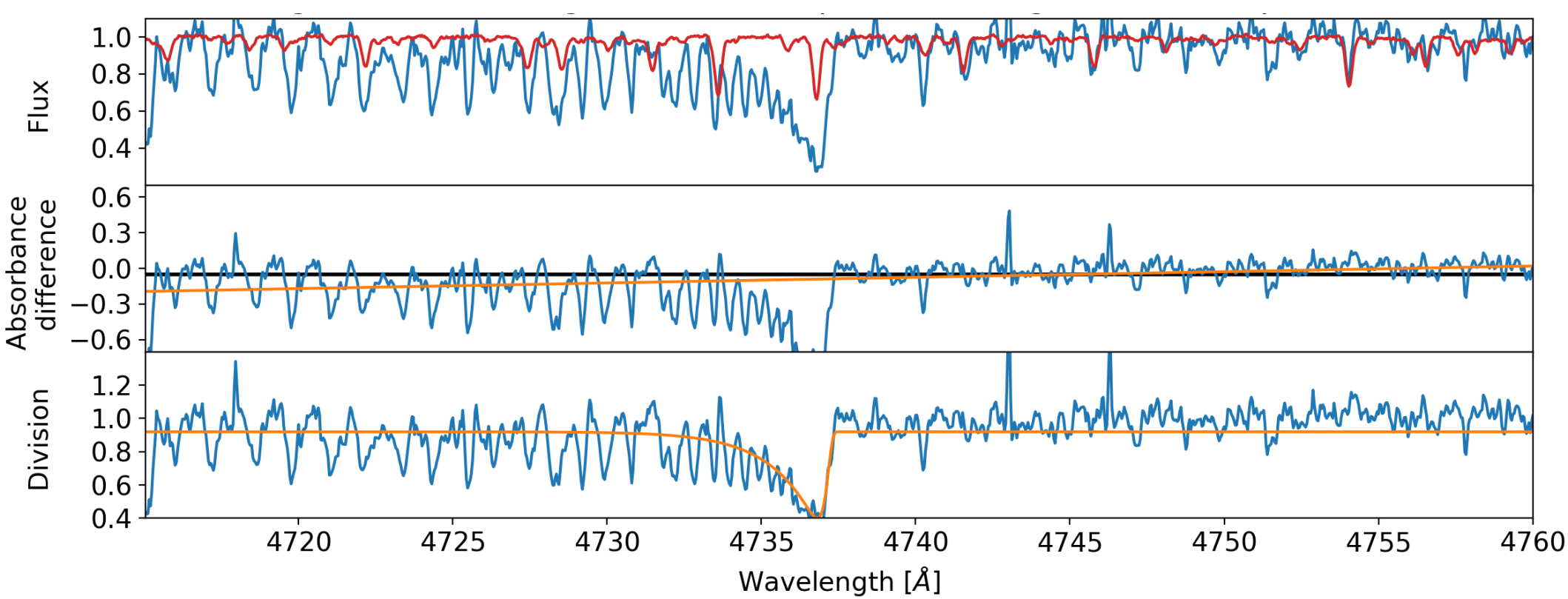


Galactic halo: carbon-enhanced stars

Klemen Čotar

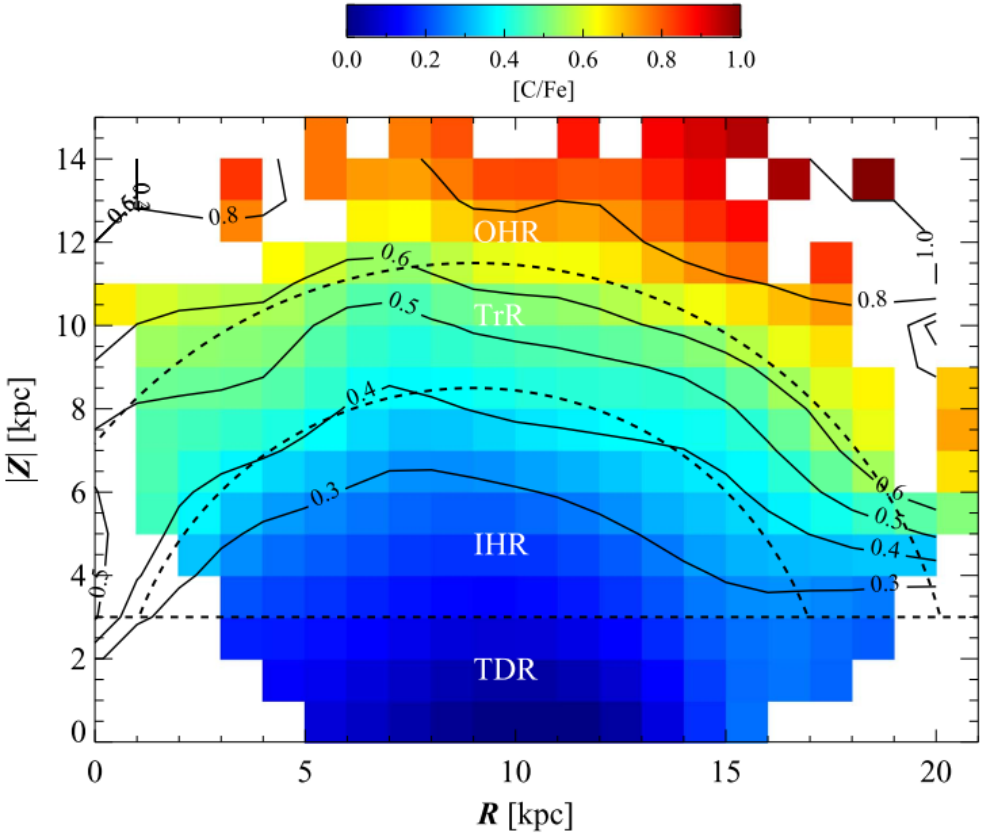
Faculty of Mathematics and Physics, Ljubljana

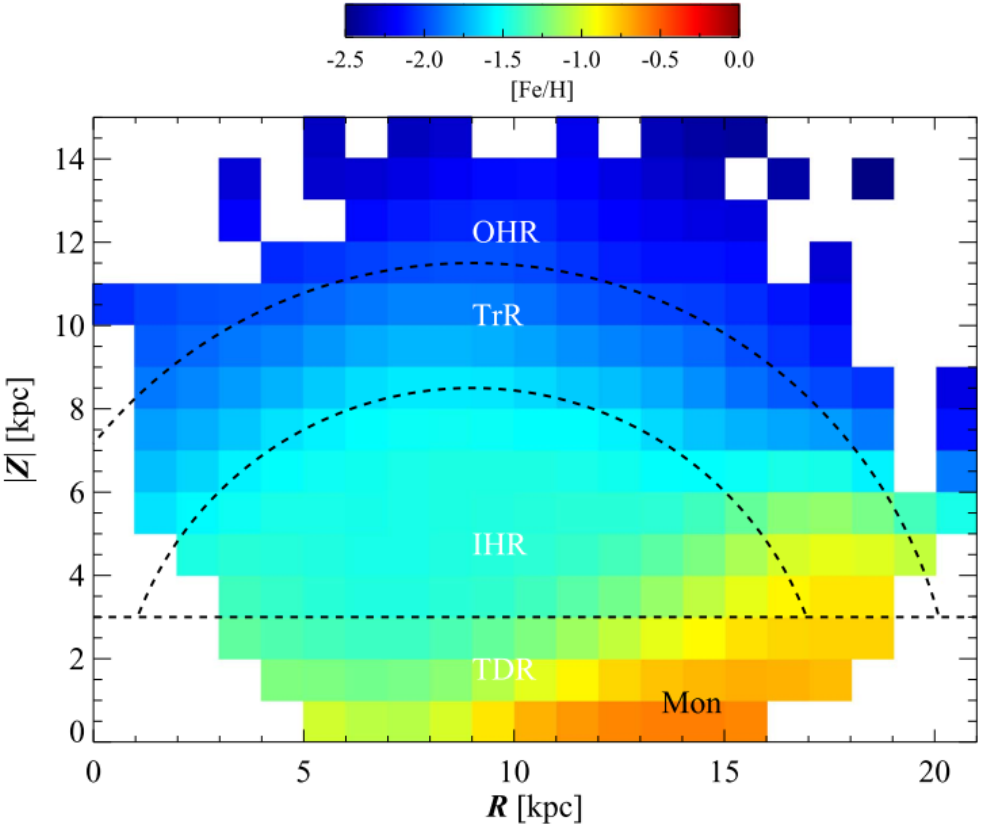
Overview

- Recent published results concerning carbon-enhanced and CEMP stars in the Galactic halo
- Open questions about CEMP stars
- Putting discovery of interesting objects among GALAH spectra into context of other research

Carbonicity map

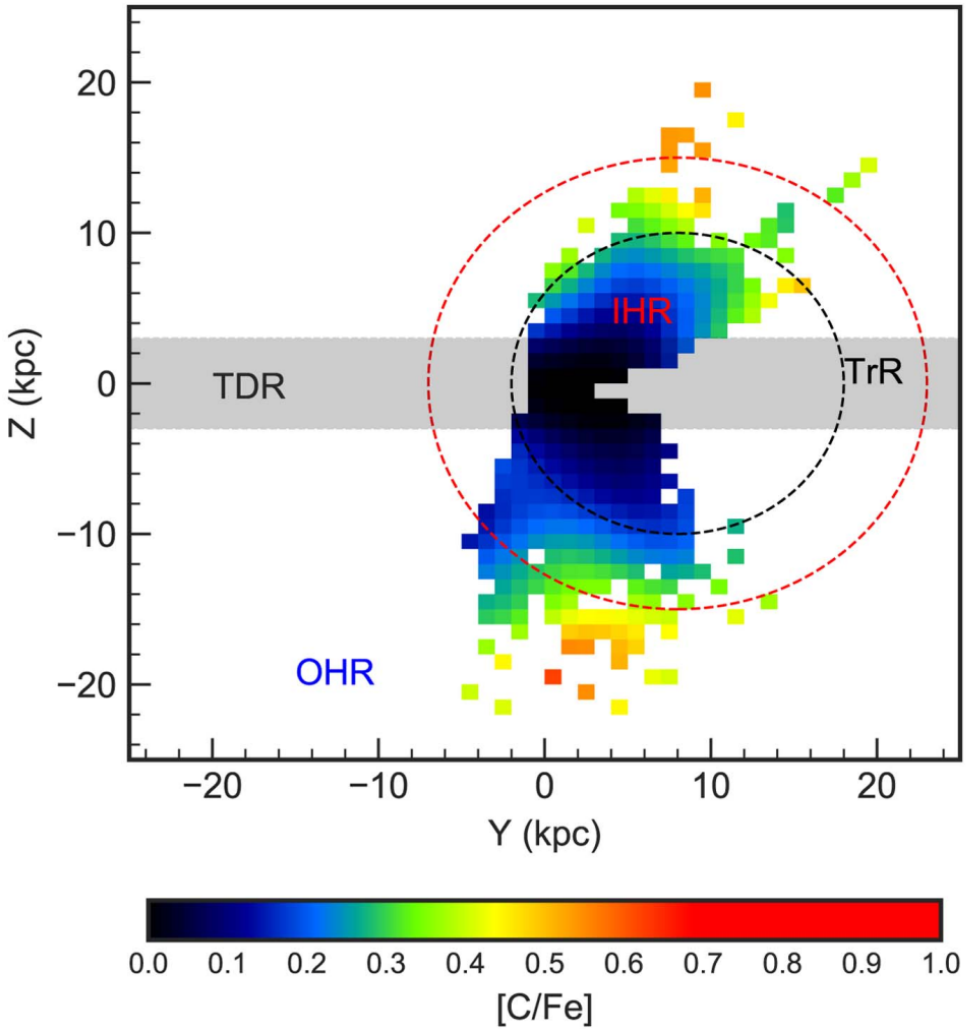
- First map of [C/Fe] (Lee+ 2017)
- Dual nature of Galactic halo
- Different chemical formation history?

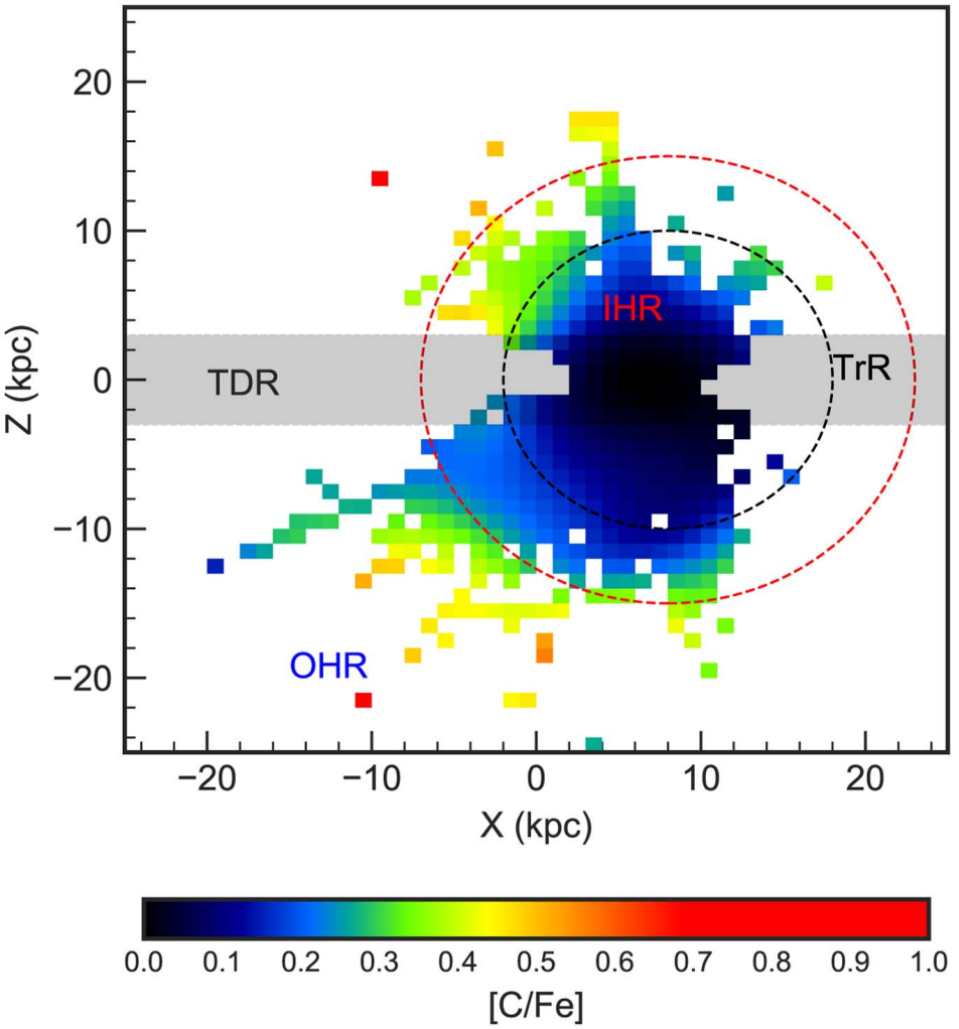




Carbonicity map

- AEGIS medium resolution sample (Yoon+ 2018)
- Similar findings as previous studies

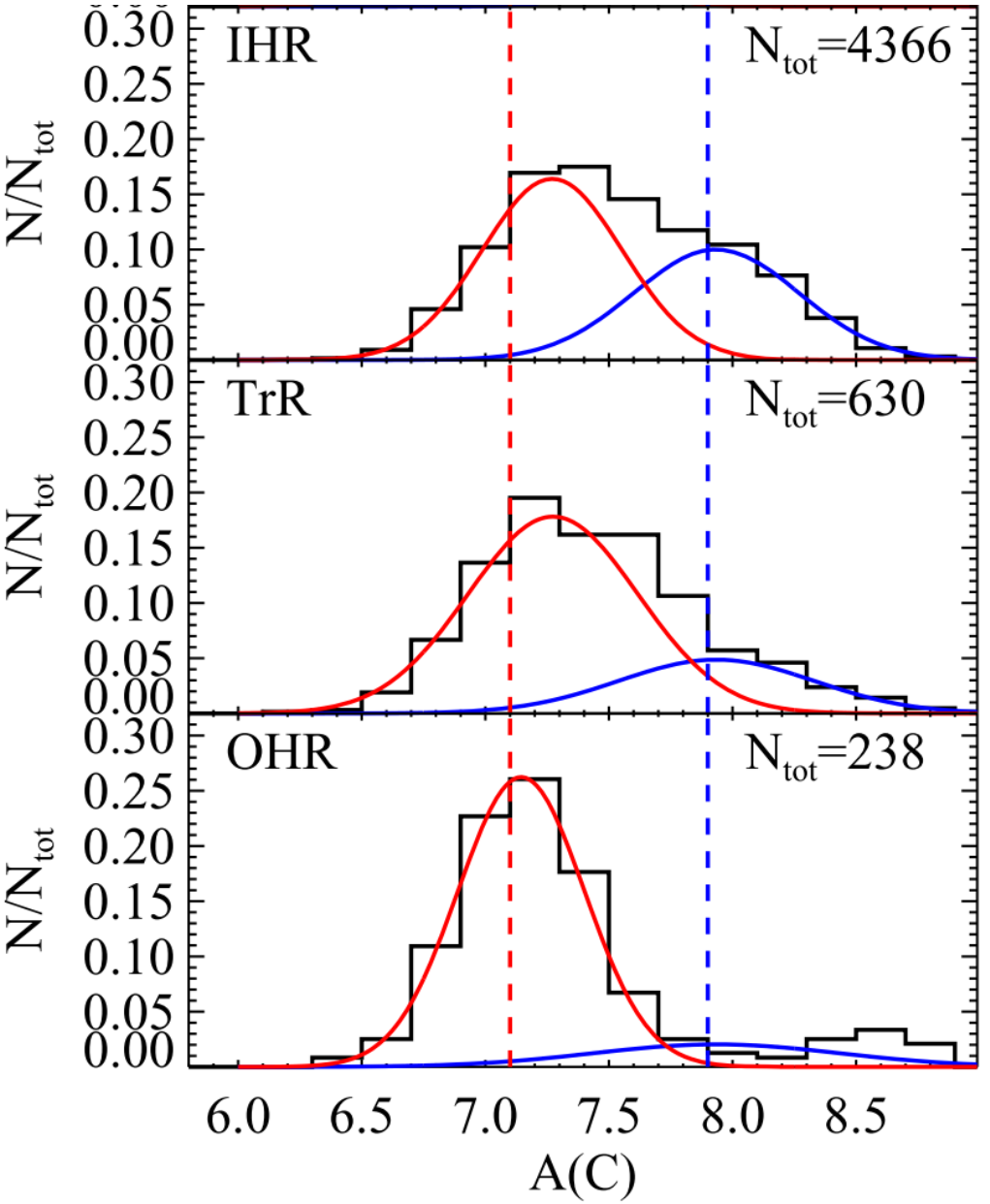




Carbonicity map

- Distribution of absolute carbon abundance
- Different population of CEMP stars among halo regions
- Tracers of assembly history and astrophysical processes

- Inner – CEMP-s
- Outer – CEMP-no



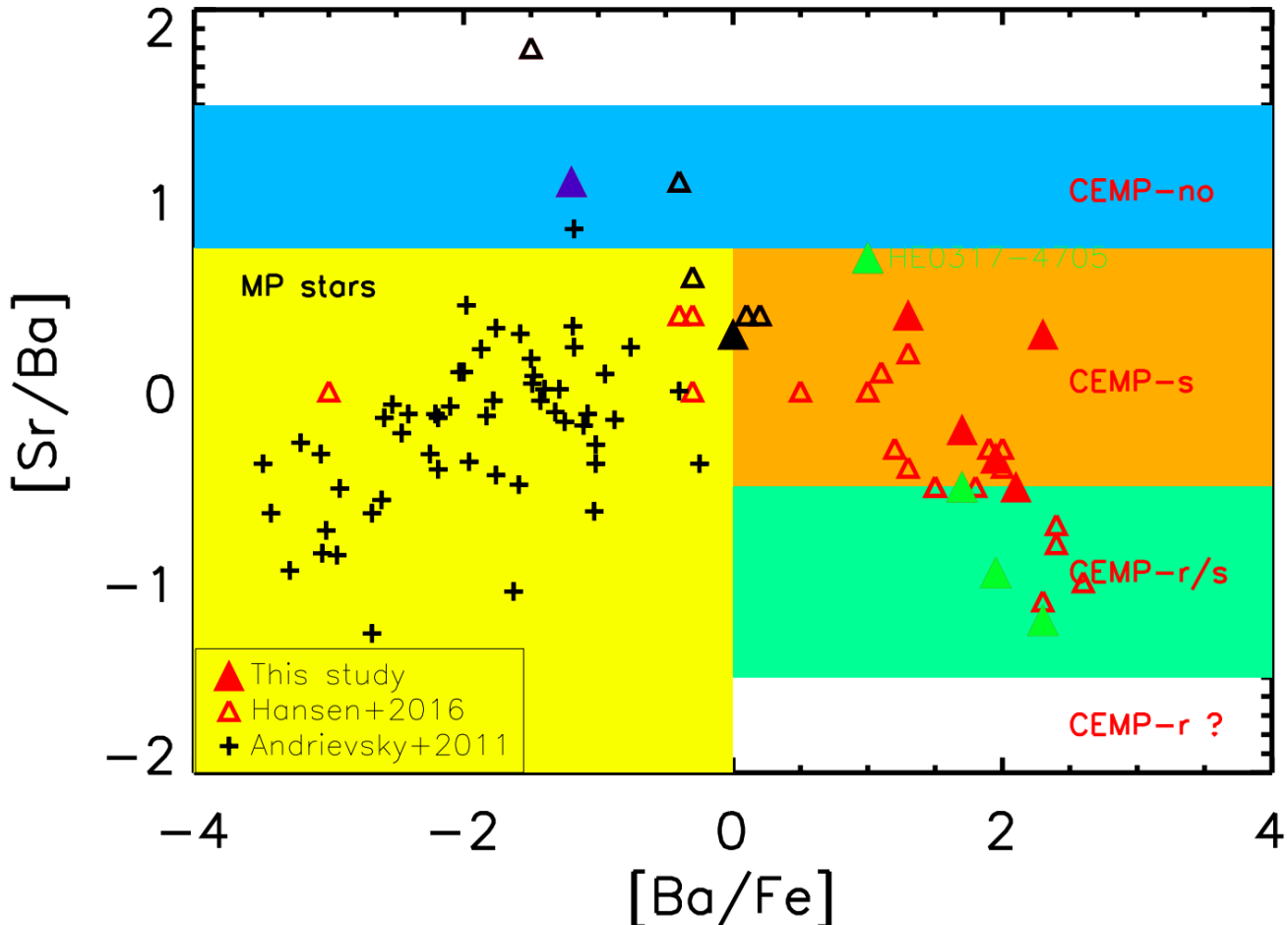
CEMP classification schema

- Metal-poor carbon-enhanced stars
  [Fe/H] < -1, [C/Fe] > 0.7
- -s / -no delineation historically made on [Ba/Fe] that requires high resolution spectra

- Medium resolution spectra → delineation can be made only on absolute C abundance
- Thresholds may vary among stellar types
- Effect of NLTE correction can be high for C

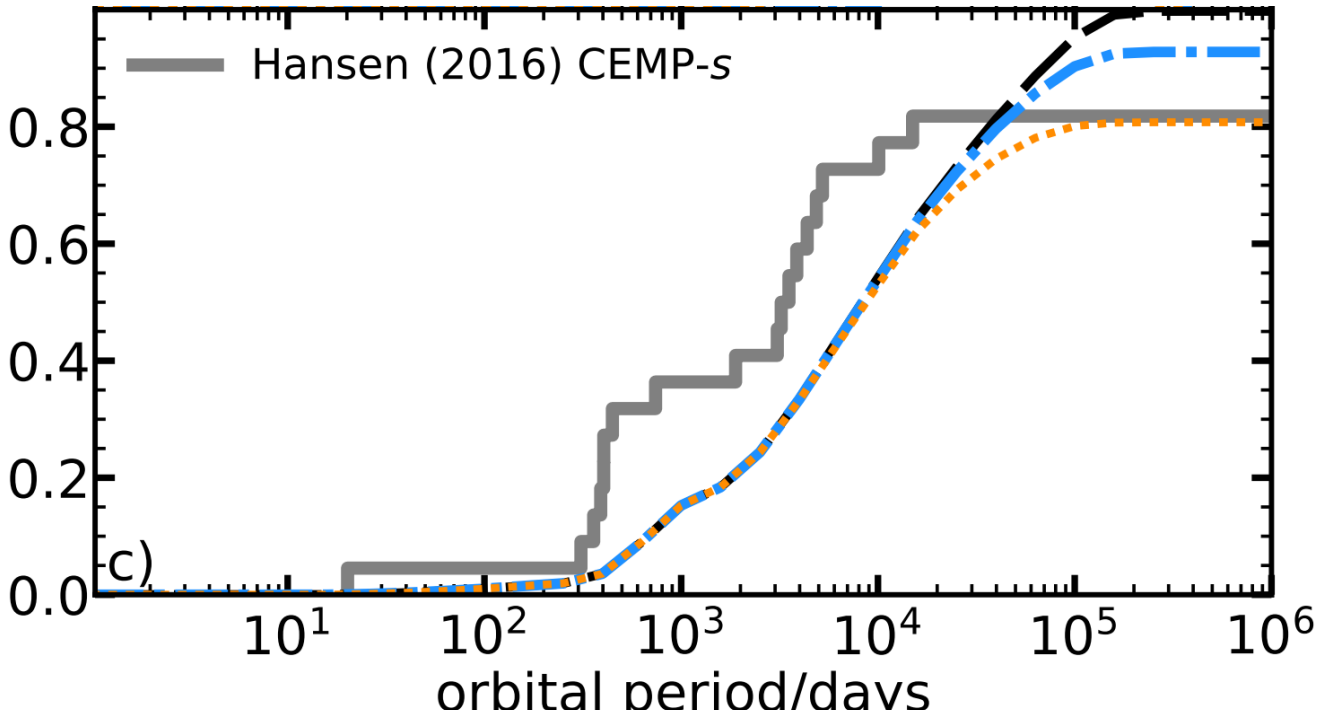
CEMP classification schema

- Novel approach (Hansen+ 2019)
- Use of Ba and Sr – less effected by NLTE
- Better delineation between processes and sites



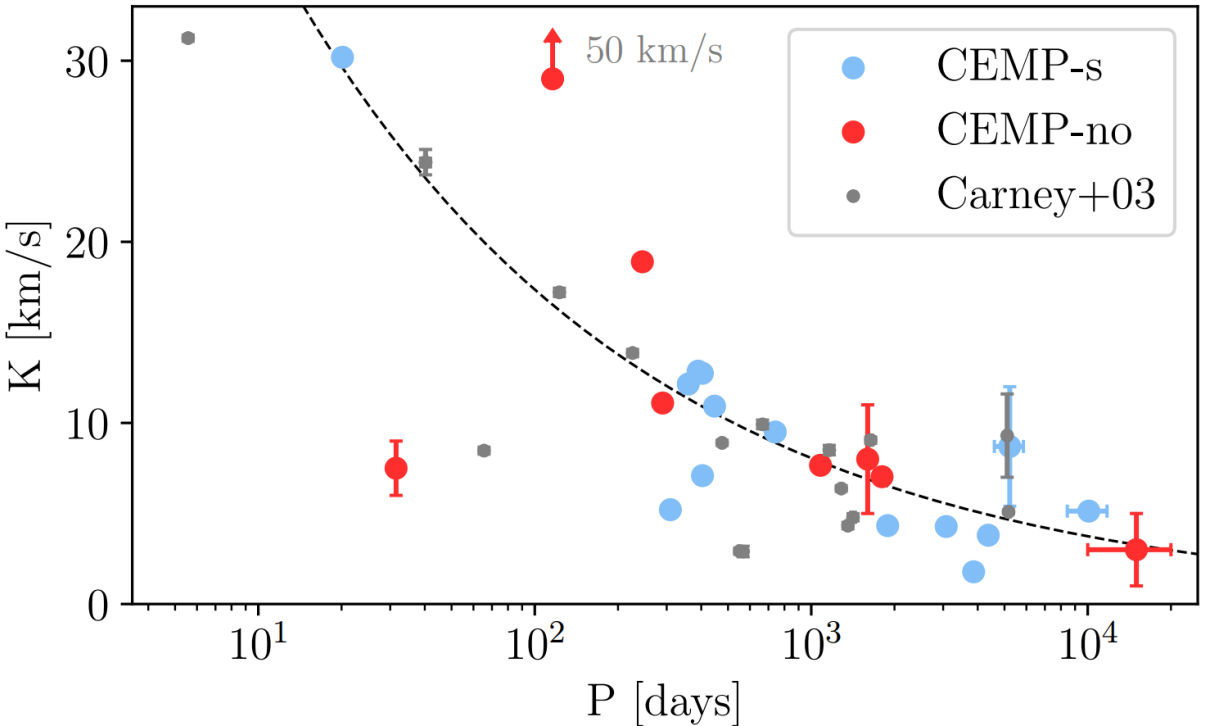
CEMP-s progenitors

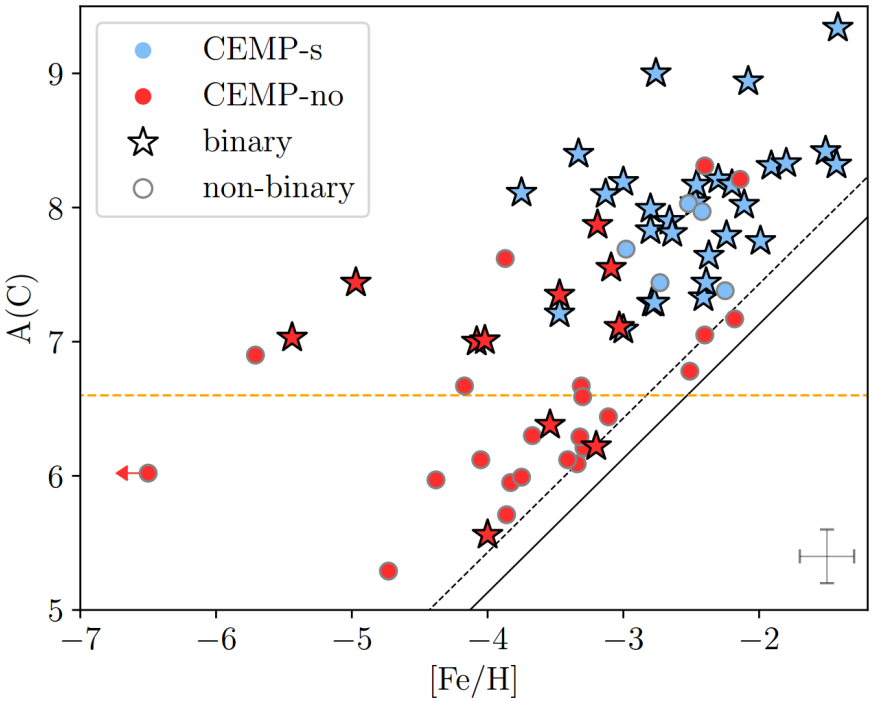
- Analysis of orbital configurations (Abate+ 2018)
- Caparison between observations and binary evolution models – disagreement, not reproducible
- Population of metal-poor binaries not as seen in local neighborhood? – necessity to recognize distant unresolved binaries (Čotar+ 2019b)
- Wrong wind models?



CEMP-no progenitors

- Primordial enrichment
- Multiplicity as a sign of multiple pathways – 11 new binaries (Arentsen+ 2019)
- Binaries with very long periods – Gaia might not help here
- Similar orbital distribution

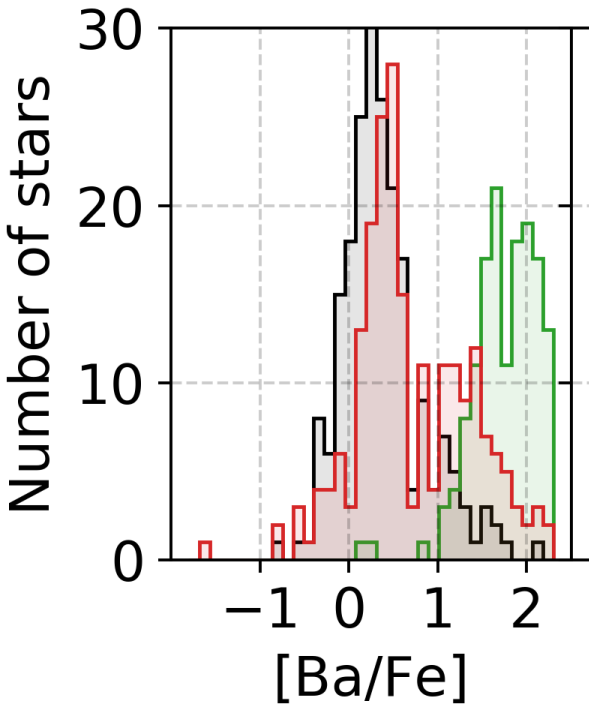


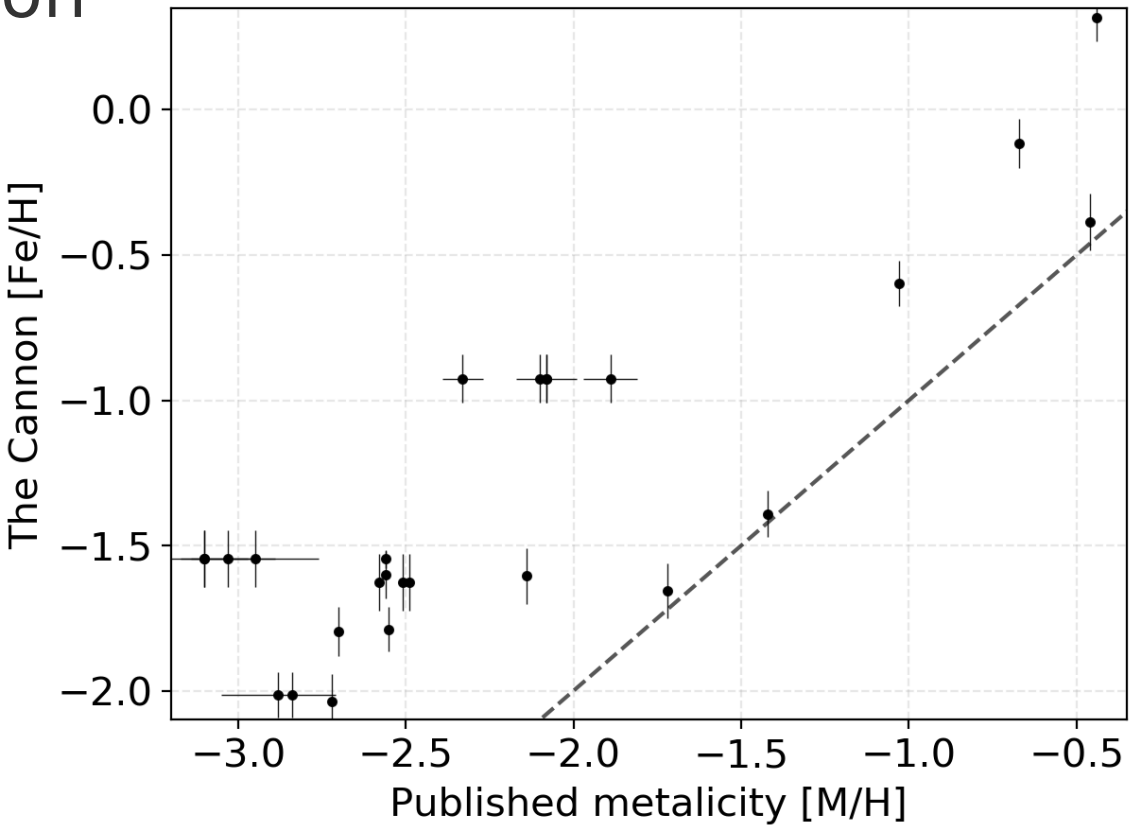


GALAH survey

(Čotar+ 2019a)

- Detection based on SWAN C_2 molecular bands
- 900+ CH stars, 28 CEMP candidates
- Probably of CEMP-no population, low s-process
- Uncertain classification

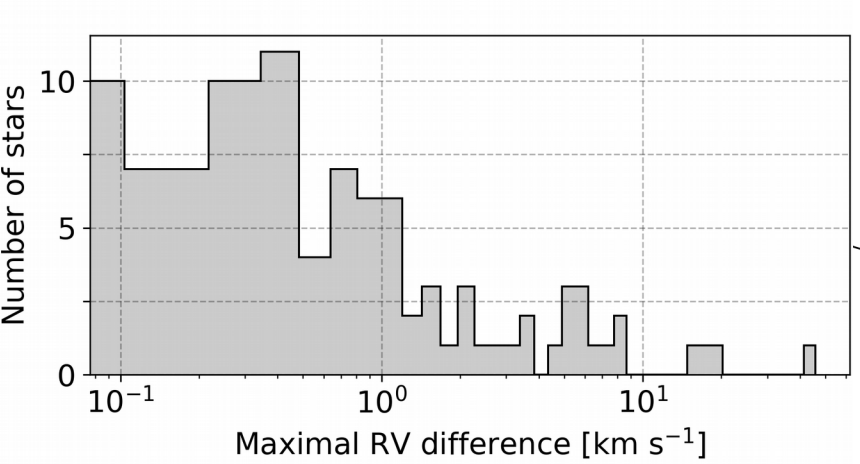


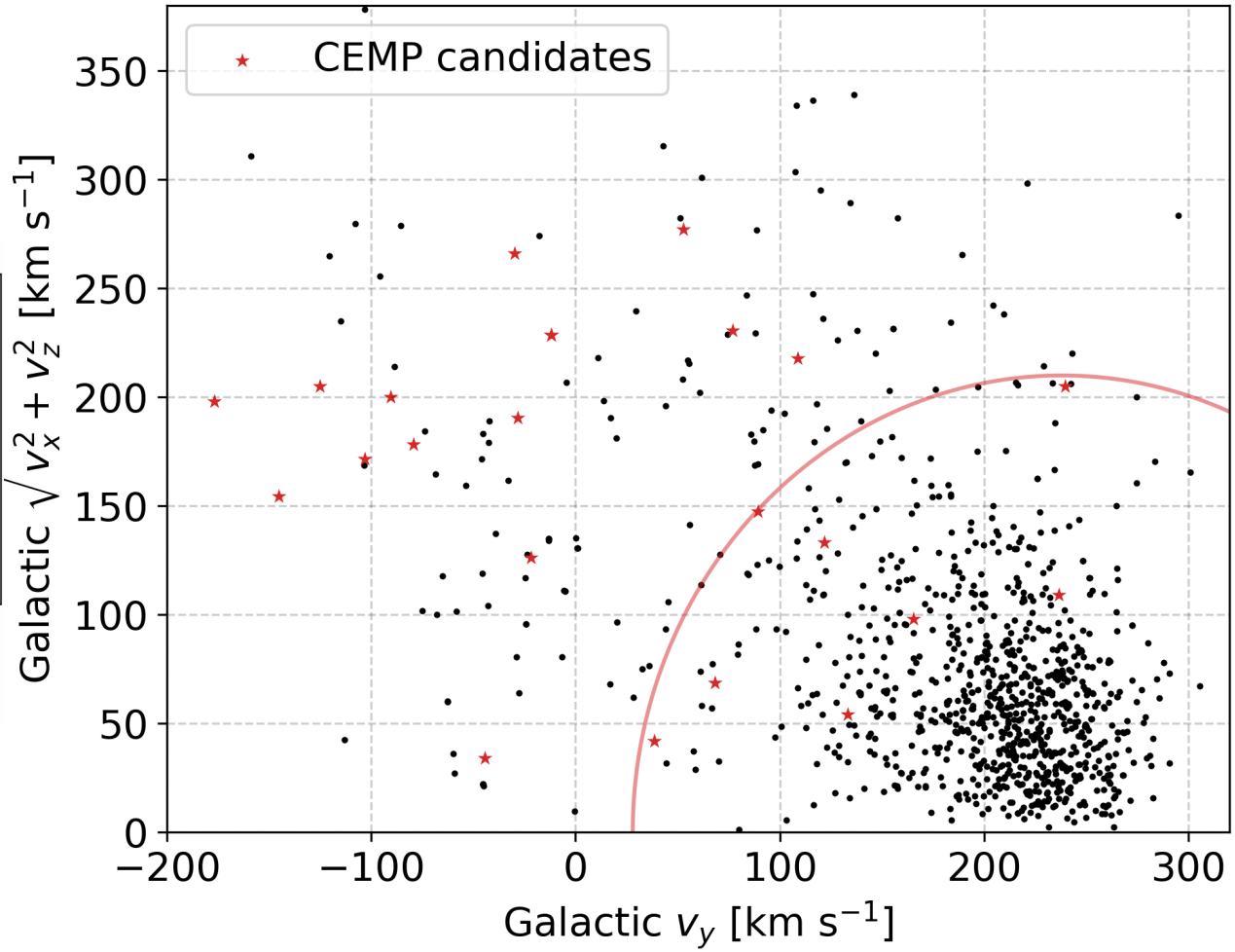


GALAH survey

(Čotar+ 2019a)

- Orbit mostly consistent with halo members
- Follow-up radial velocity survey needed to further investigate nature of those objects





Looking ahead

- Precise long-term radial velocity measurements to uncover wide binaries

- Detailed and accurate abundances to determine progenitors and their mass