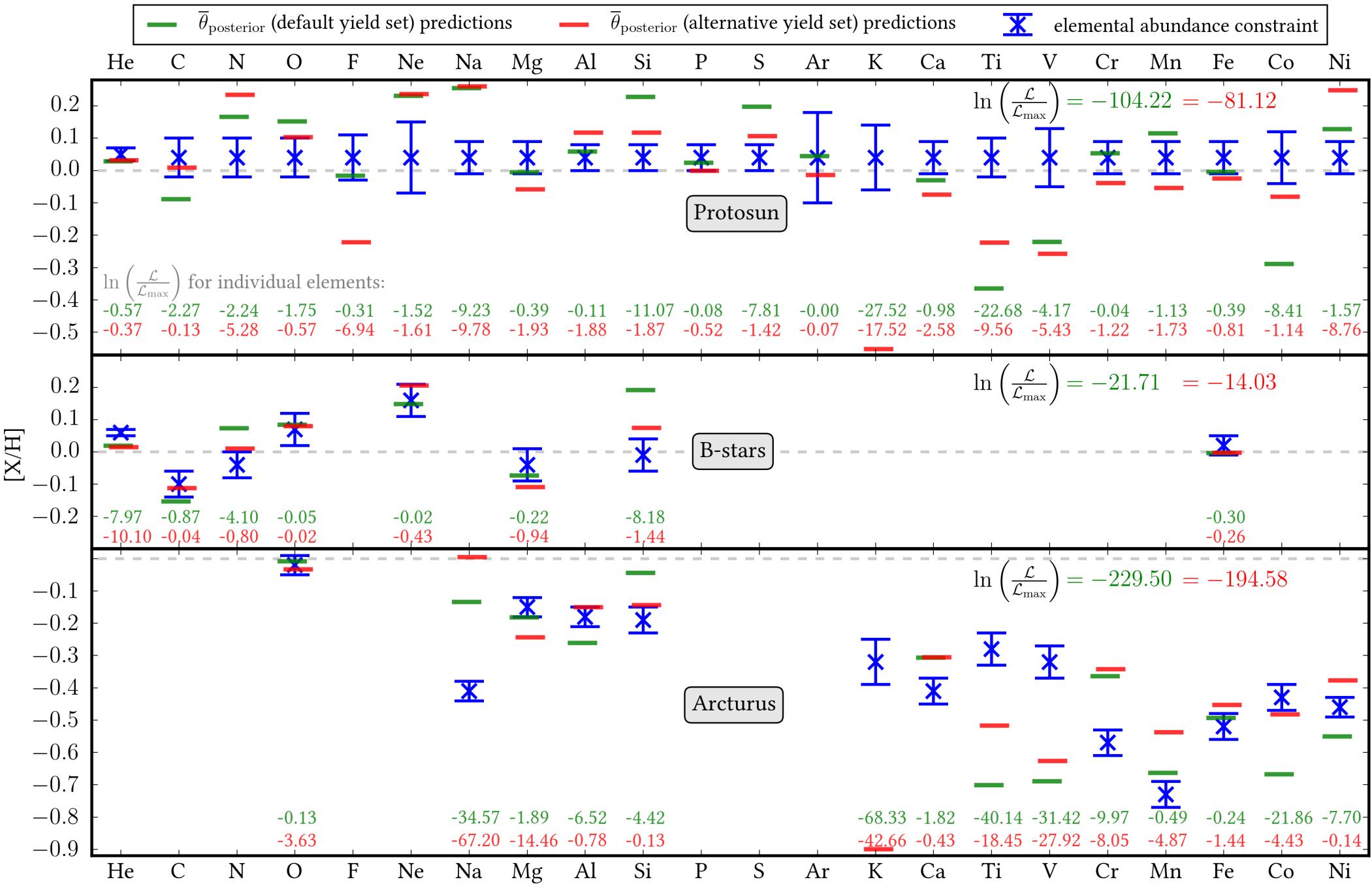


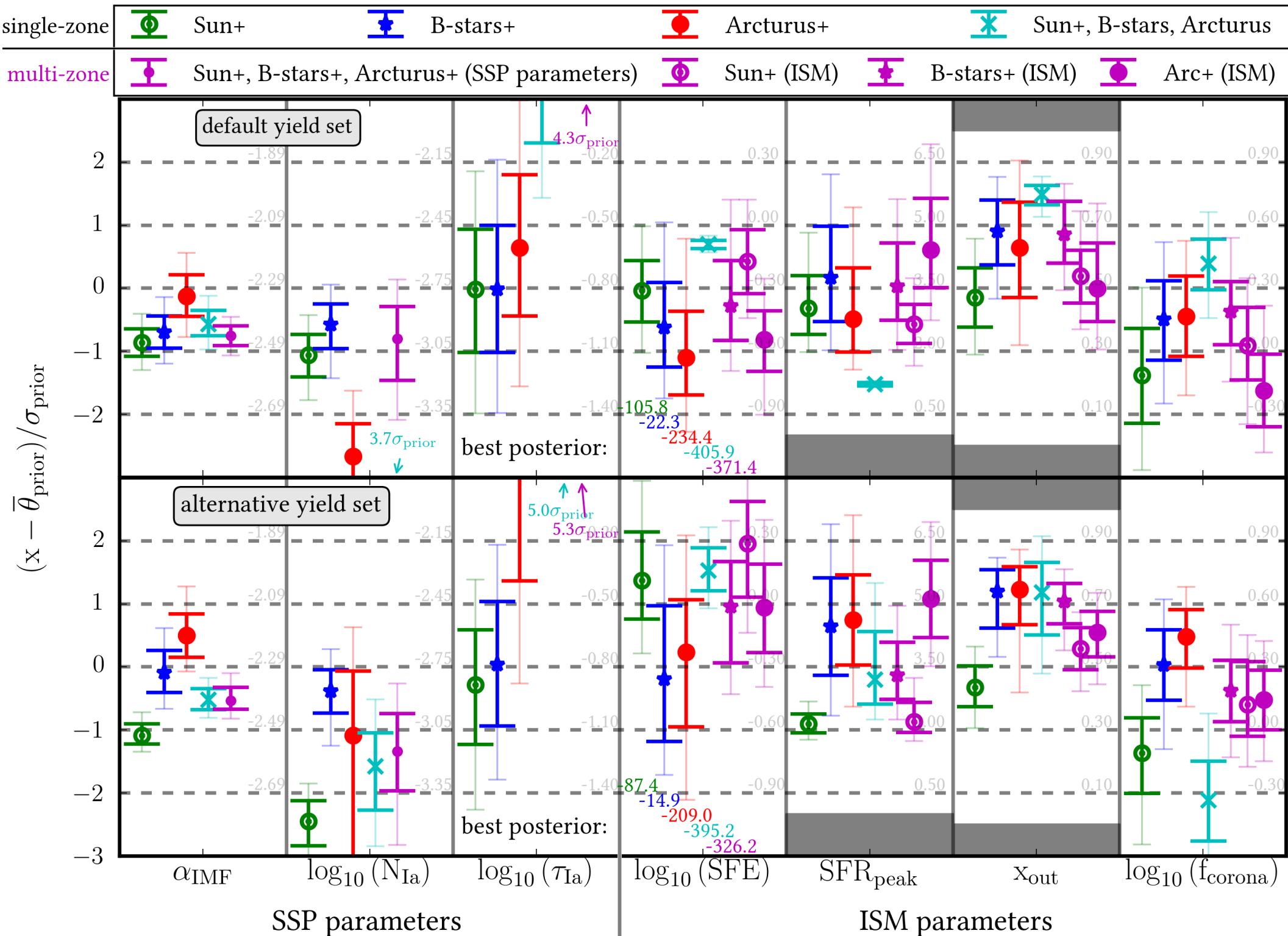
joint probability of agreeing with the sun (normed to pmax) = -16.09



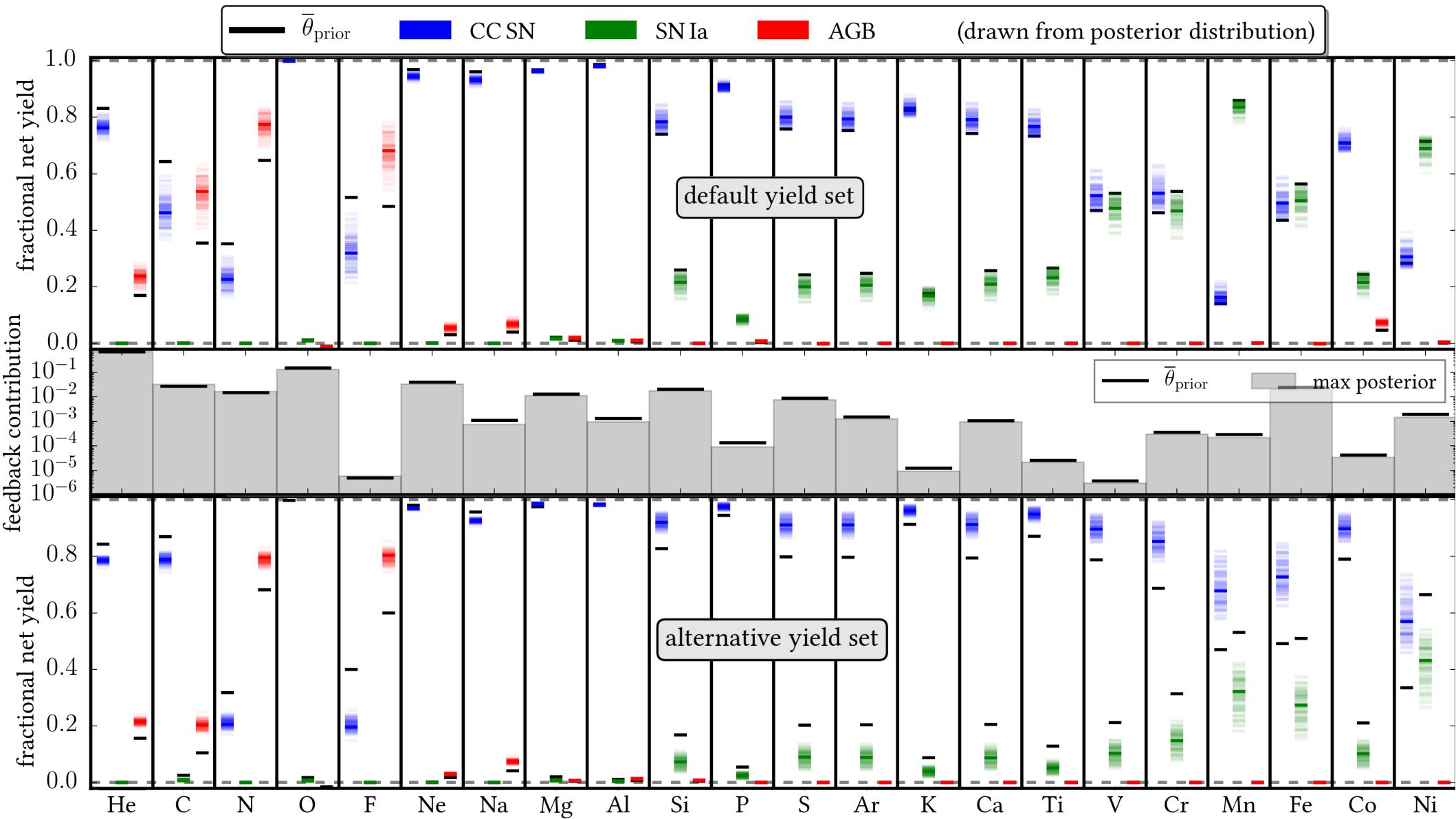
Backup Slides

Chempy predictions

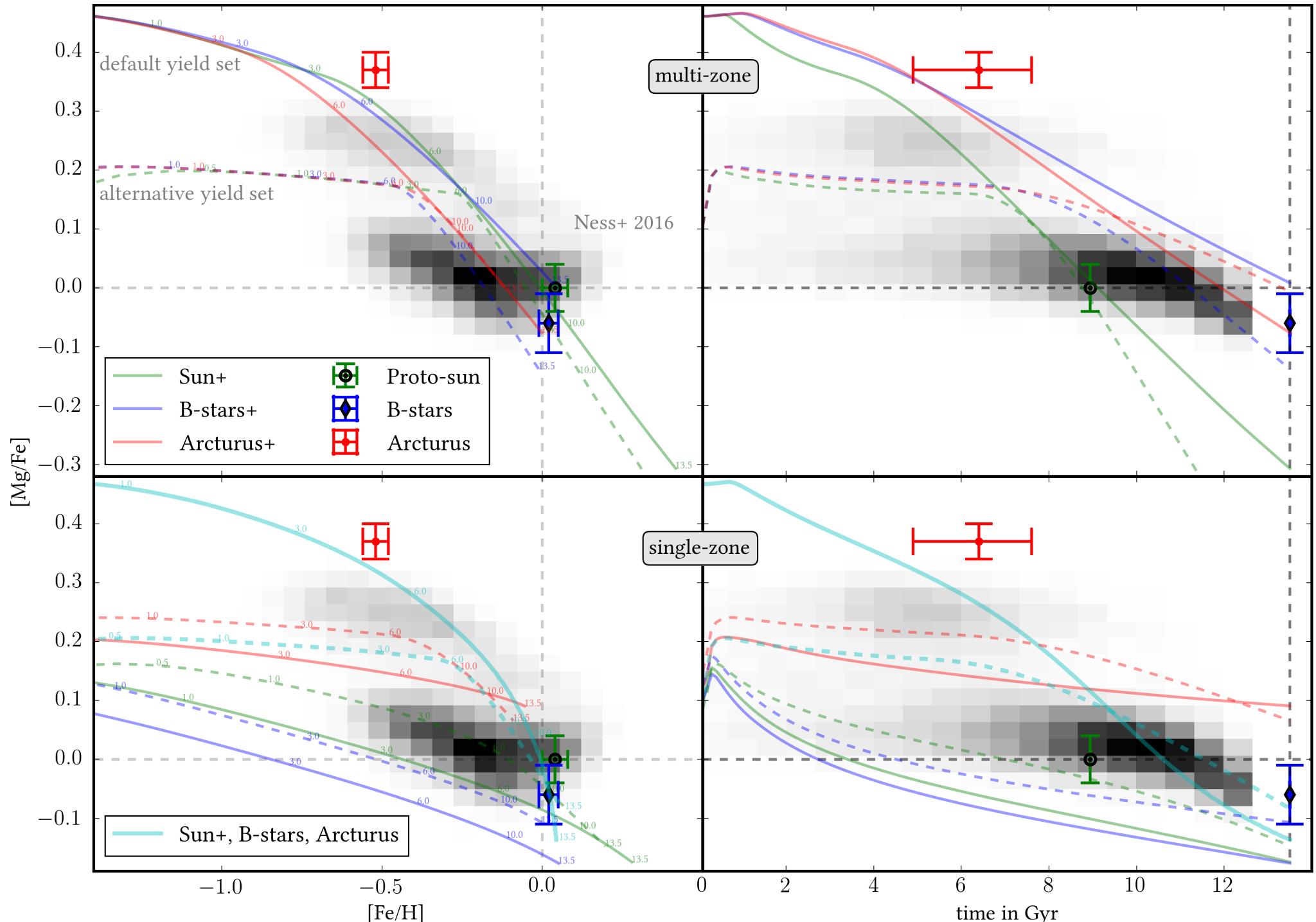




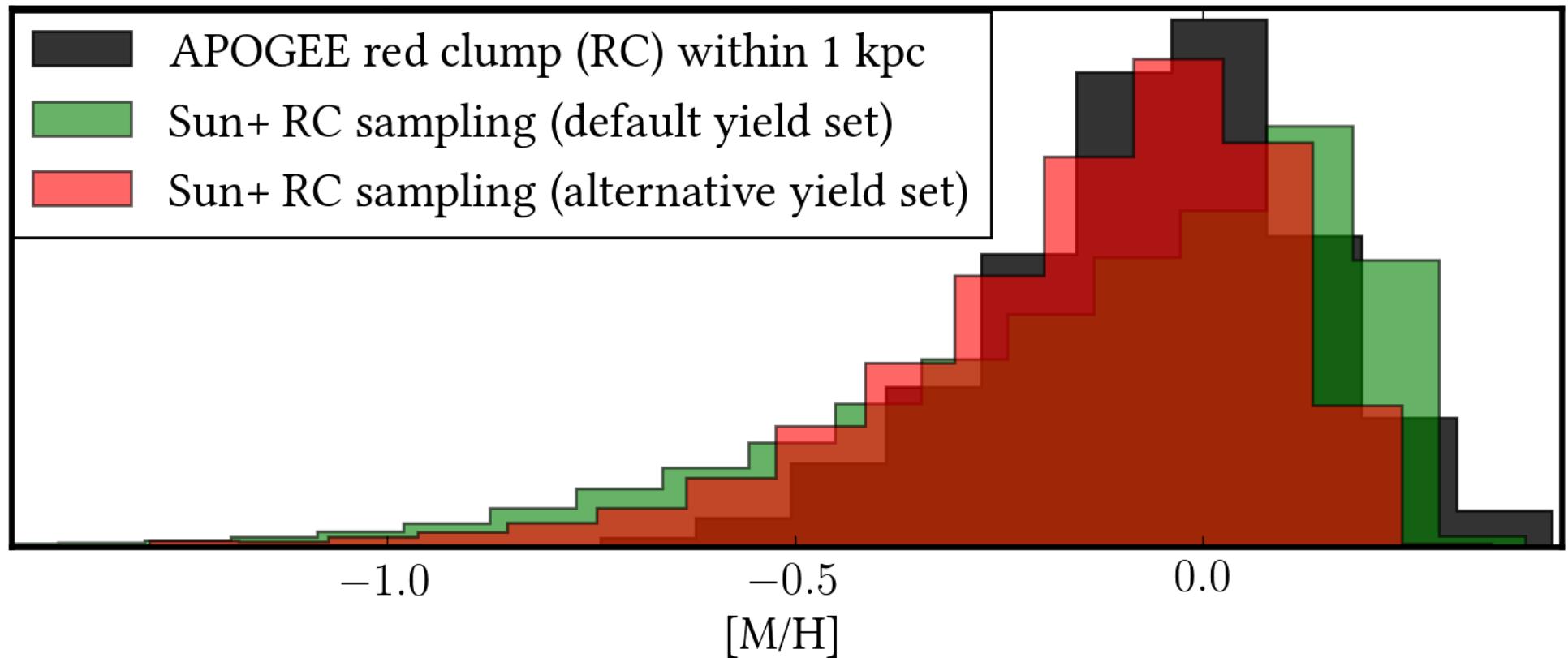
4. Inferred parameters



APOGEE Abundances



Metallicity distribution function



3. Bayesian parameter inference

- 1) Choose parameters $\theta \rightarrow$ Prior
 - 2) Chempy(θ , yield set) \rightarrow Predictions
 - 3) Comparing to observations \rightarrow Likelihood
 - 4) MCMC(Posterior) \rightarrow Parameterspace sampling
 - 5) Get parameter constraints (yield set, data)
- First: synthetic data test for two yield sets
Data set ,Sun+':
Solar abundances, SN-ratio, corona metallicity

imprints of the IMF on chemical evolution models

