A MONTE CARLO APPROACH TO FIND THE PROGENITORS OF ULTRA METAL-POOR STARS

Vinicius M. Placco

University of Notre Dame and JINA–CEE

UMP STARS AND CARBON

- Ultra Metal-Poor (UMP; [Fe/H] < −4.0) stars are believed to be "true second generation" objects [1].
- 80% of UMP stars are Carbon-Enhanced (CEMP-no - [C/Fe] ≥ 0.7 and [Ba/Fe] < 0.0) [2].
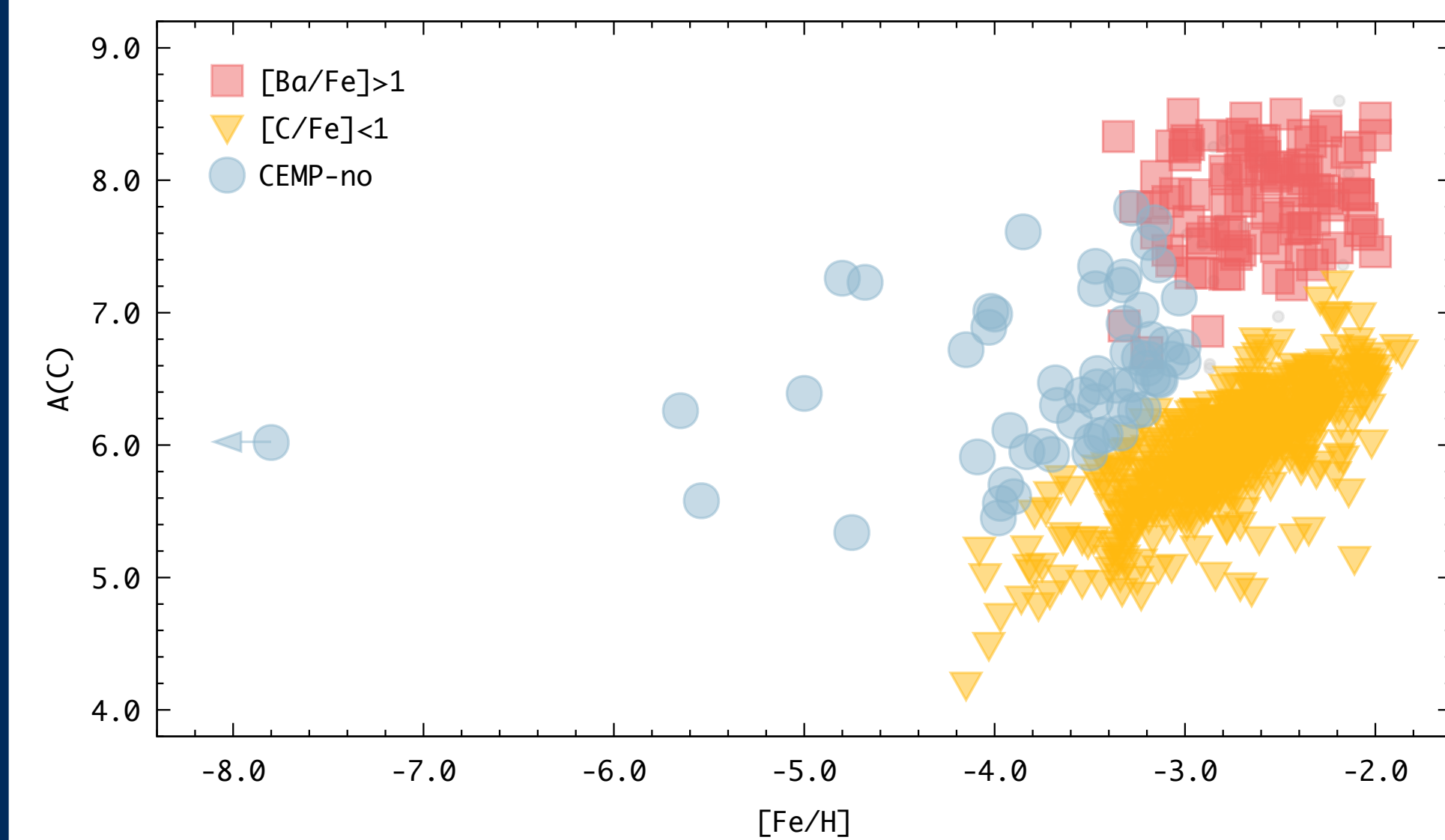- Chemistry of UMP stars → yields from the First Stars.

Figure 1: A(C) vs. [Fe/H] distribution for metal-poor stars.
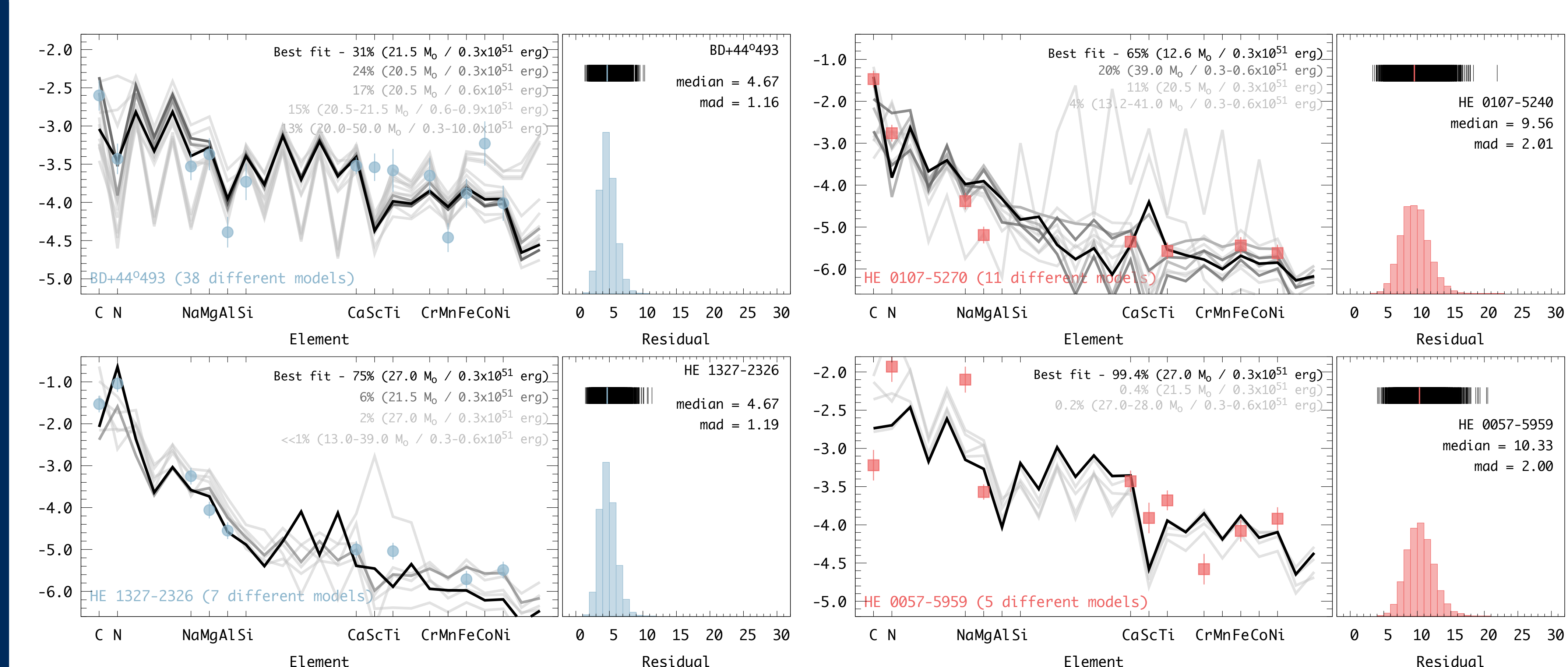
SN MODEL-MATCHING PROCEDURE

Figure 3: Results of the SN model-matching procedure for 4 UMP stars from the literature.

MONTE CARLO APPROACH

- Starfit database (Faint SNe models) [3]
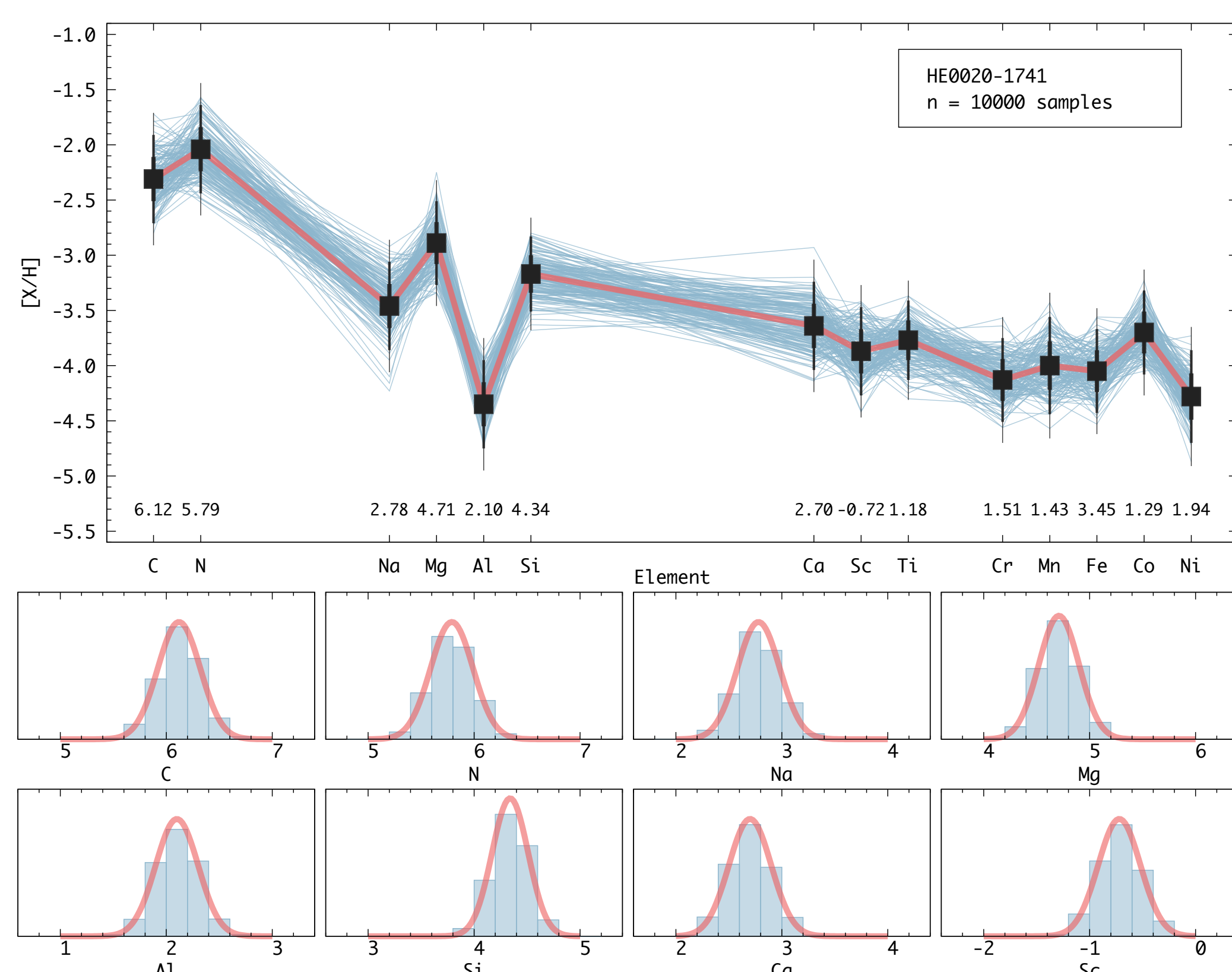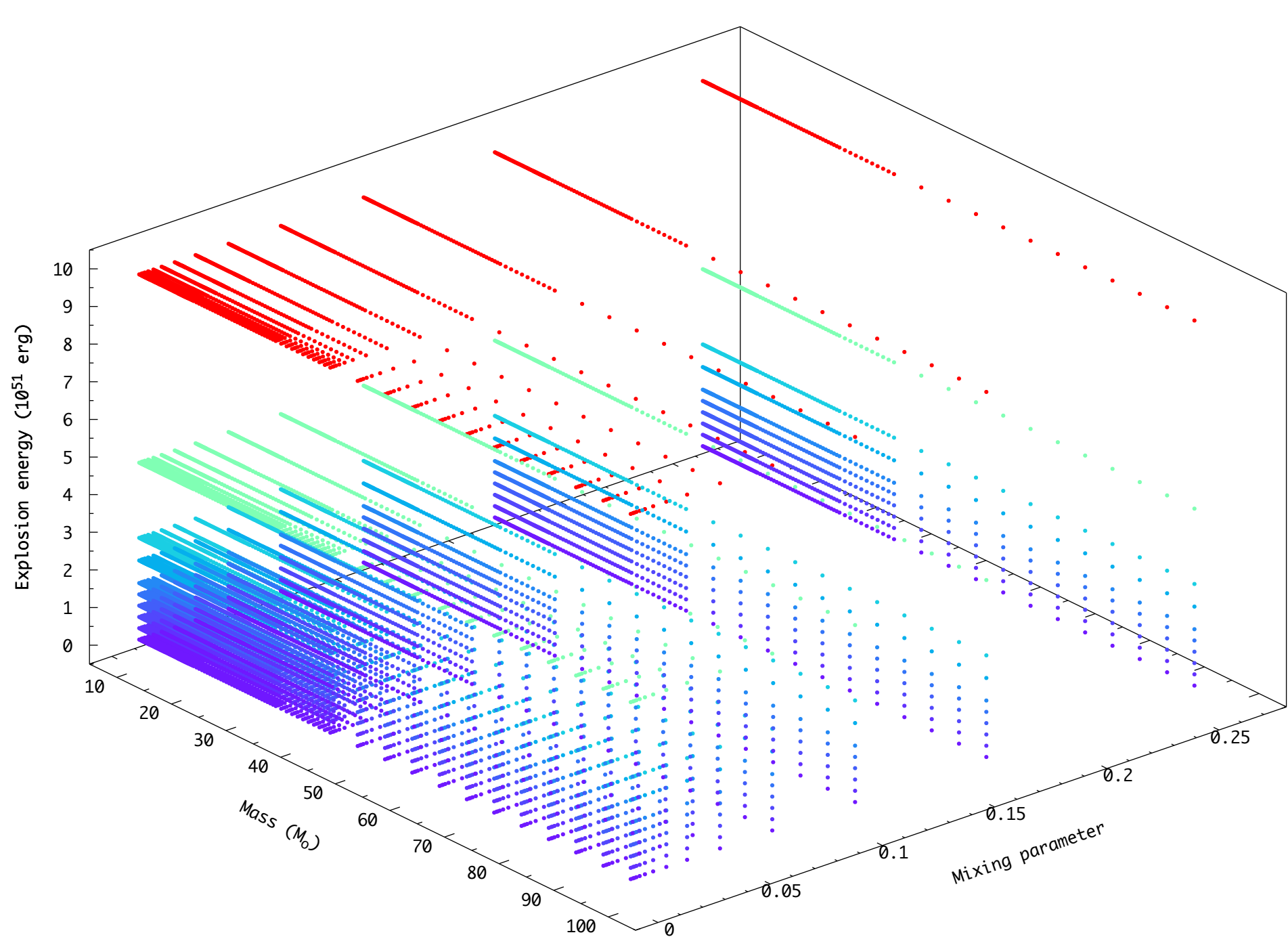- Ultra Metal-Poor Stars from literature [4, 5]

Figure 2: Upper panel: SN model grid used in this work. Bottom panel: Monte Carlo re-sampling of observed abundances.
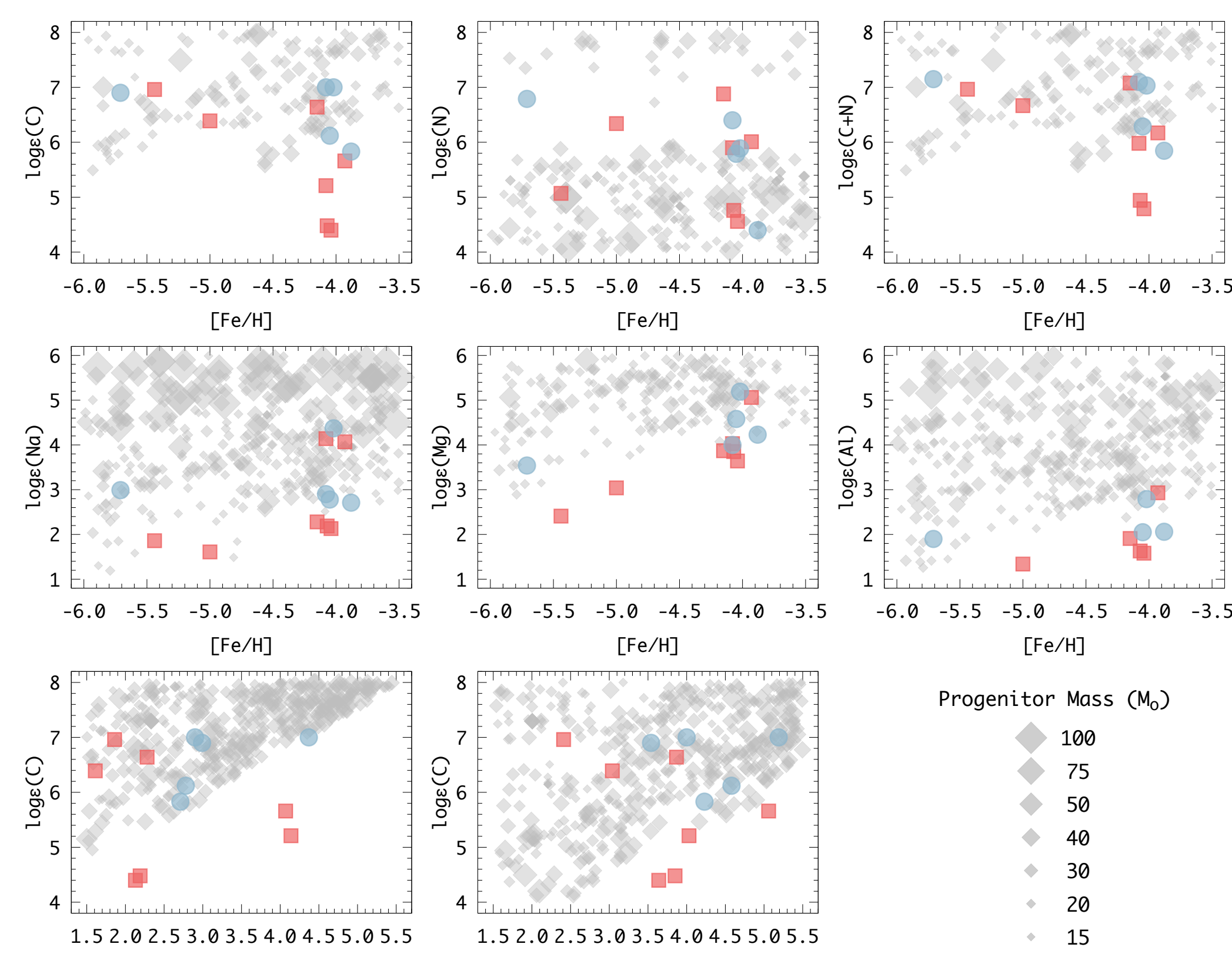
ABUNDANCE COMPARISON

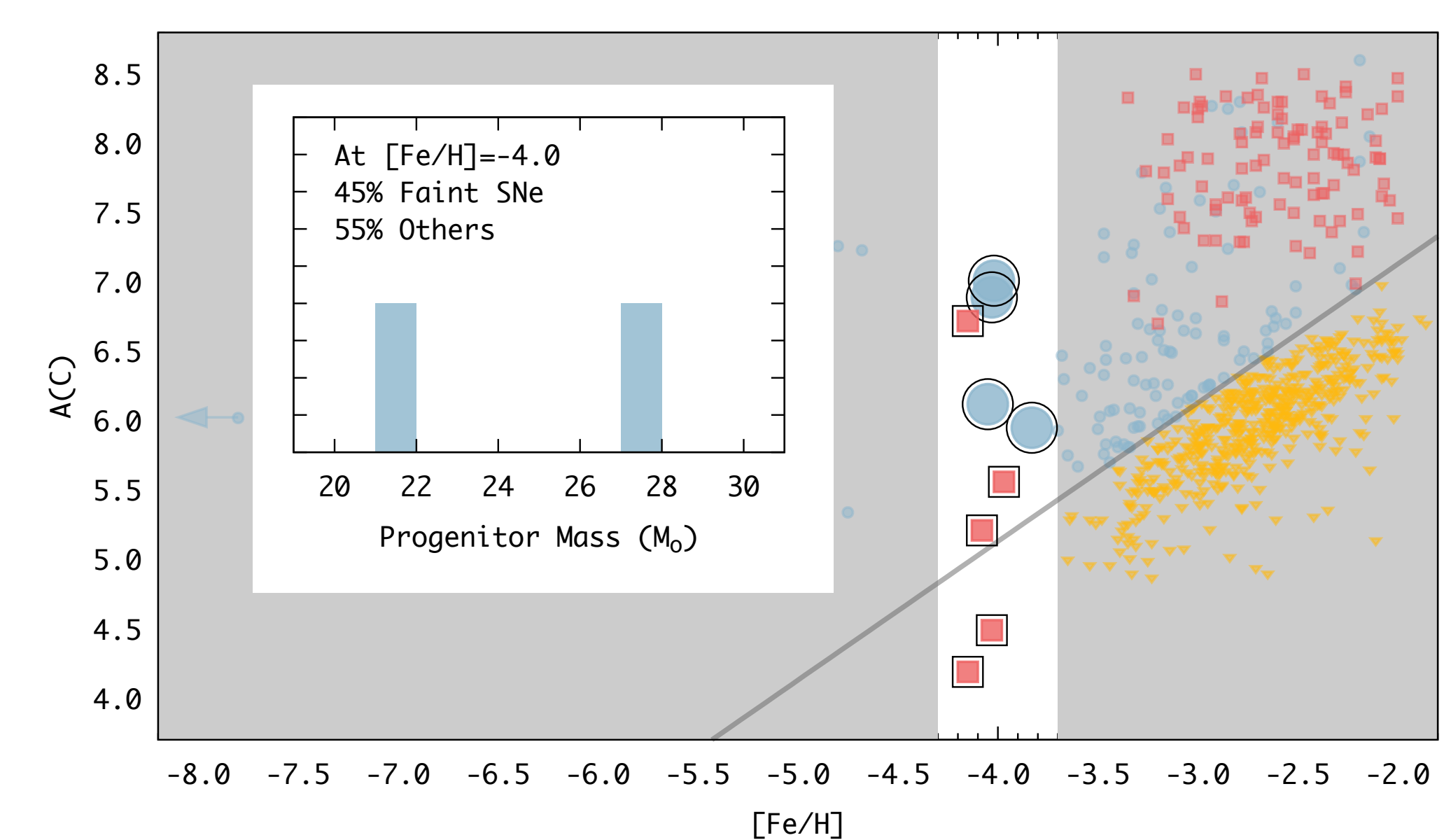Figure 4: Measured abundances of UMP stars and SN yields.

ONLINE SIMULATIONS

Monte Carlo Method   Starfit Models   Abundance Matching

CONTACT INFORMATION

vmplacco@gmail.com   nd.edu/~vplacco   github.com/vmplacco

POPULATION III IMF

Figure 5: Progenitor Mass distribution for [Fe/H] = −4.0.

CONCLUSIONS AND FUTURE WORK

- Faint SN cannot account for abundances of all UMP stars.
- A second progenitor population is needed (Spin stars?).
- Additional UMP stars observed with measured Carbon and Nitrogen (+ other light elements) are crucial!
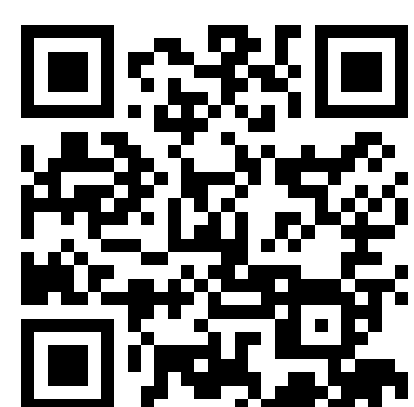- Extend analysis to [Fe/H] < −3.5 and other Population III stellar progenitors.

REFERENCES

[1] Yoon, J., Beers, T., Placco, V., et al. 2016, ApJ, 833, 20

[2] Placco, Frebel, Beers & Stancliffe. 2014, ApJ, 797, 21

[3] Heger, A., & Woosley, S. E. 2010, ApJ, 724, 341

[4] Placco, V., Frebel, A., Lee, Y., et al. 2015, ApJ, 809, 136

[5] Placco, V., Frebel, A., Beers, T., et al. 2016, ApJ, 833, 21

ACKNOWLEDGEMENTS