Chasing the most metal-poor stars

David Aguado

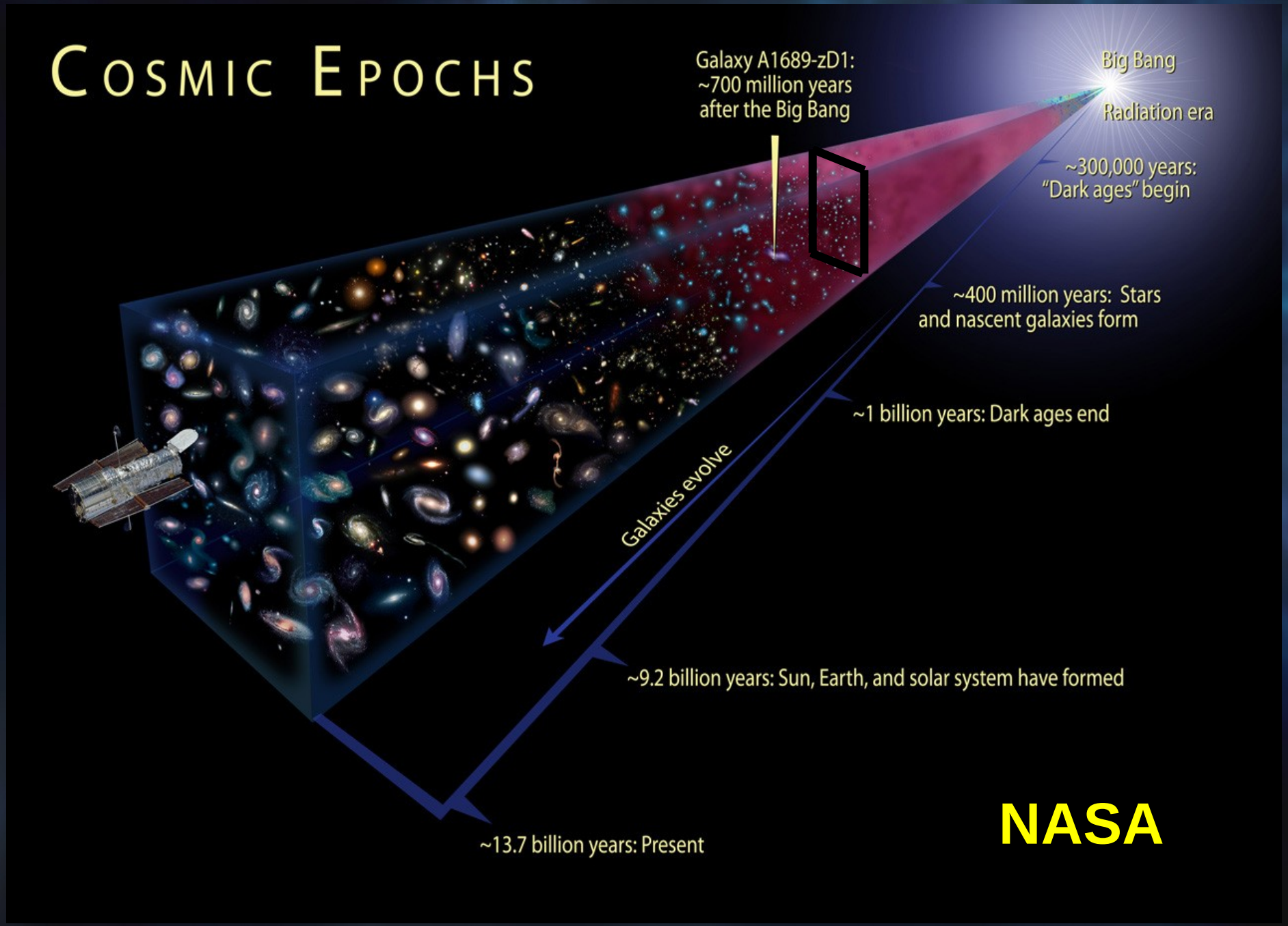
Focus Week

Trieste 20230518

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

Unión Europea
Fondo Europeo
de desarrollo Regional
"Una manera de hacer Europa"

Introduction: The First Stars



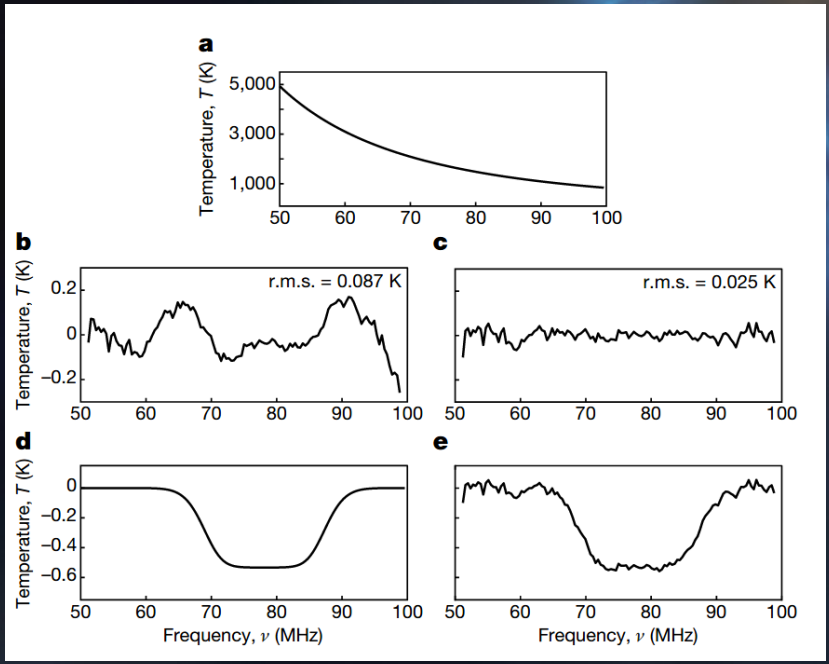
Introduction: The First Stars

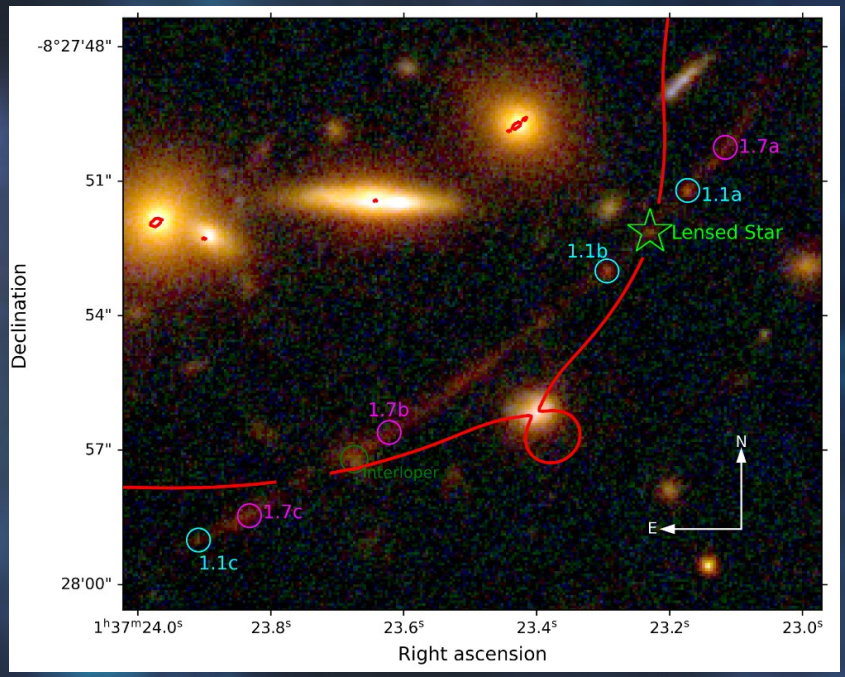
LETTER

doi:10.1038/nature25792

An absorption profile centred at 78 megahertz in the sky-averaged spectrum

Judd D. Bowman[1], Alan E. E. Rogers[2], Raul A. Monsalve[1,3,4], Thomas J. Mozdzen[1] & Nivedita Mahesh[1]





Article

A highly magnified star at redshift 6.2

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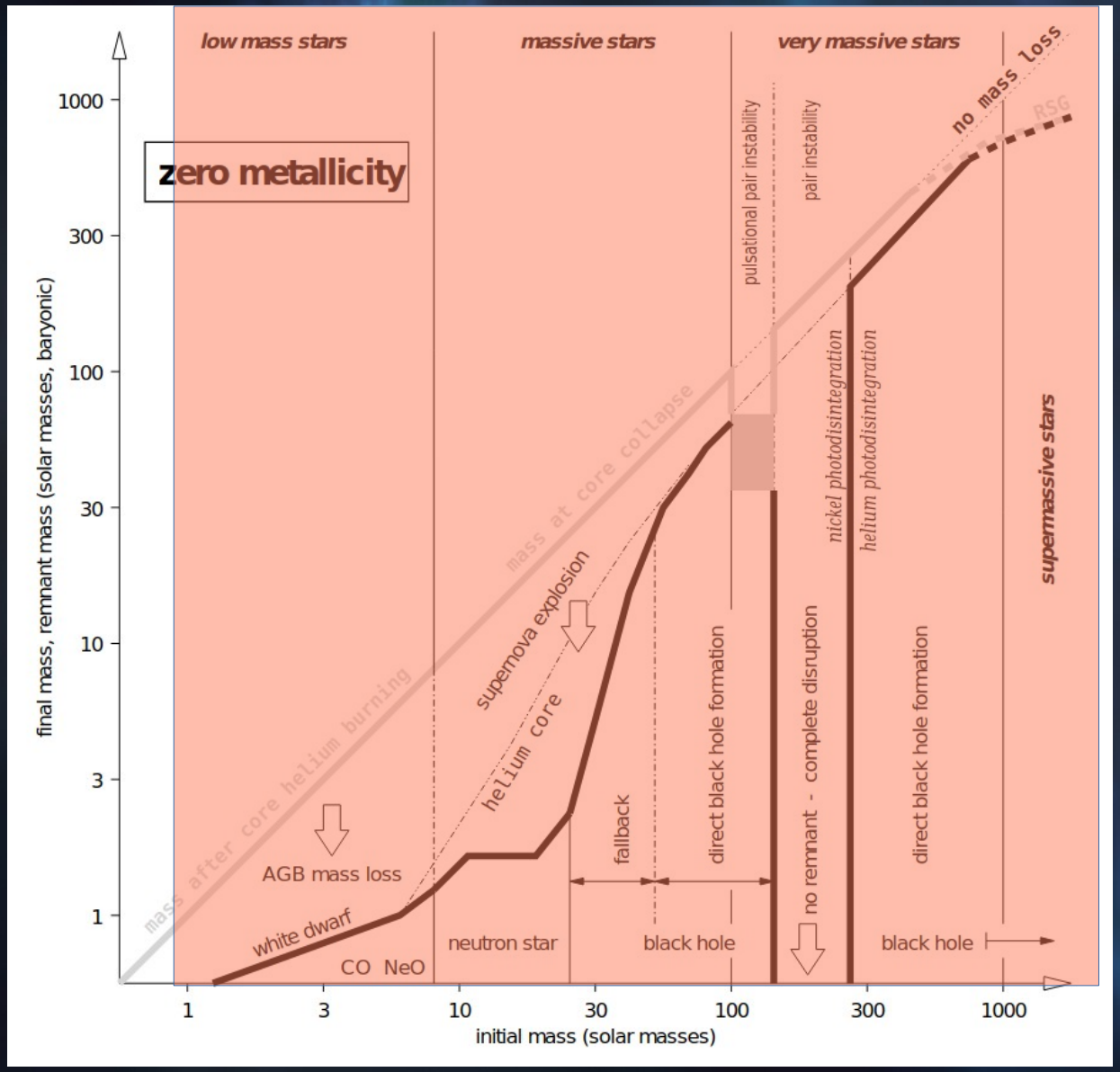
Check for updates

Brian Welch[1✉], Dan Coe[1,2,3], Jose M. Diego[4], Adi Zitrin[5], Erik Zackrisson[6], Paola Dimauro[7], Yolanda Jiménez-Teja[8], Patrick Kelly[9], Guillaume Mahler[10,11,12], Masamune Oguri[13,14,15], F. X. Timmes[16,17], Rogier Windhorst[16], Michael Florian[18], S. E. de Mink[19,20,21], Roberto J. Avila[2], Jay Anderson[2], Larry Bradley[2], Keren Sharon[10], Anton Vikaeus[6], Stephan McCandliss[1], Maruša Bradač[22], Jane Rigby[23], Brenda Frye[18], Sune Toft[24,25], Victoria Strait[22,24,25], Michele Trenti[26,27], Soniya Sharma[23], Felipe Andrade-Santos[21,28] & Tom Broadhurst[29,30,31]

Introduction: The First Stars

Pop III stars at z~0?

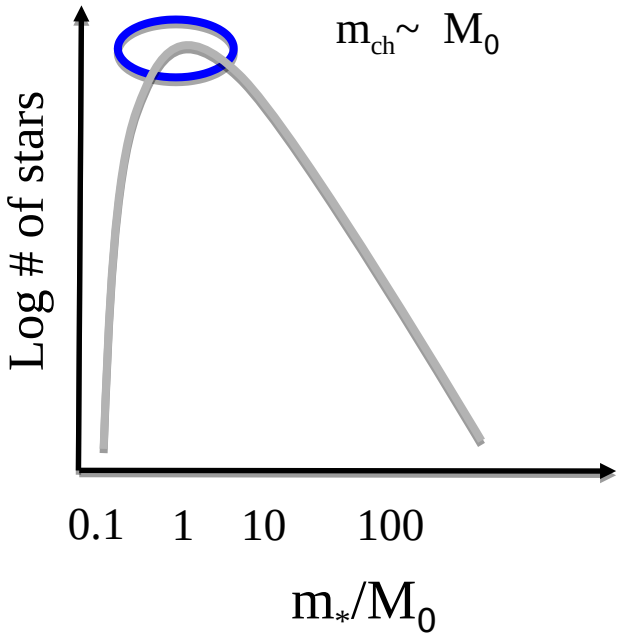
Introduction: The First Stars



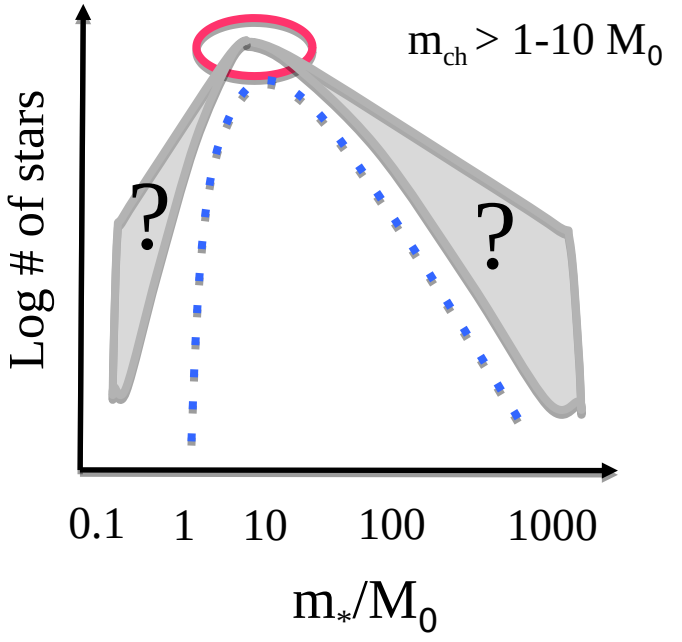
Heger & Woosley 2002

Introduction: The First Stars

PRESENT-DAY STARS
(PopII/I)



FIRST STARS
(PopIII)



from S. Salvadori

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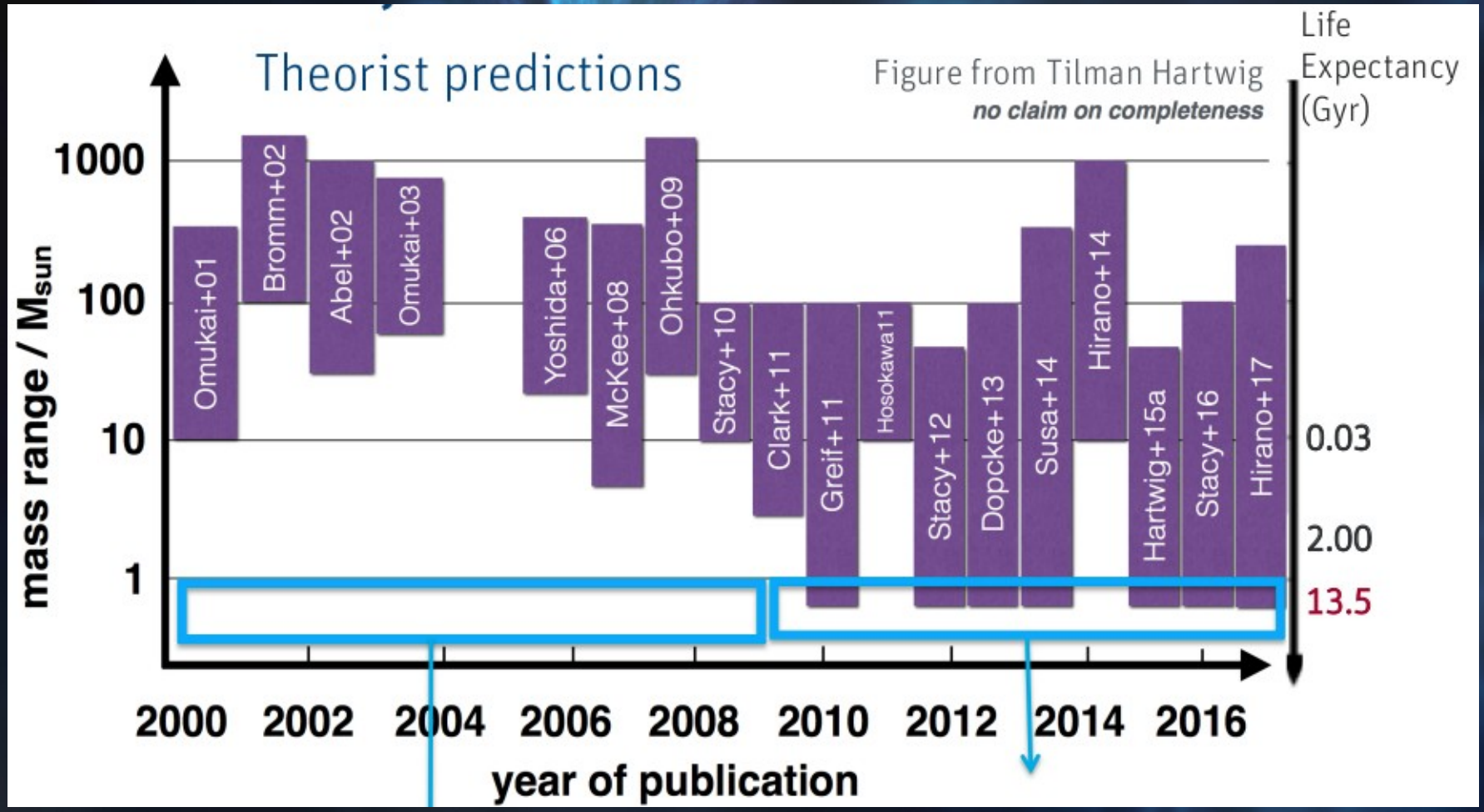

Hartwig, Starkenburg

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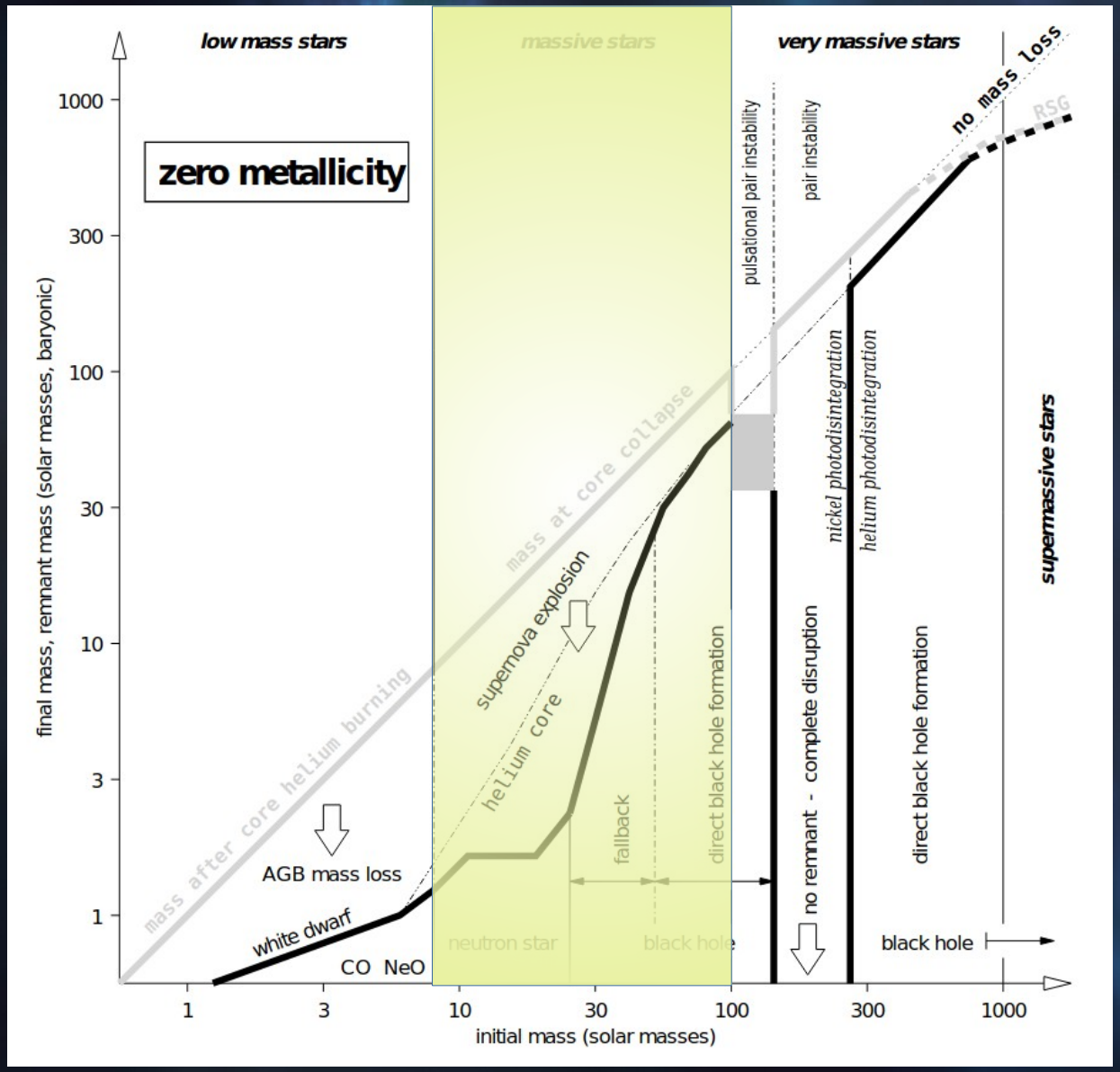
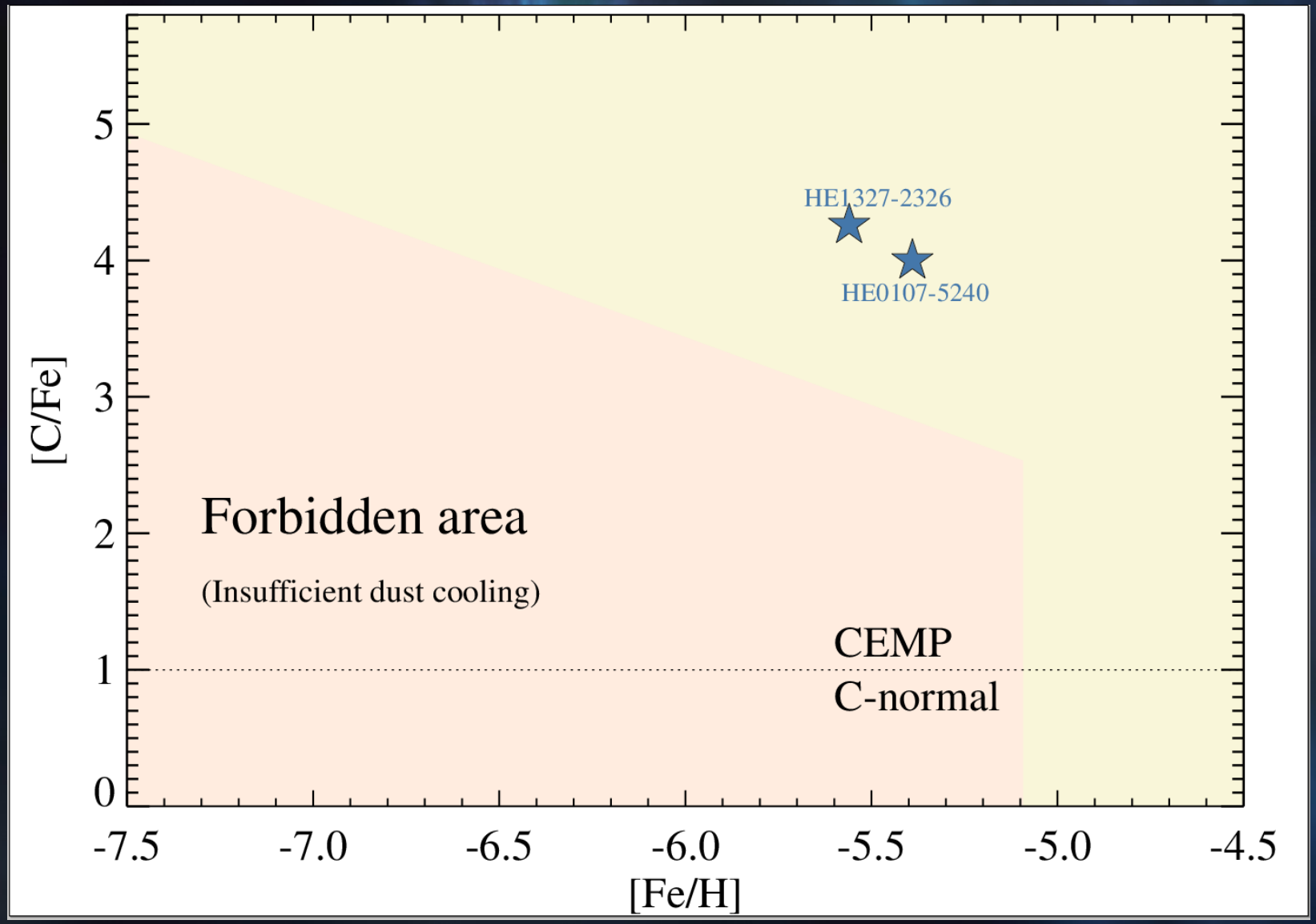


Heger & Woosley 2002

2-What are the most metal-poor stars



DA, Molaro, et al. 2022

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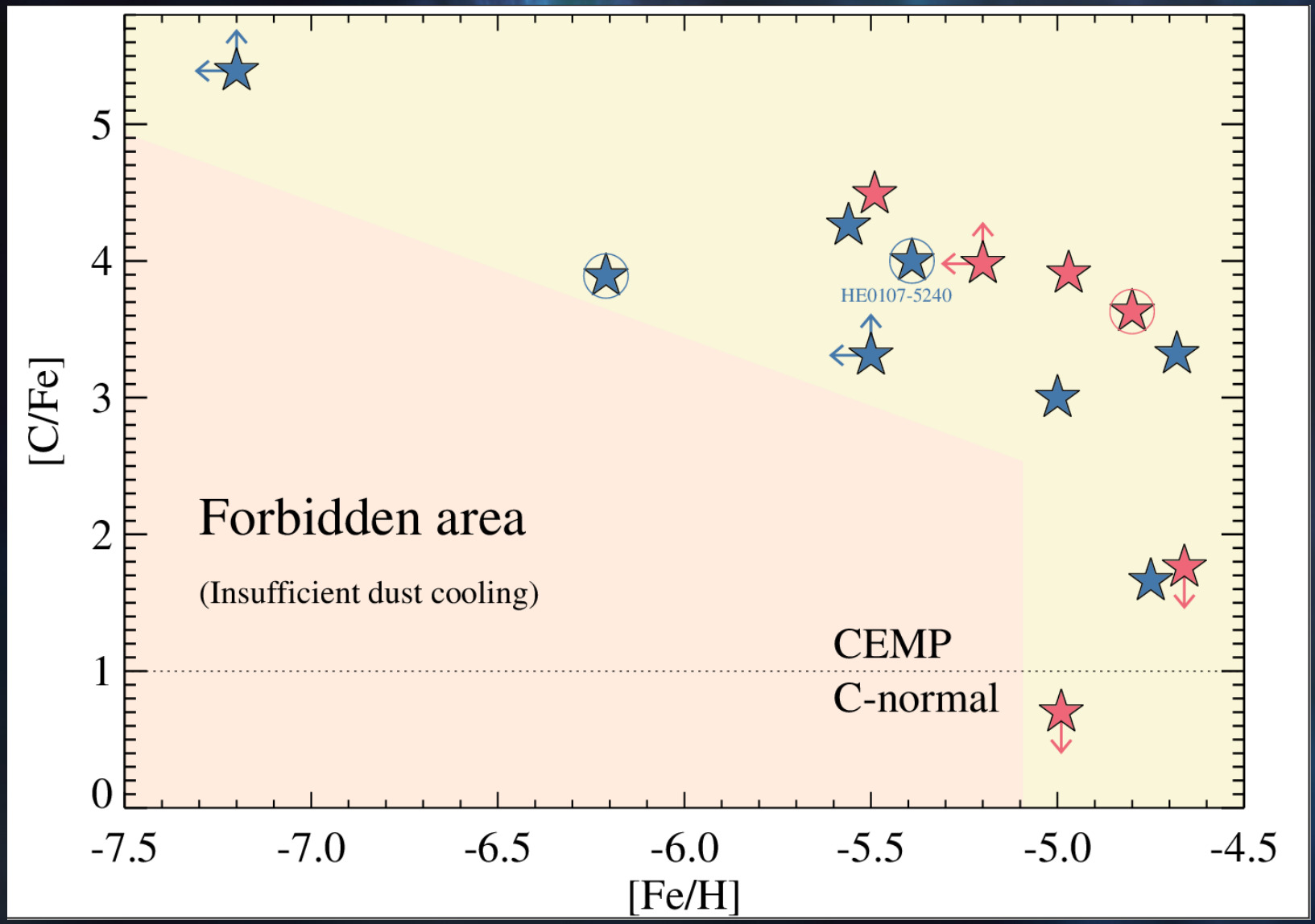

DA, Molaro, et al. 2022

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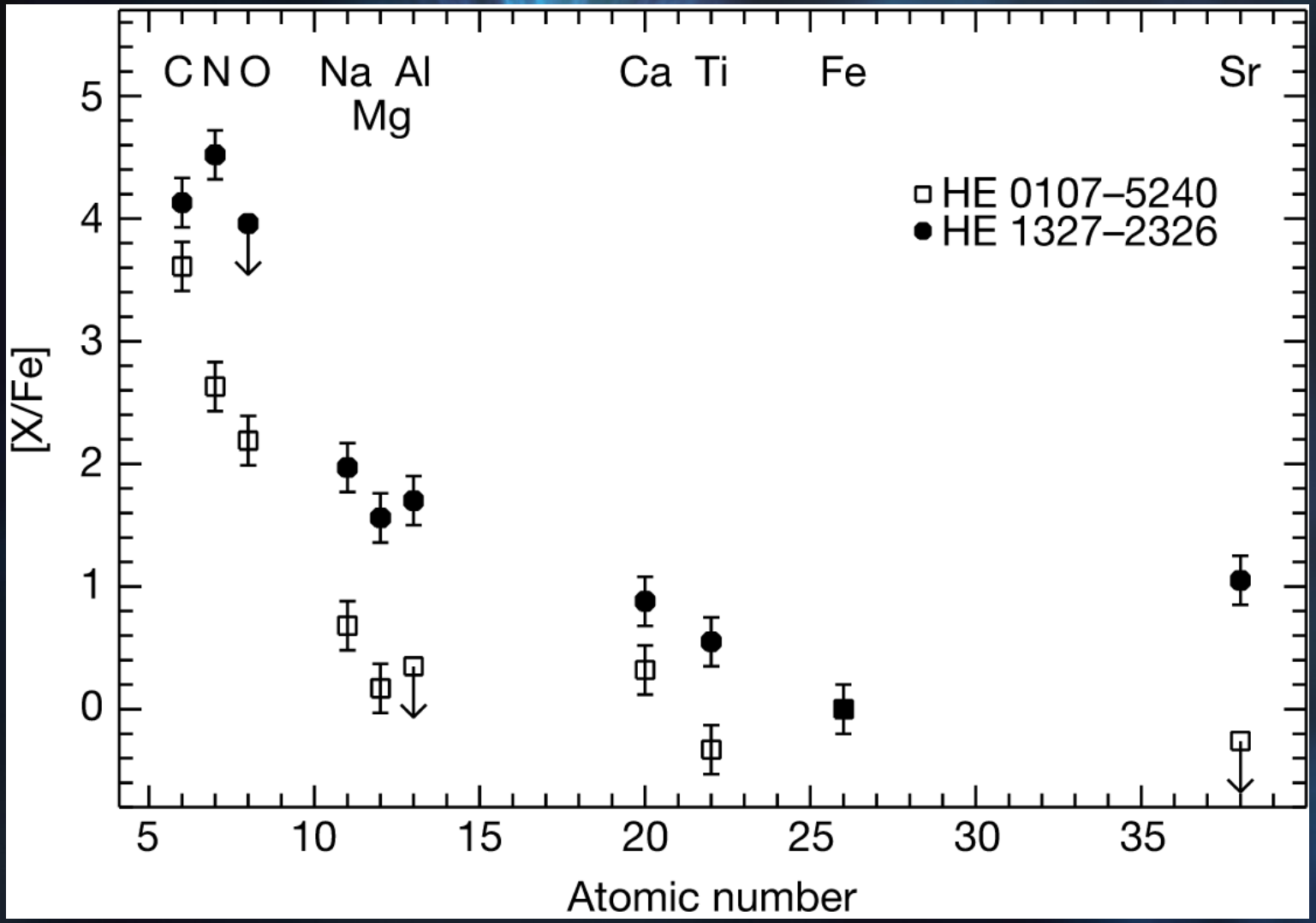

Frebel et al. 2005

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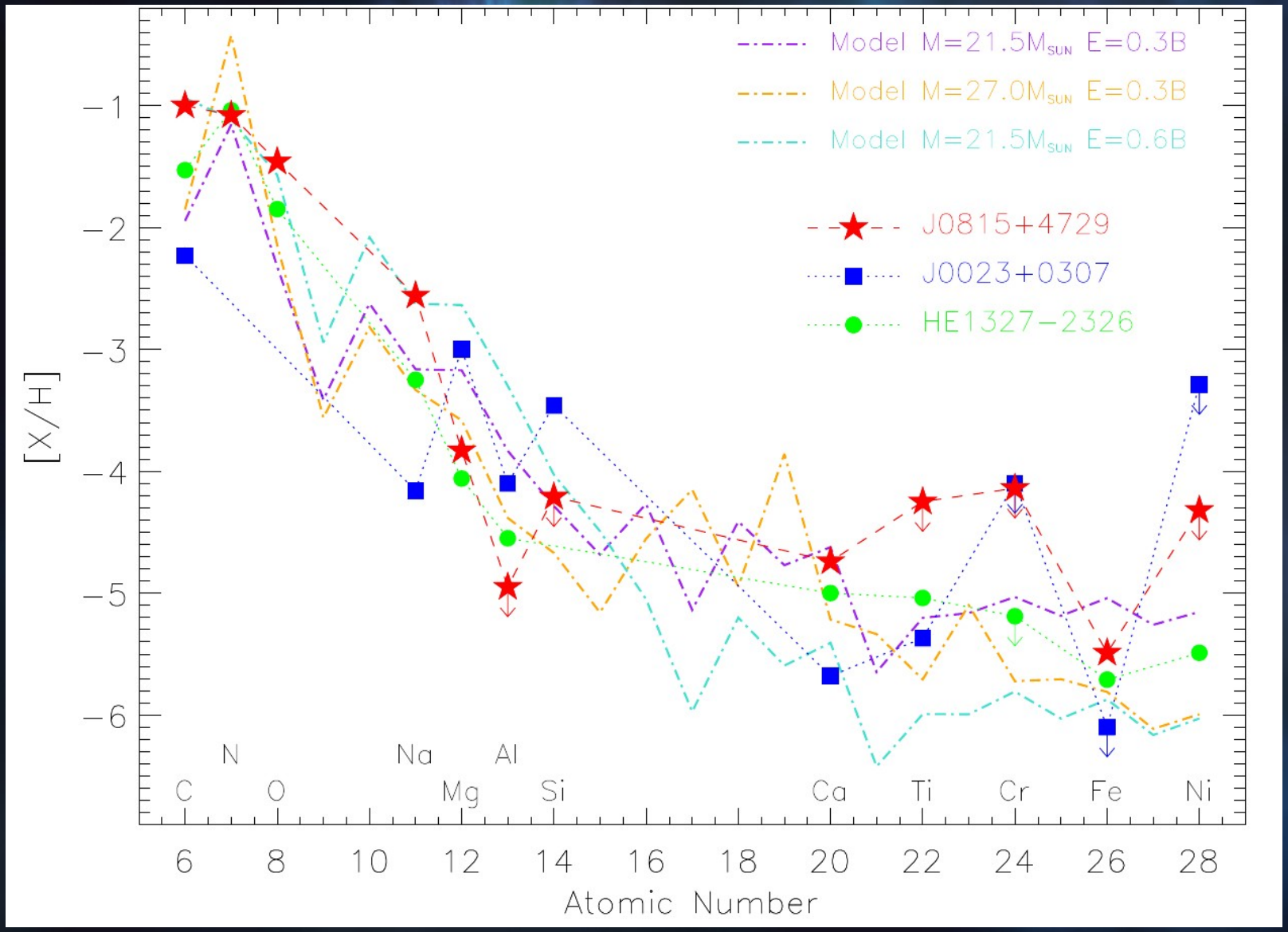
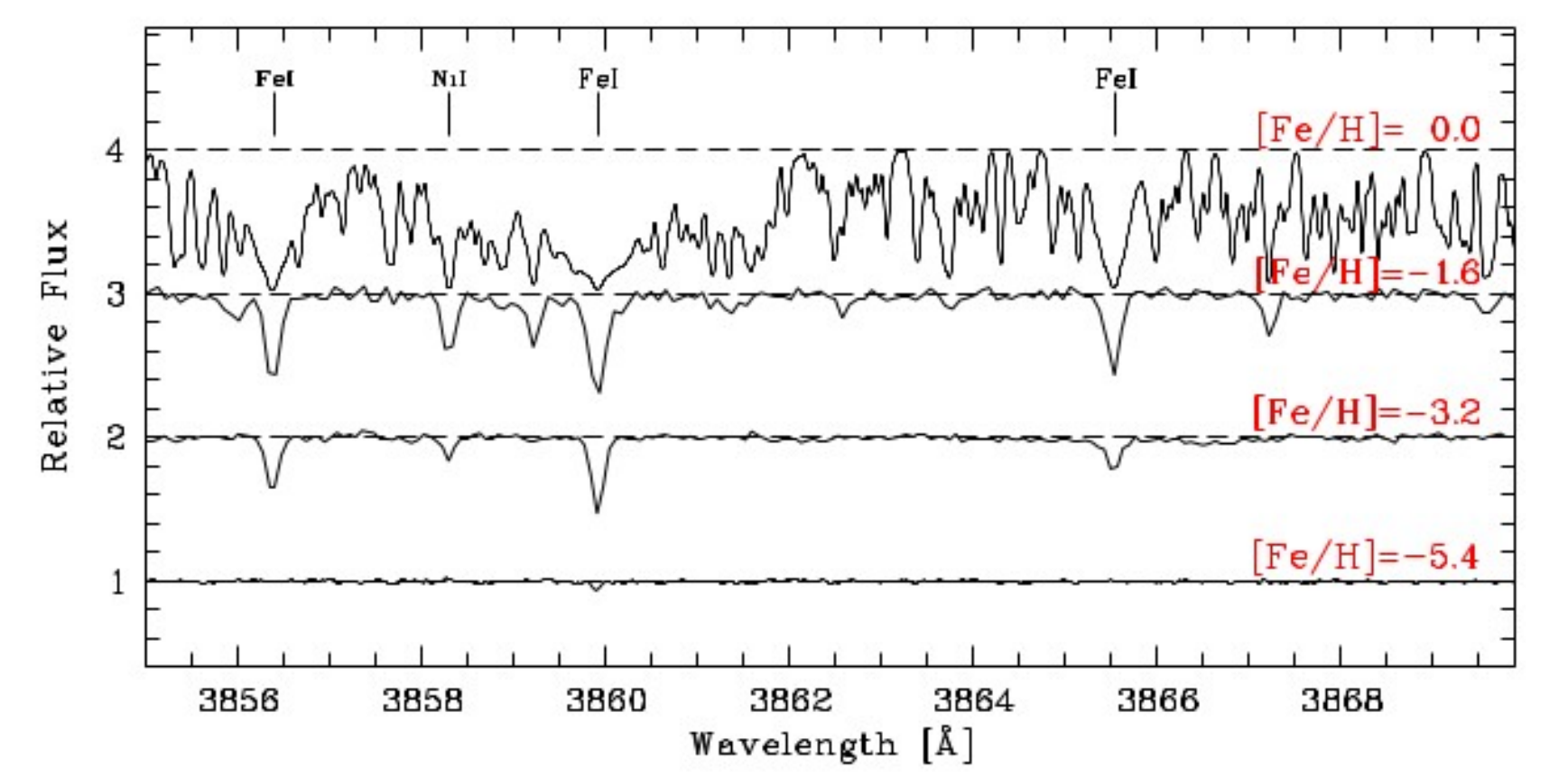


González Hernández, DA, et al. 2020

3-Where are the most metal-poor stars

Very rare stars

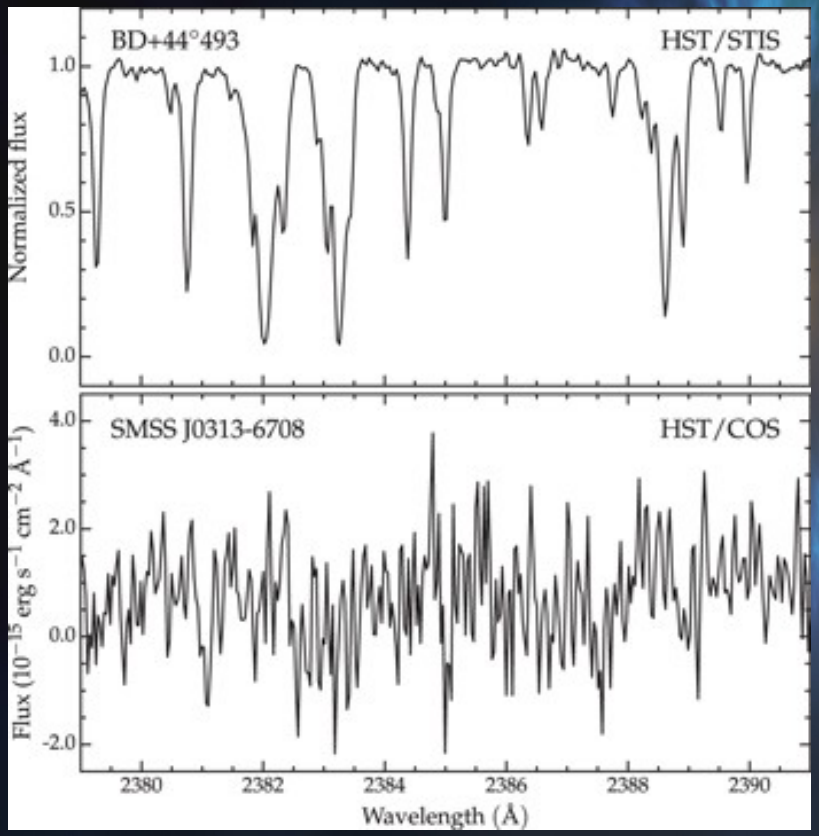
3-Where are the most metal-poor stars



Frebel+ 2010

Absence of features

3-Where are the most metal-poor stars



Ian U. Roederer 2017

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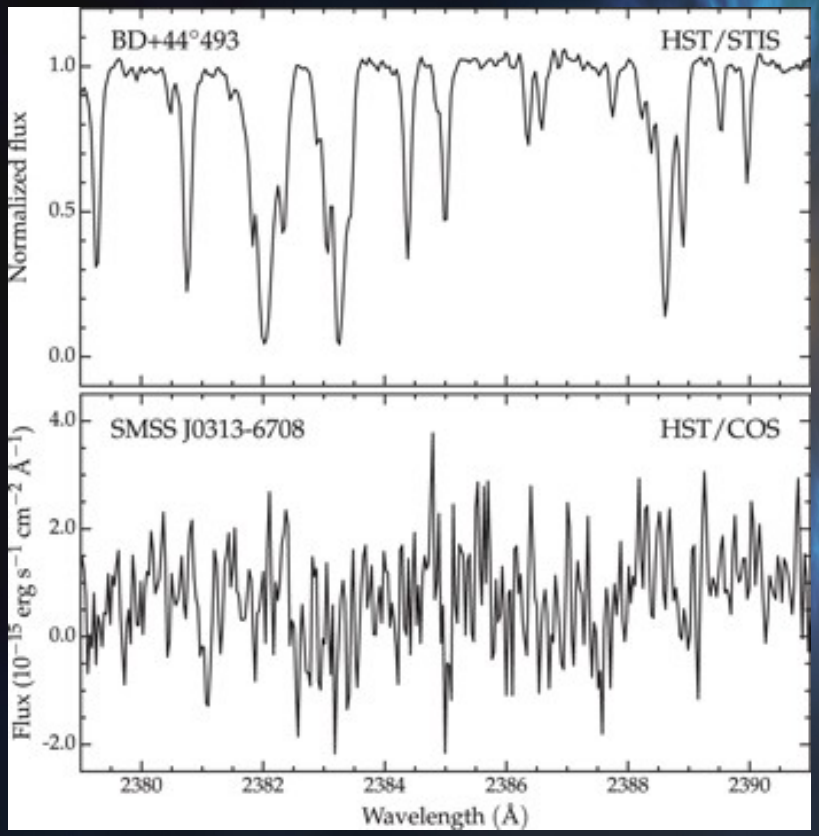
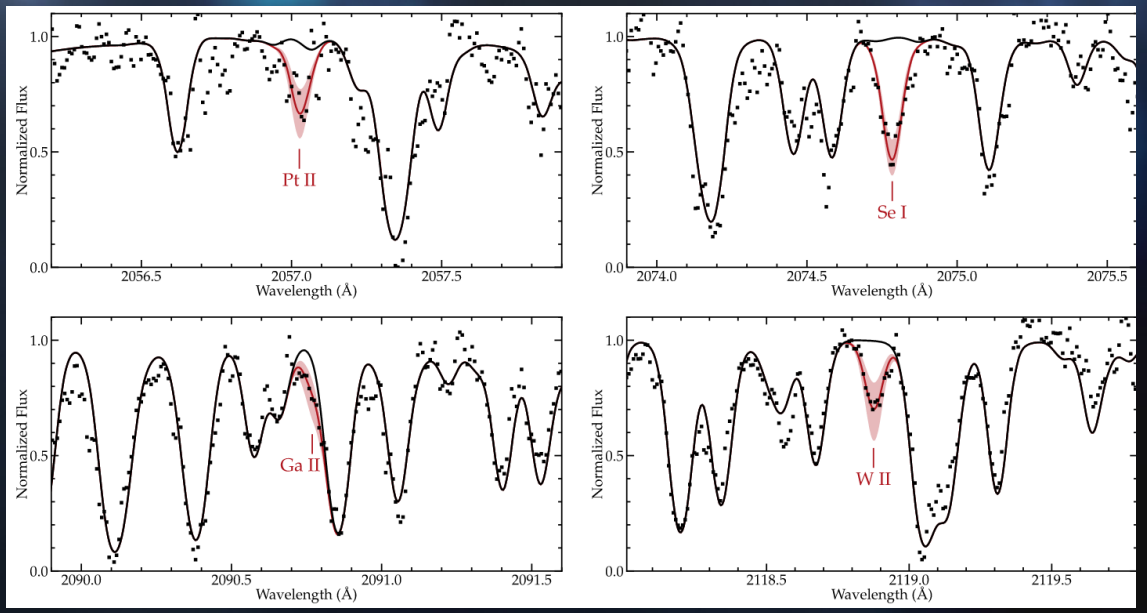


Ian U. Roederer 2017

Roederer et al. 2022



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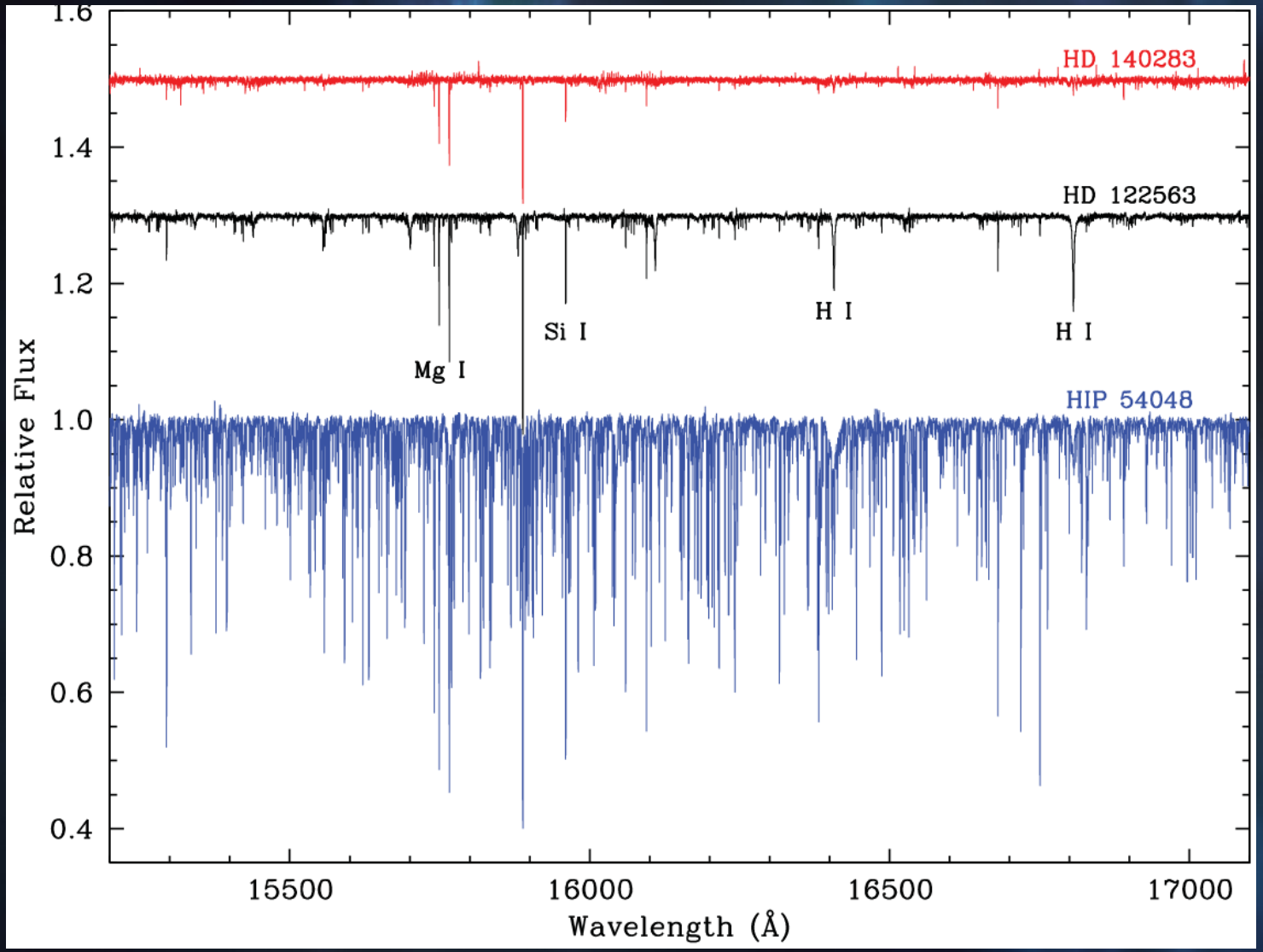


Afsar et al. 2016

4-How find the most metal-poor stars

HK objective-prism survey (Beers, Preston & Shectman 1985)

Hamburg ESO survey (Christlieb, Wisotzki & Graßhoff 2002)

CaHK filter (Anthony-Twarog et al. 2000, Koch et al. 2016)

SkyMapper (e.g. Keller 2007)

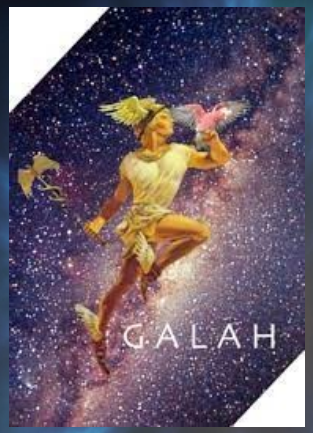
Best and brightest (Schlaufman & Casey 2014)

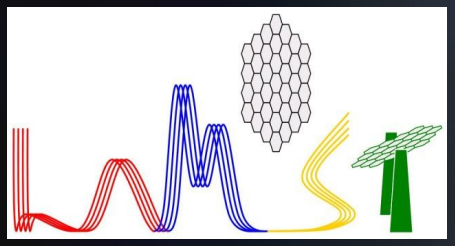
Pristine Project (Starkenburg & Martin 2017)

Spectroscopic Searches

TOPOS (Caffau+2013); SDSS (Aoki+2013); LAMOST (Li+2015)

4-How find the most metal-poor stars





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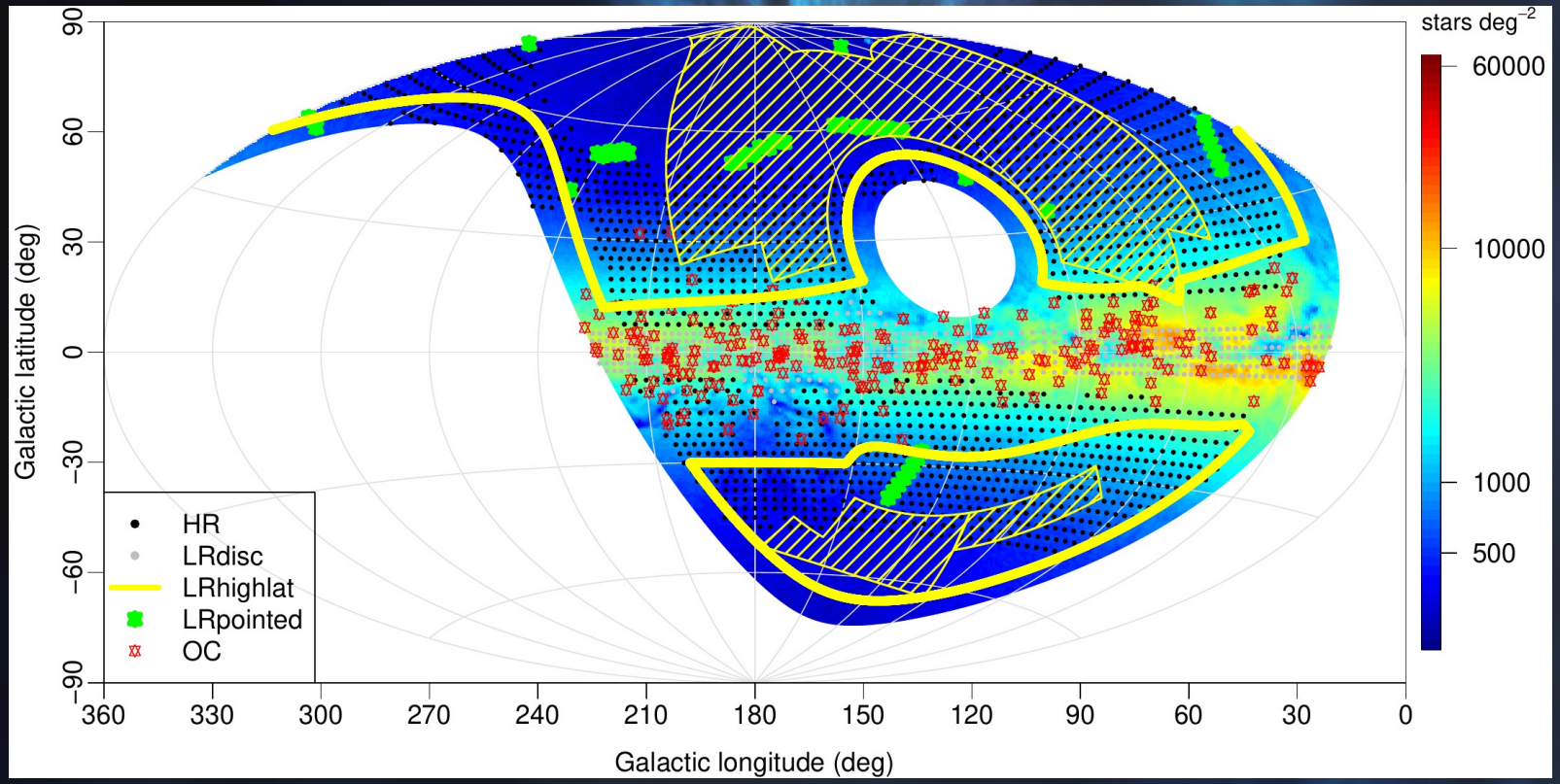
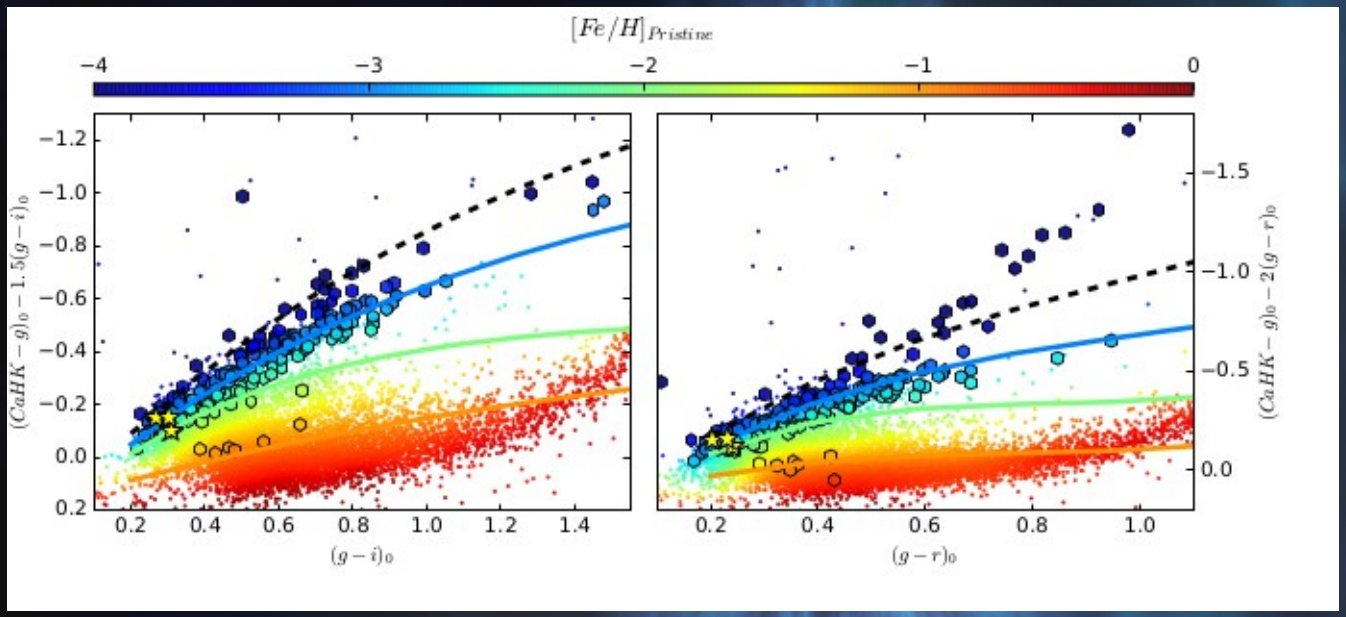


From V. Hill

4-How find the most metal-poor stars



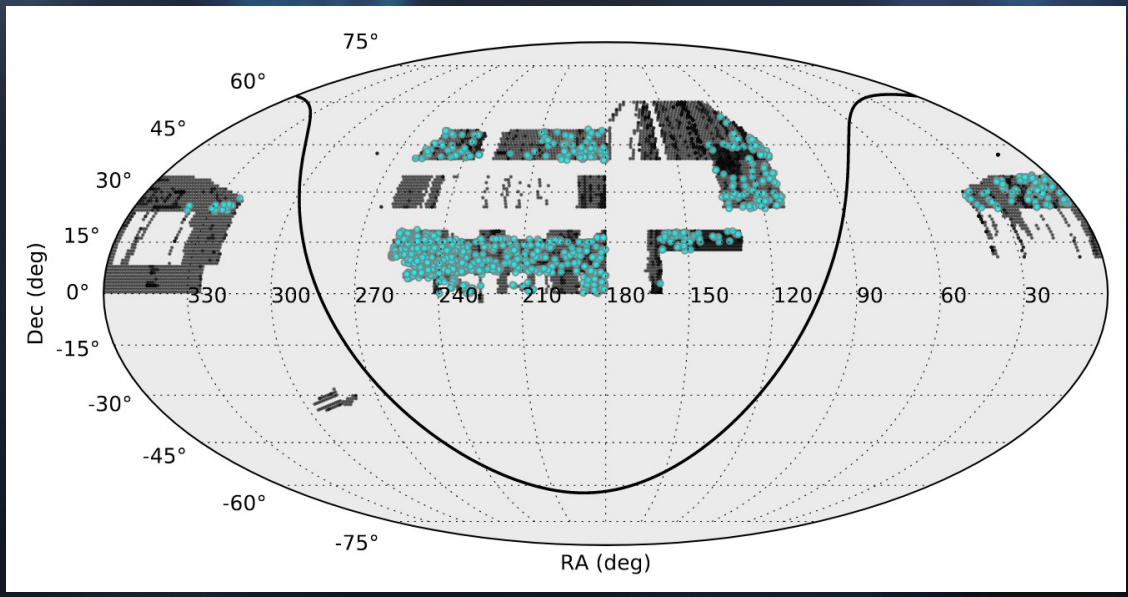
Starkenburg+2017; Youakim+2017

DA, Youakim+2019

5-7K stars with [Fe/H]<-3

15-200 stars with [Fe/H]<-4

~10 stars with [Fe/H]<-5



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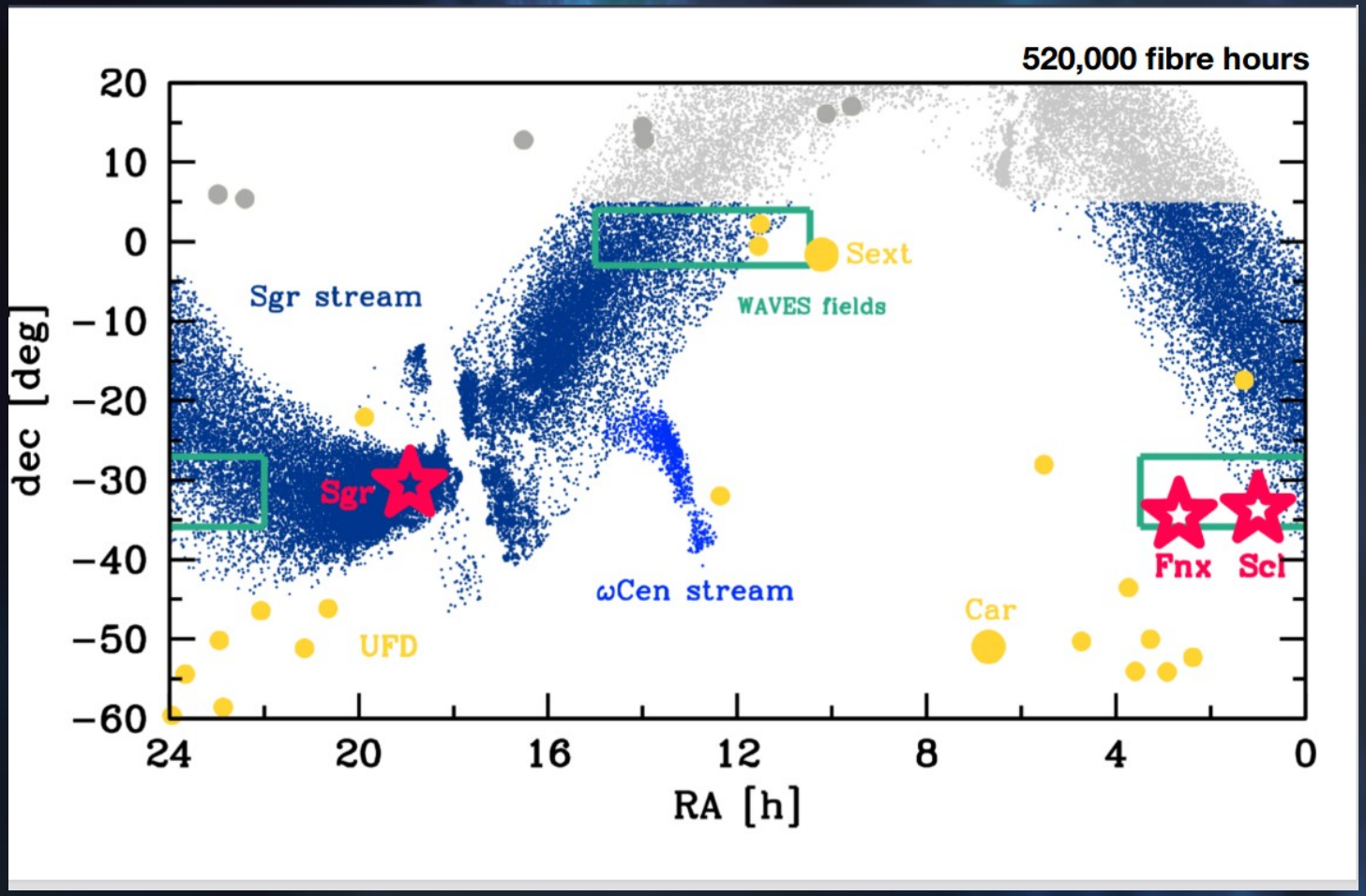
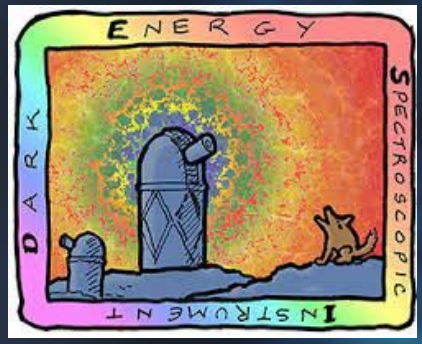
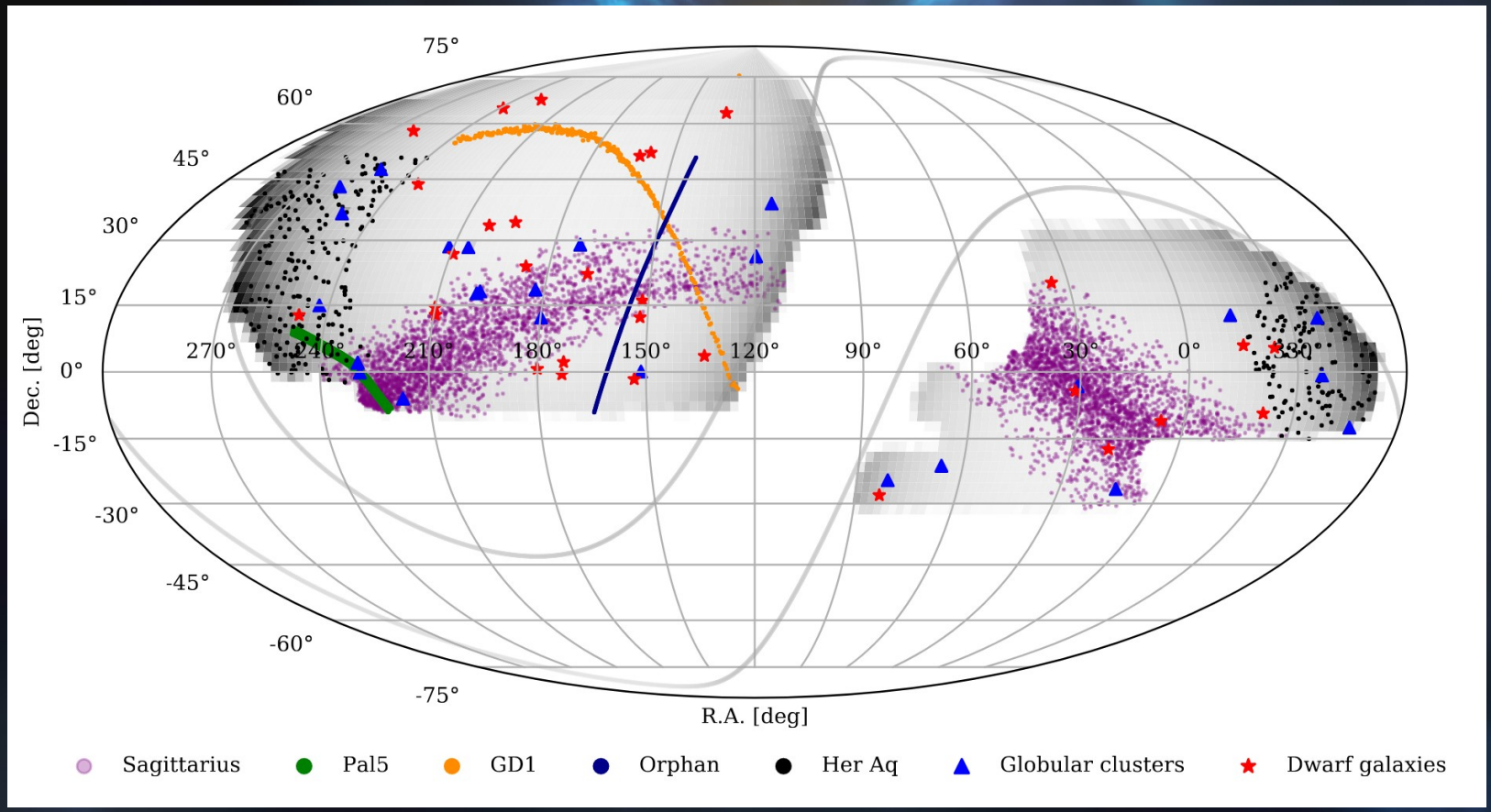


From Asa Skúladóttir: 4DWARFS!!

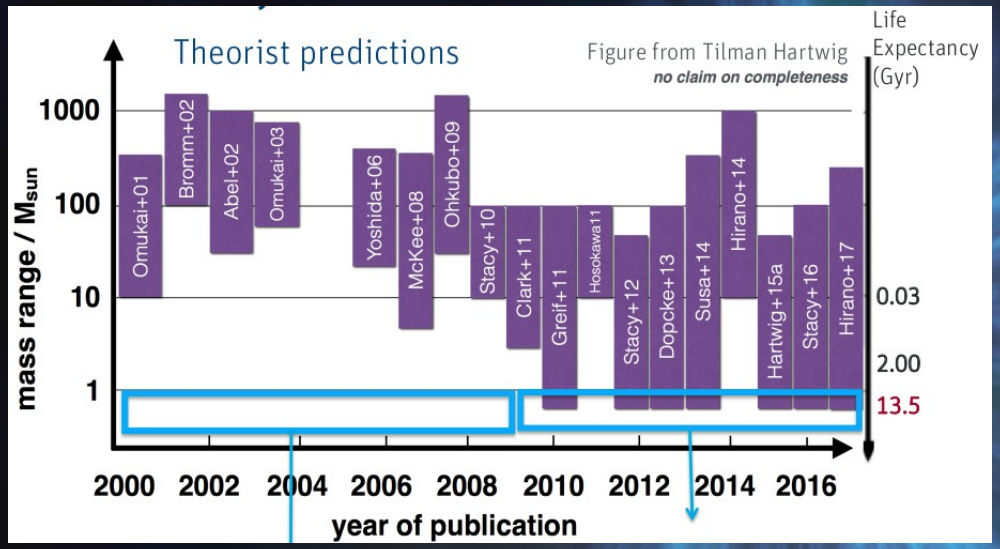
4-How find the most metal-poor stars



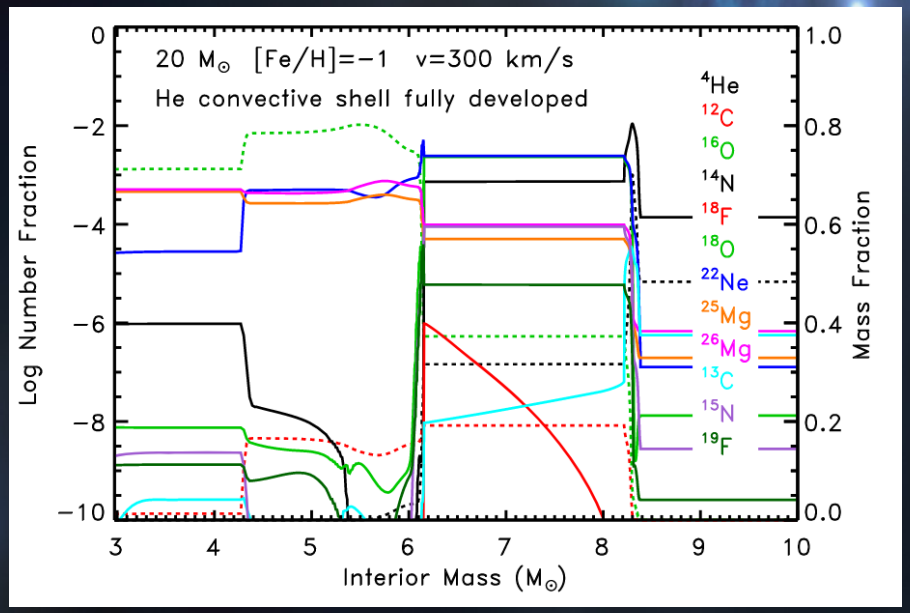


From A. Cooper+ 2022

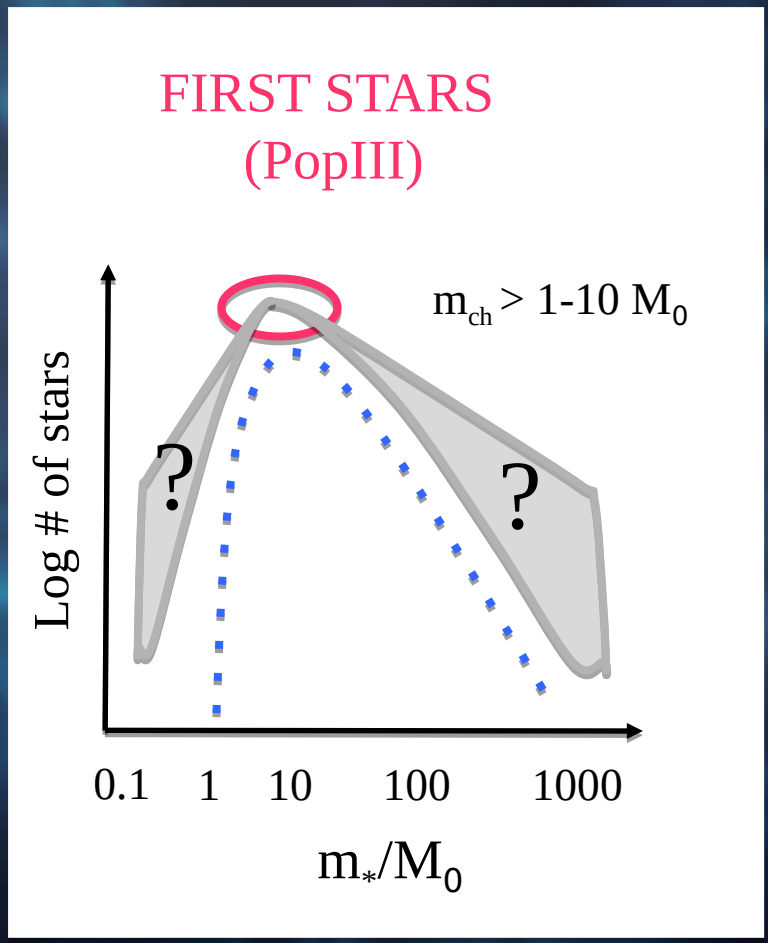
4-How find the most metal-poor stars



Hartwig, Stakenburg



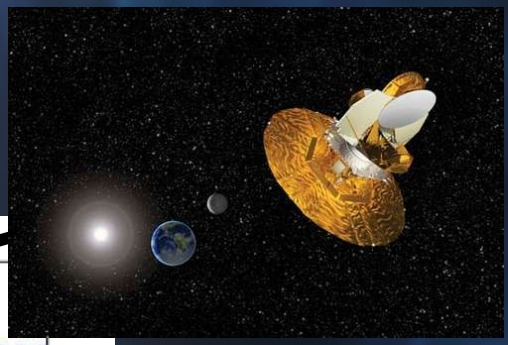
Limongi & Chieffi 2018

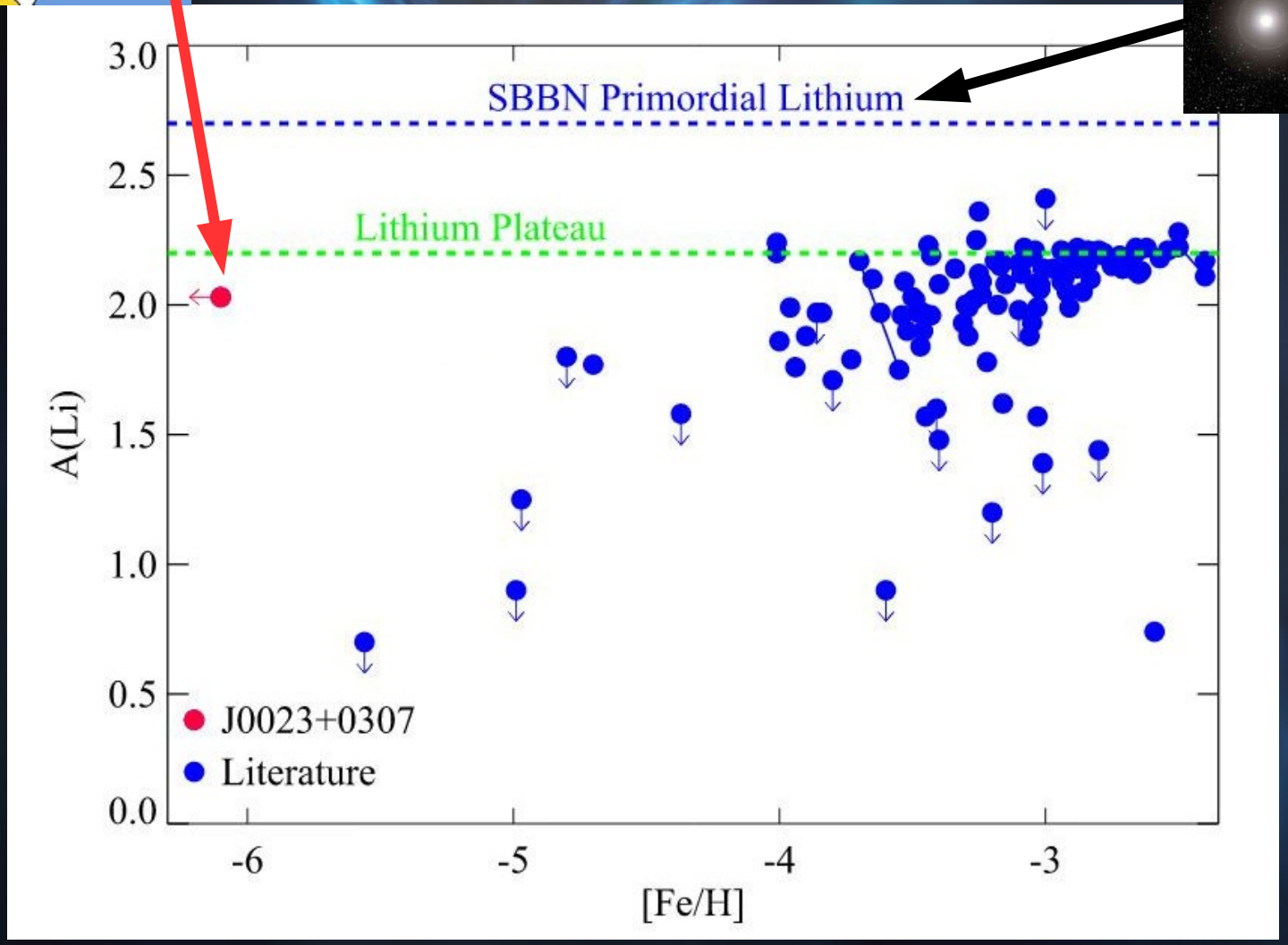


Salvadori

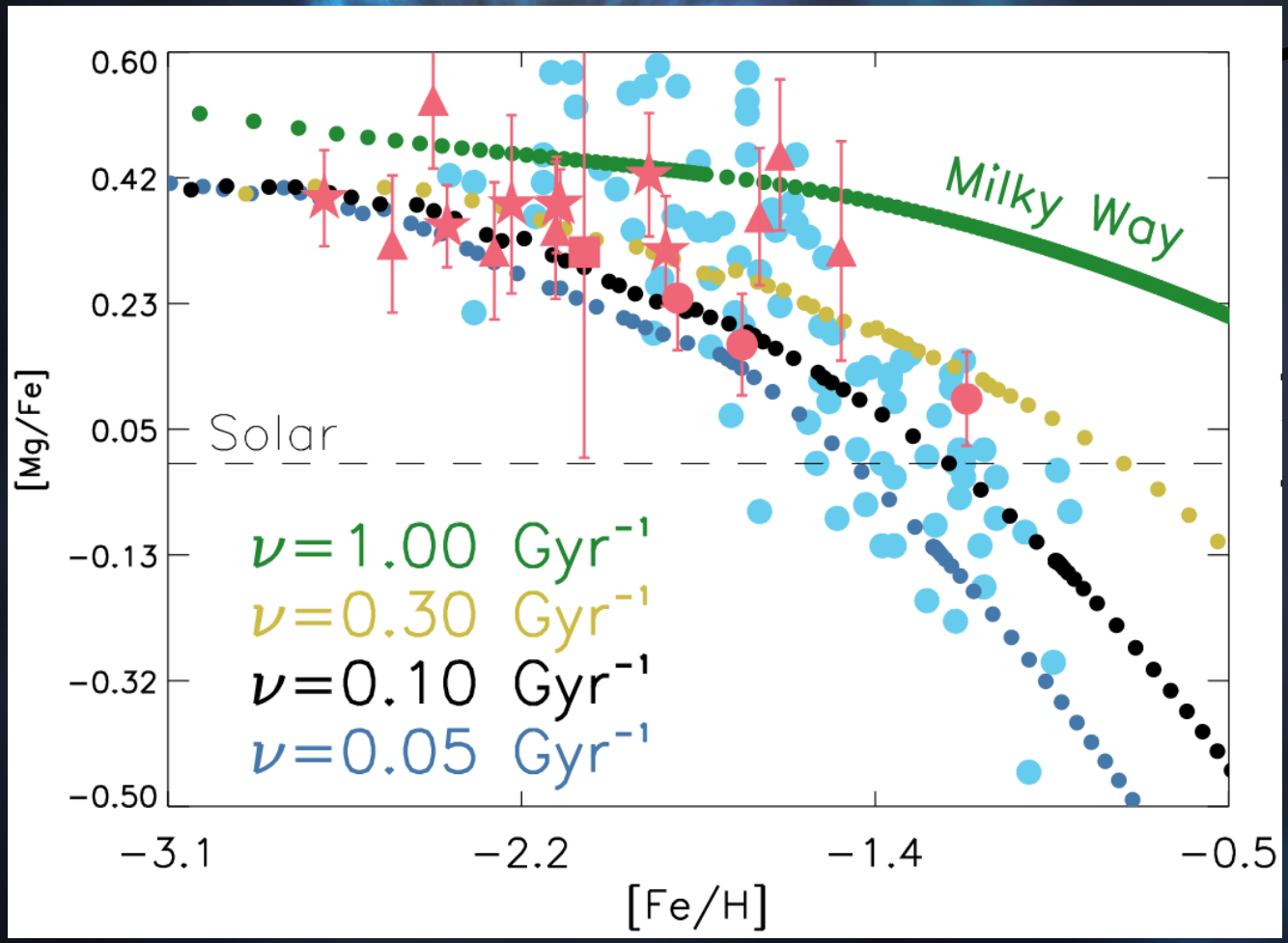
The Lithium Problem

DA+ 2019a



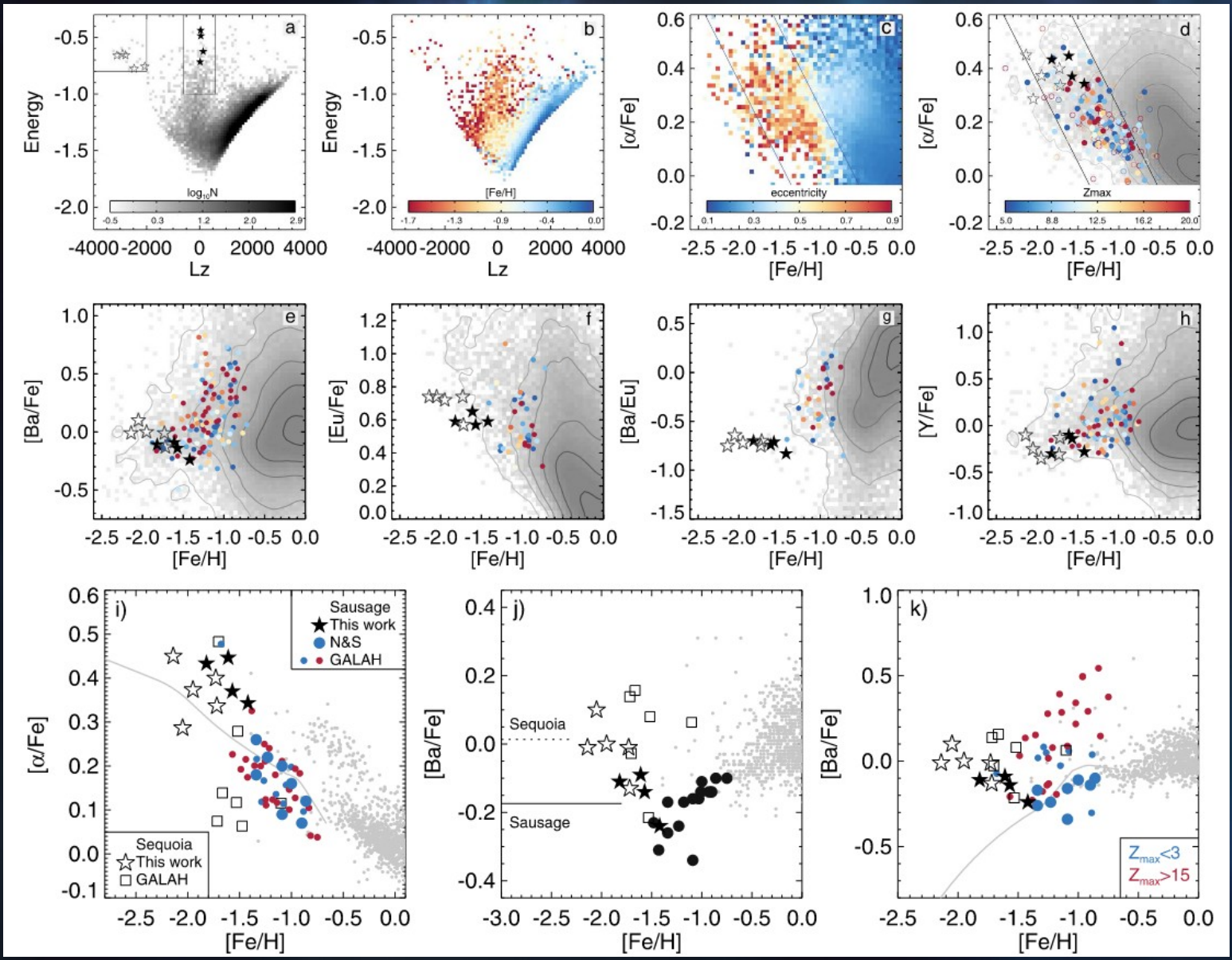


Chemical evolution SN Ia vs CCSN



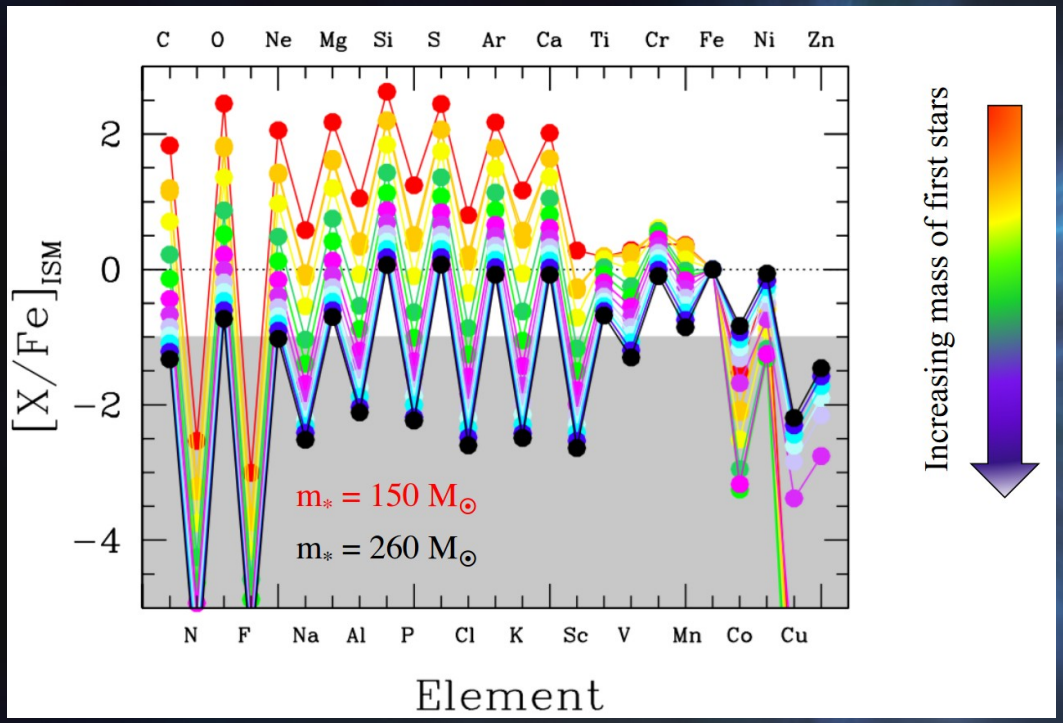
DA+ 2021a

r-process production



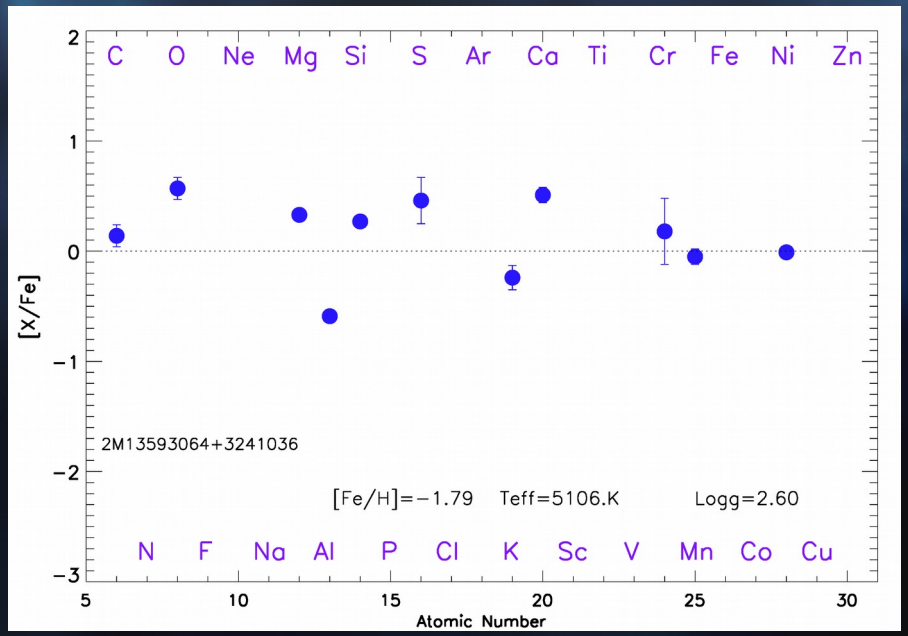
DA+ 2021b

PISN descendants

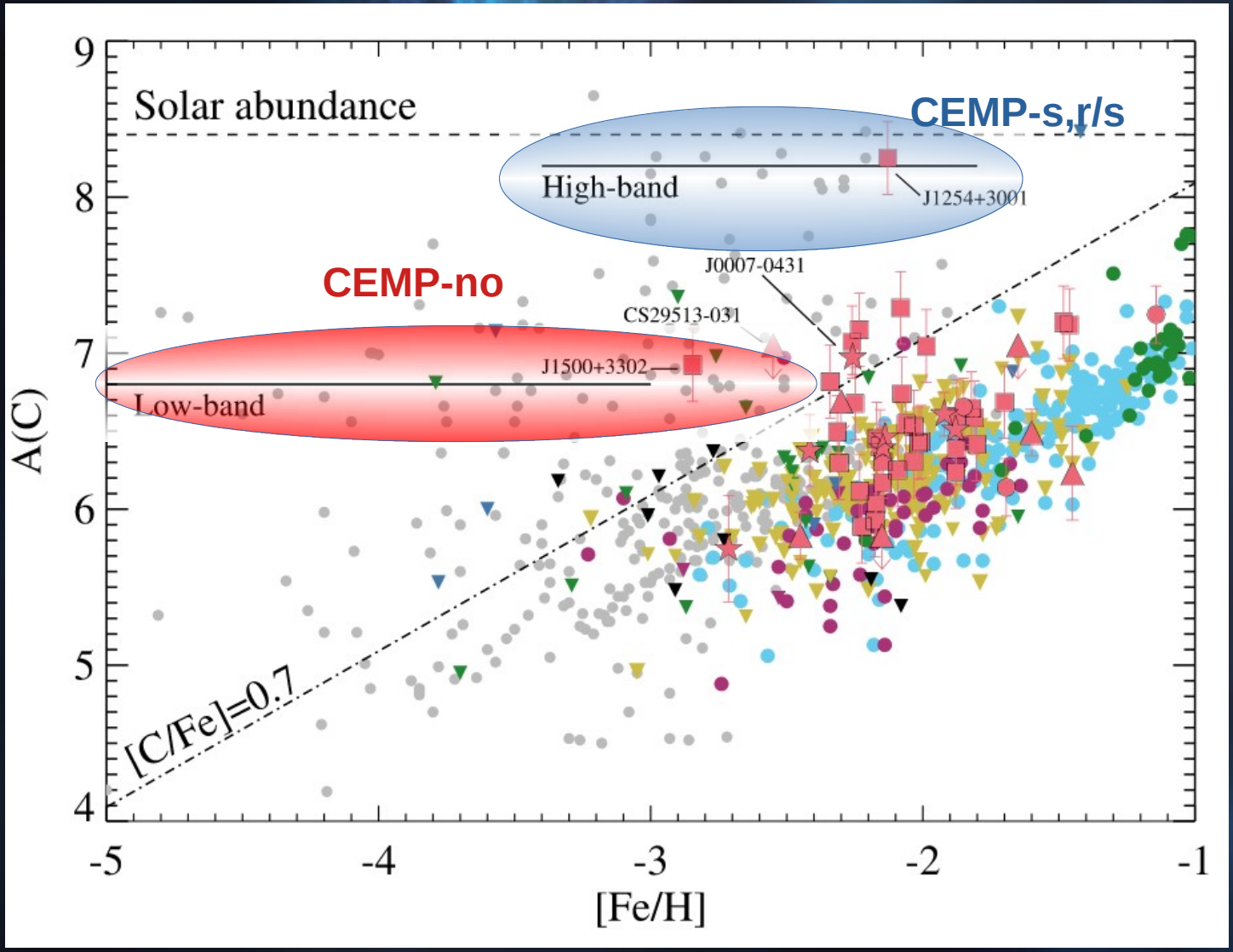


Salvadori et al. 2019

DA, Salvadori, Skúladóttir + 2023



Binarity in CEMP-no stars



DA+2021a

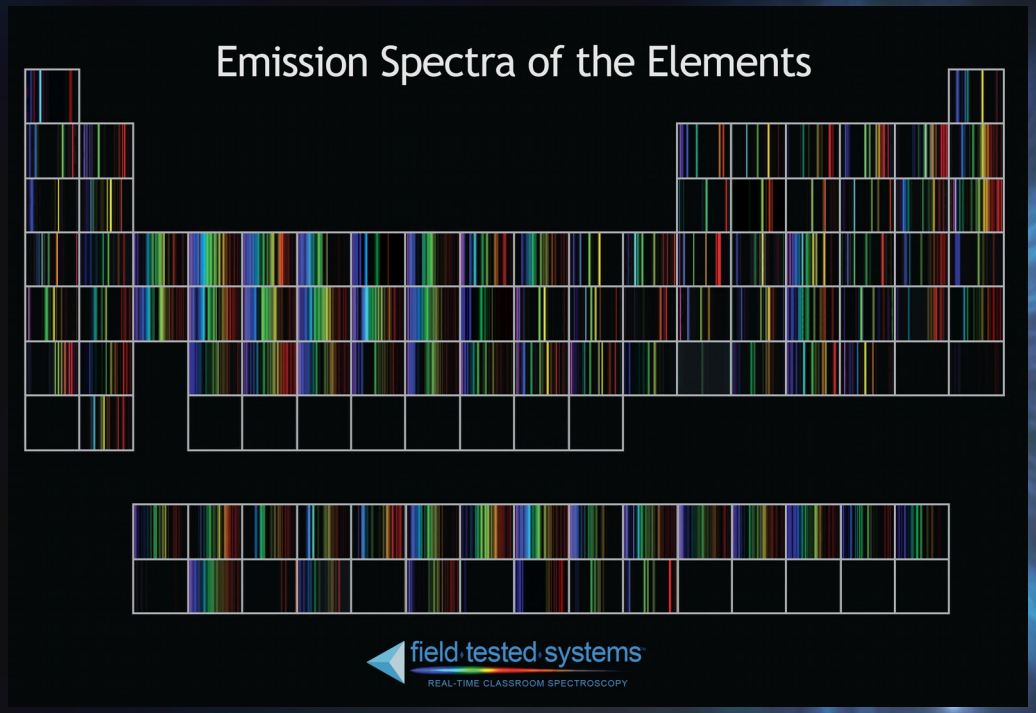
Key questions

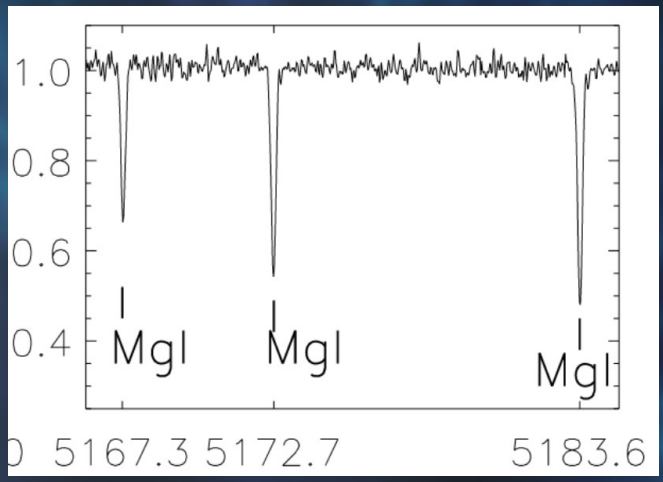
Are the PopIII stars still around or second generation stars is our closest probes to them?

How far we are to understand the mass distribution of first stars?

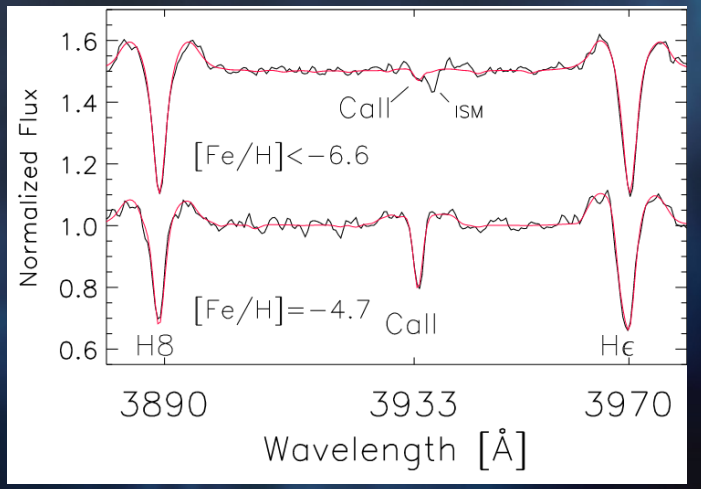
How many hyper/mega metal-poor stars are needed to converge our supernova yields?

Observability in the optical

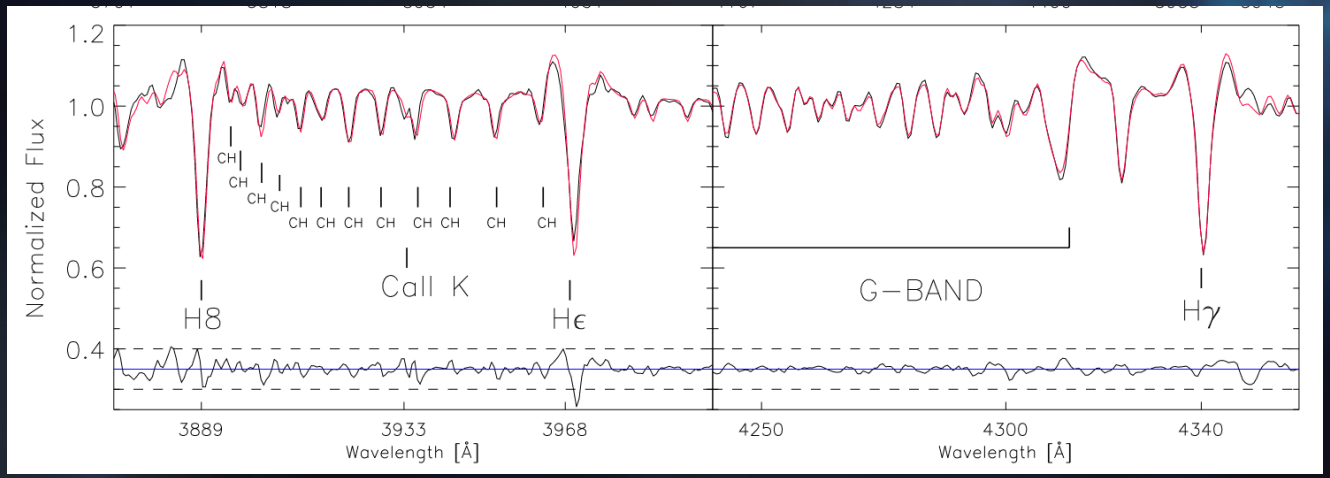




DA+2019a

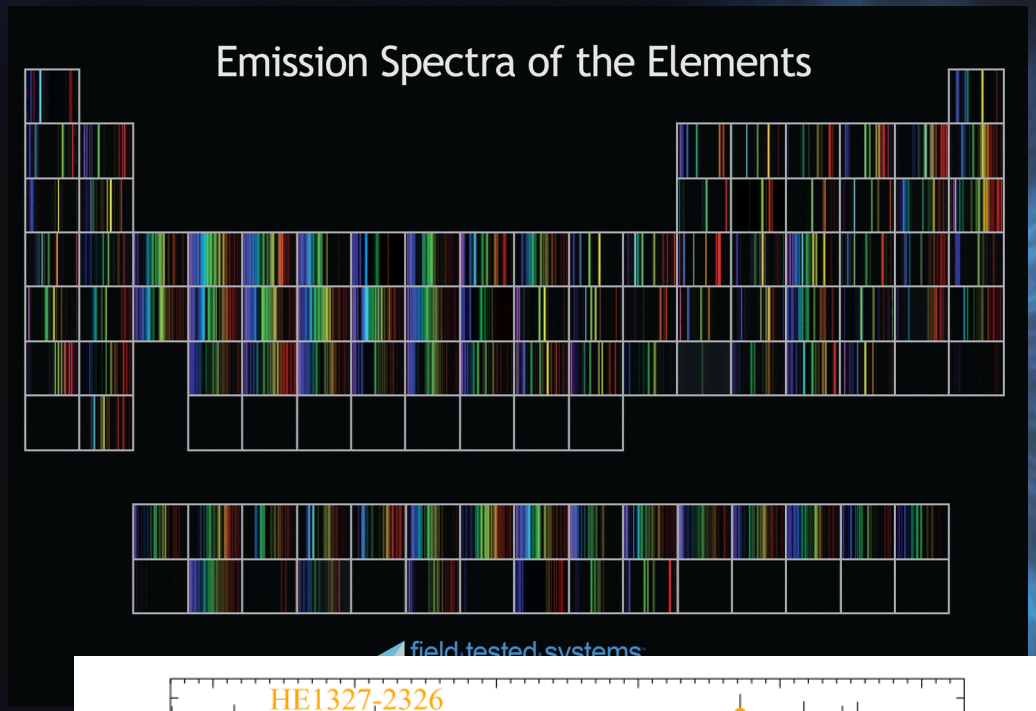


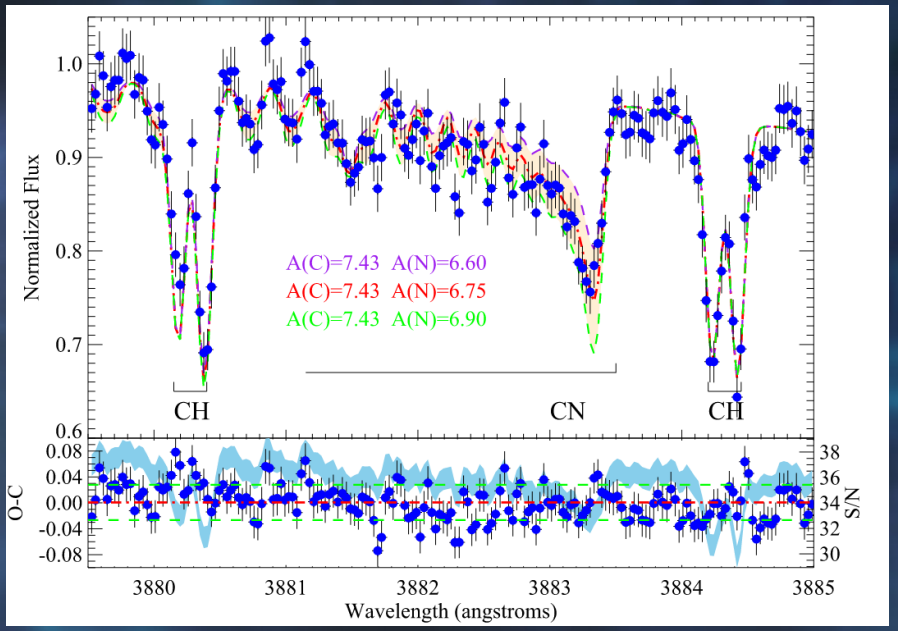
DA+2018b

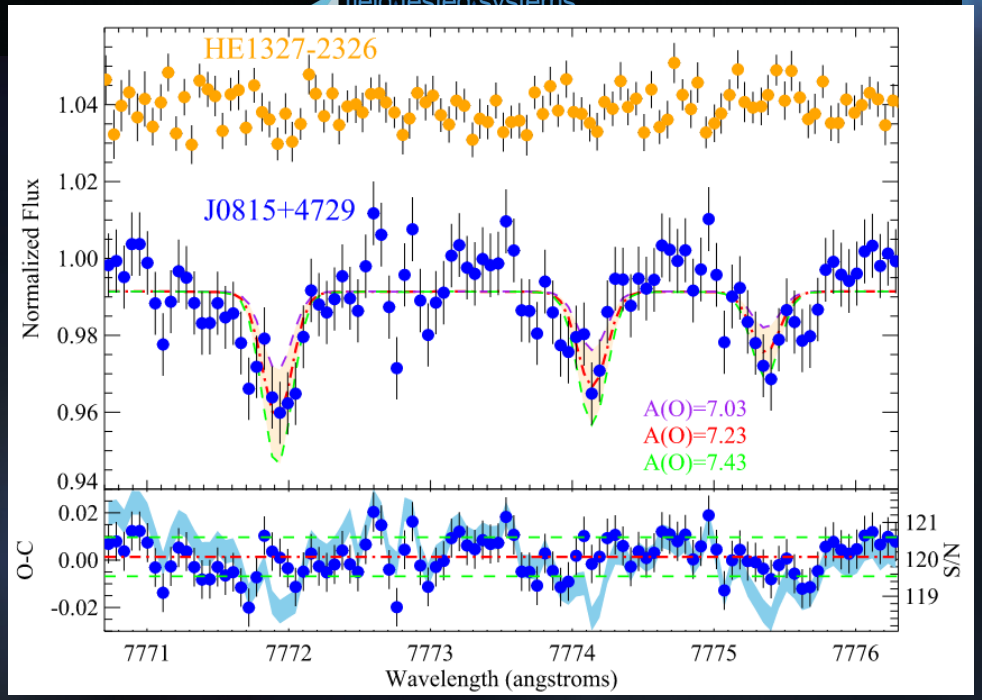


DA+2018a

Observability in the optical

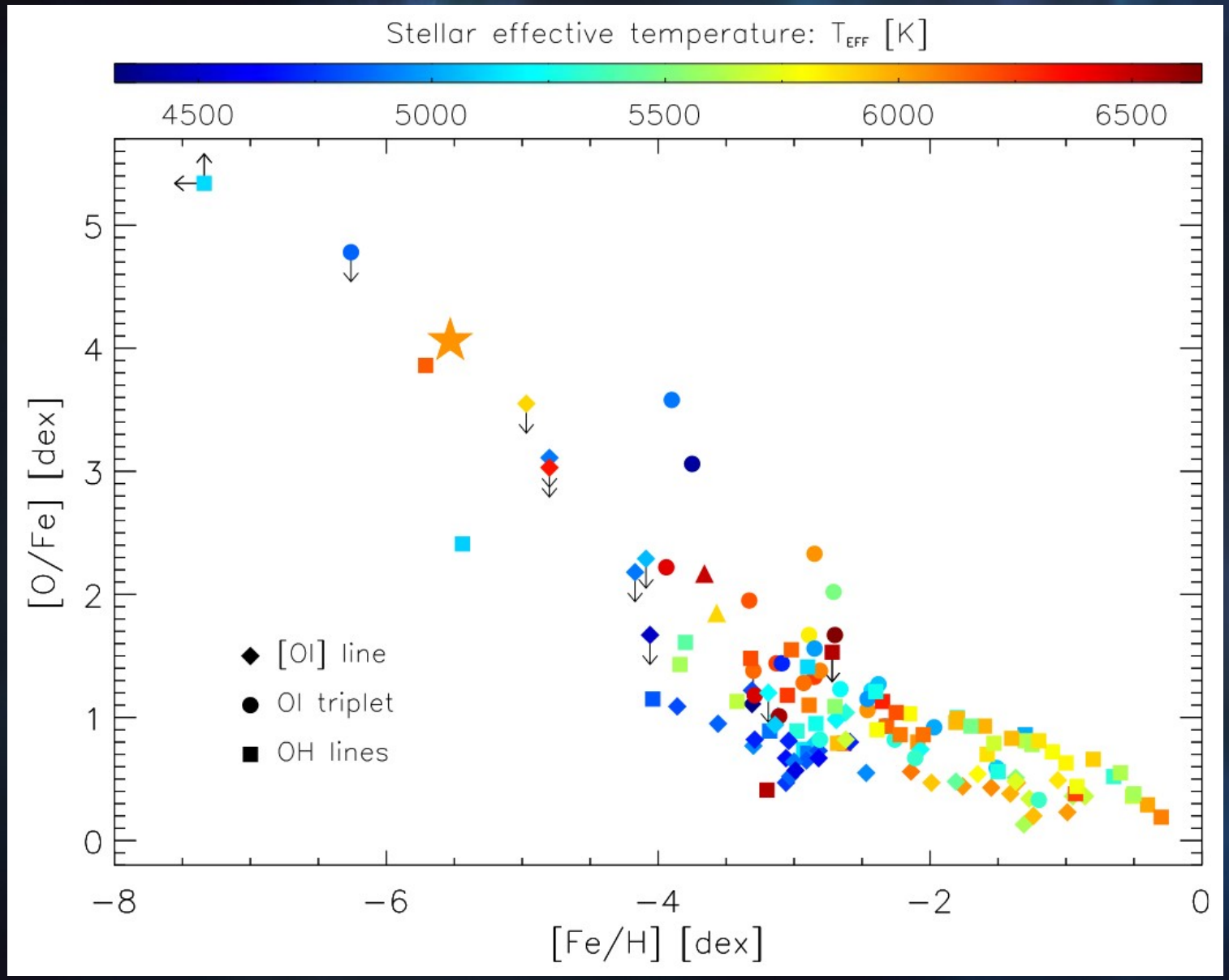






González Hernández, DA, et al. 2020

Observability in the optical



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