2014-11-13 – GES Second Science Meeting

C-enriched objects and binaries

S. Van Eck, T. Merle, C. Abia
T. Masseron, G. Traven, T. Zwitter,
D. Hatzidimitriou, C. Worley, A. Hourihane

WG14

1. Common outliers dictionary

updated and adopted by all WG
http://great.ast.cam.ac.uk/GESwiki/GesWg/GesWg14

+ Node specific flags

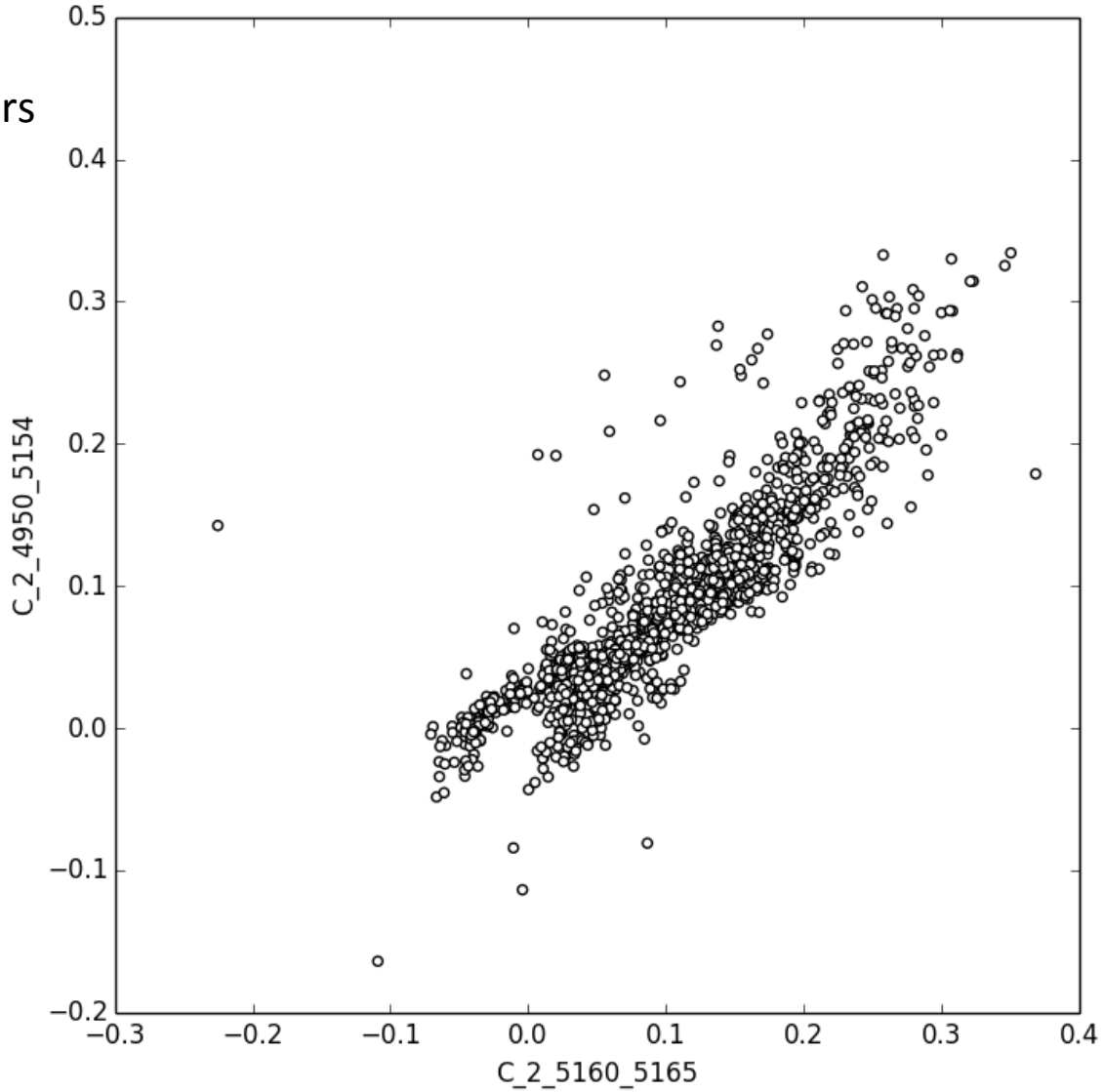
2. Peculiarities that endanger parameters and abundances determinations:

- Reduction issues
- Binaries → T. Merle (2nd part of this talk)
- Emission lines (continuum placement) → T. Zwitter
- Molecular bands (continuum placement)

3. Peculiar objects characterization

UVES: Tracking C-enriched stars

- Narrow band spectroscopic filters
Here: C2 bands
+ GES UVES



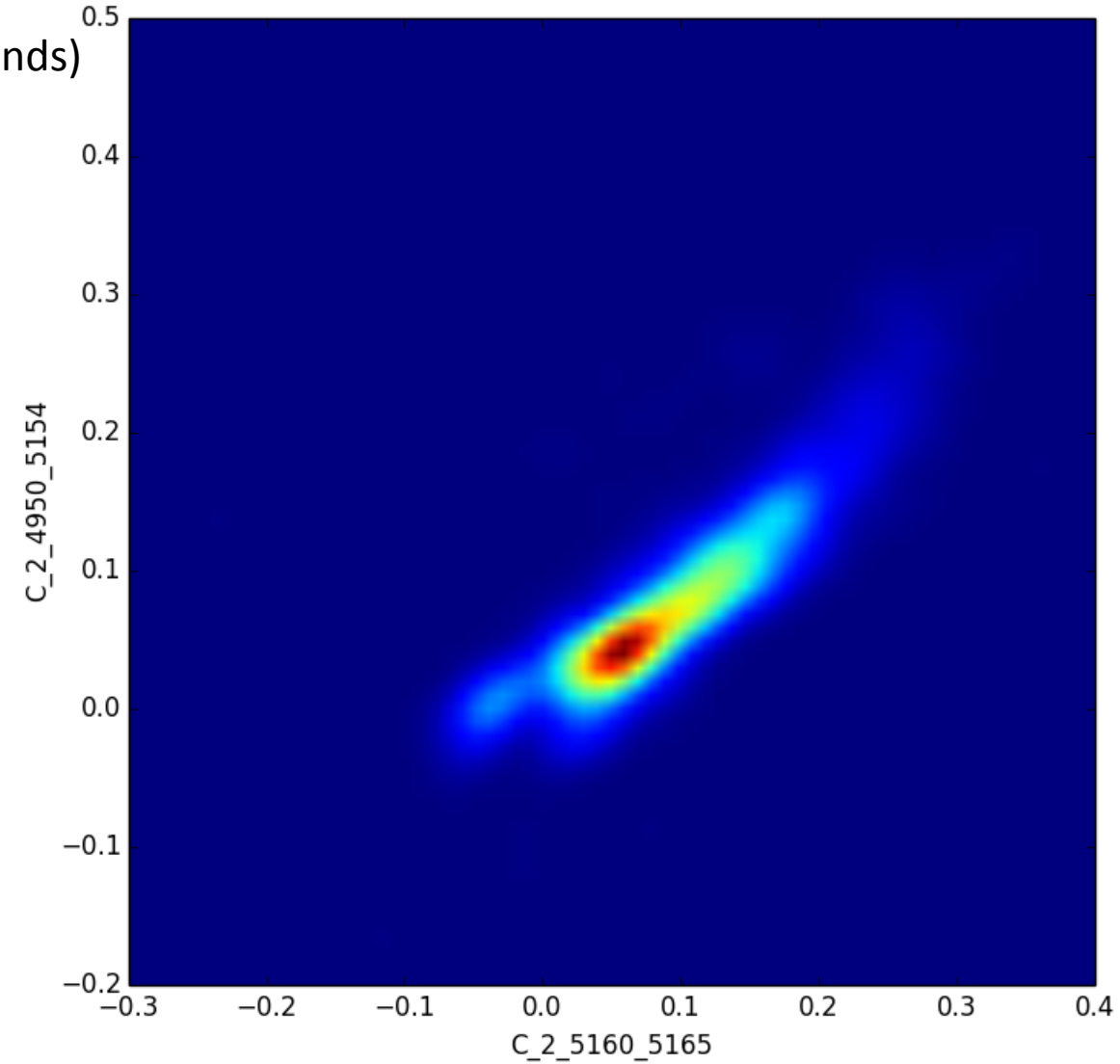
UVES: Tracking C-enriched stars

- 2 filters (C2 bands)

+ (all) GES UVES

- Keep low S/N

- Density plot



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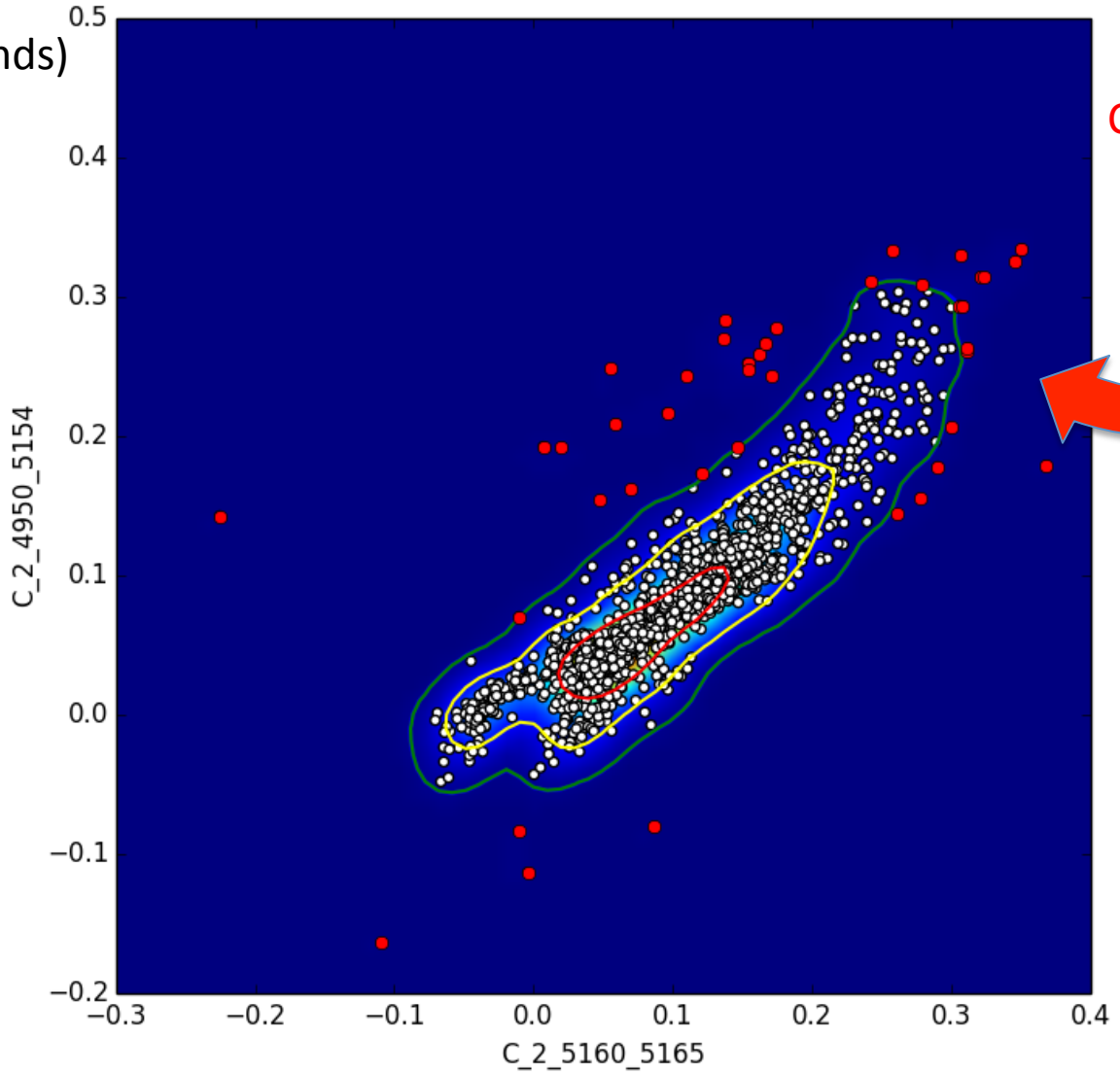

C-enriched objects

GES C-enriched candidates: parameters

CNAME	Teff	log g	[Fe/H]	Vt	remarks
18033785-3009201	4483	2.44	0.19	1.5	GES
19241832+0057159	5467	4.51	0.13	1.01	GES
15532925-4059522	5256	3.80	0.30	1.2	GES
21094323-0156596	5415	4.4	0.27	1.08	GES
17251797-5531479	4370	1.05	0.1	2.3	WG14
	4372	1.04	-0.04	2.48	GES
12581939-6453533	4062	1.39	0.01	1.20	WG14
	4062	1.39	0.01	1.41	GES
12202074+0318444	4440	1.95	-0.40	1.50	GES
19584548+1929320	4144	2.41	0.11	1.3	WG14
	3899	1.51	-0.06	1.49	GES
11140585-7729058	3900	0.50	-0.50	1.6	WG14
	3900	1.59	-0.1	-	GES
18472891-0542189	4540	3.72	-	-	WG14
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21300361-1230394	4490	4.70	0.0	1.0	WG14
	4494	4.69	-	-	GES
13201799-0503160	4962	3.37	-0.45	1.24	GES
14194521-0506063	4722	3.04	-0.26	1.36	GES

BACCHUS code (interactive mode)
+ Visual inspection of spectra
→ GES parameters confirmed in most cases
Clearly improved in 4 cases out of 13 (coolest objects)

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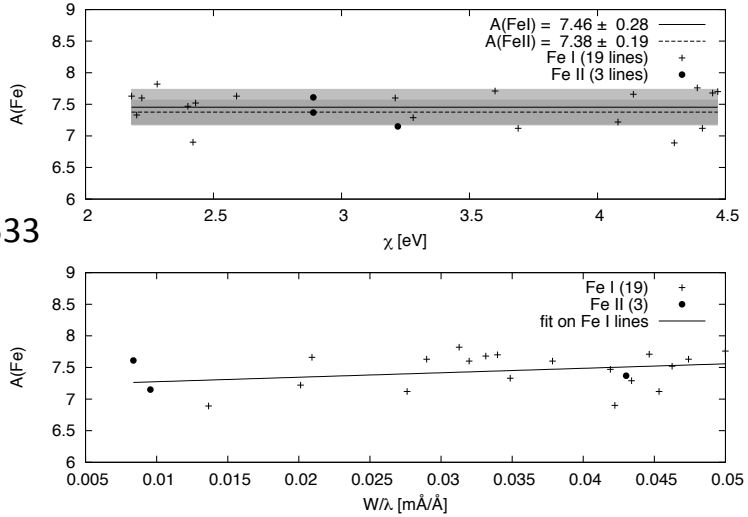
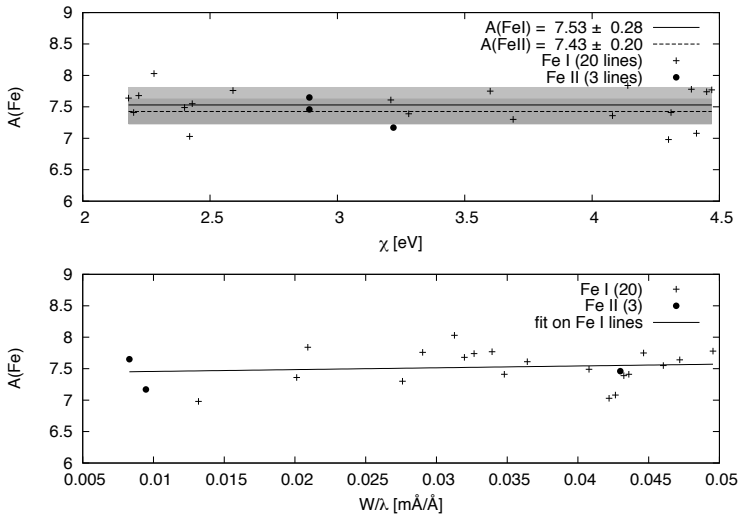
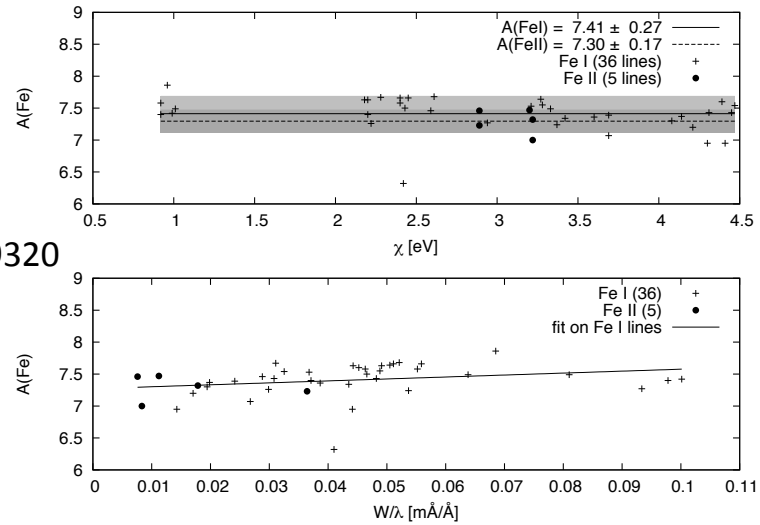
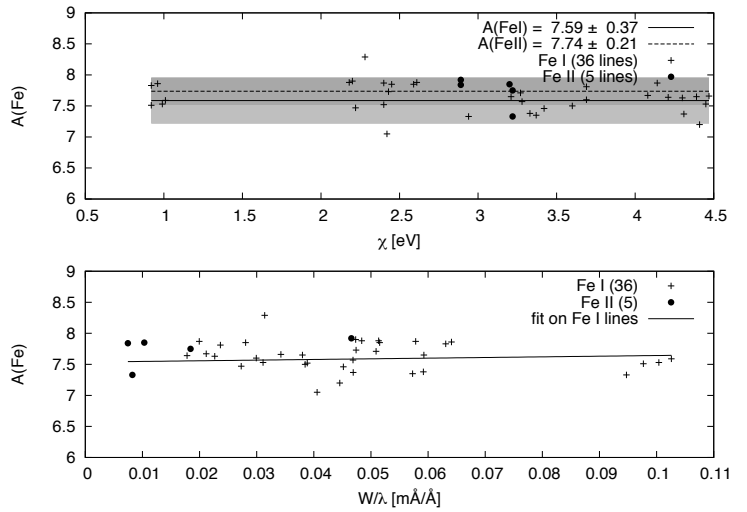
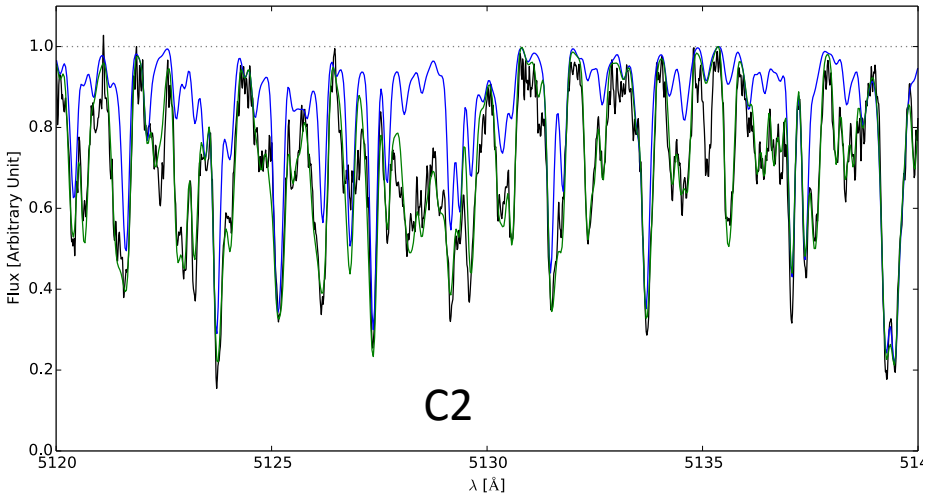
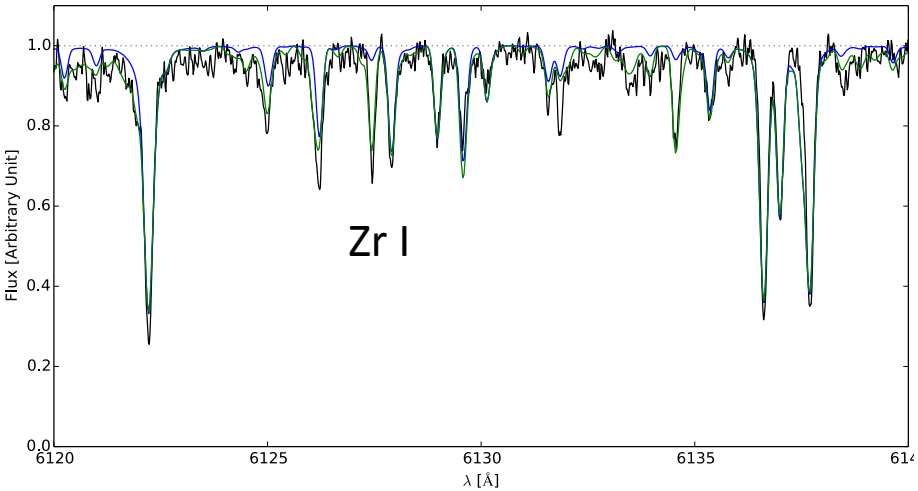
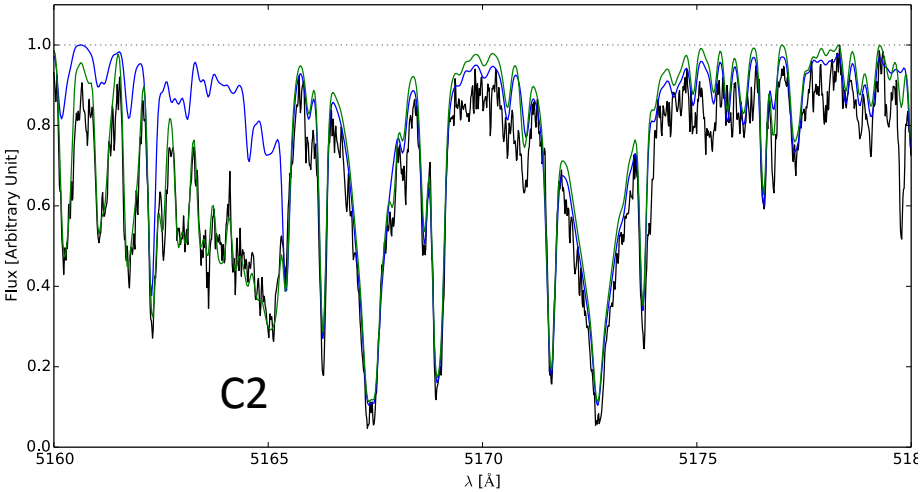
GES C-enriched candidates: parameters

	GES	WG14 reprocessed
12581939-6453533		
19584548+1929320		

GES C-enriched candidates: parameters





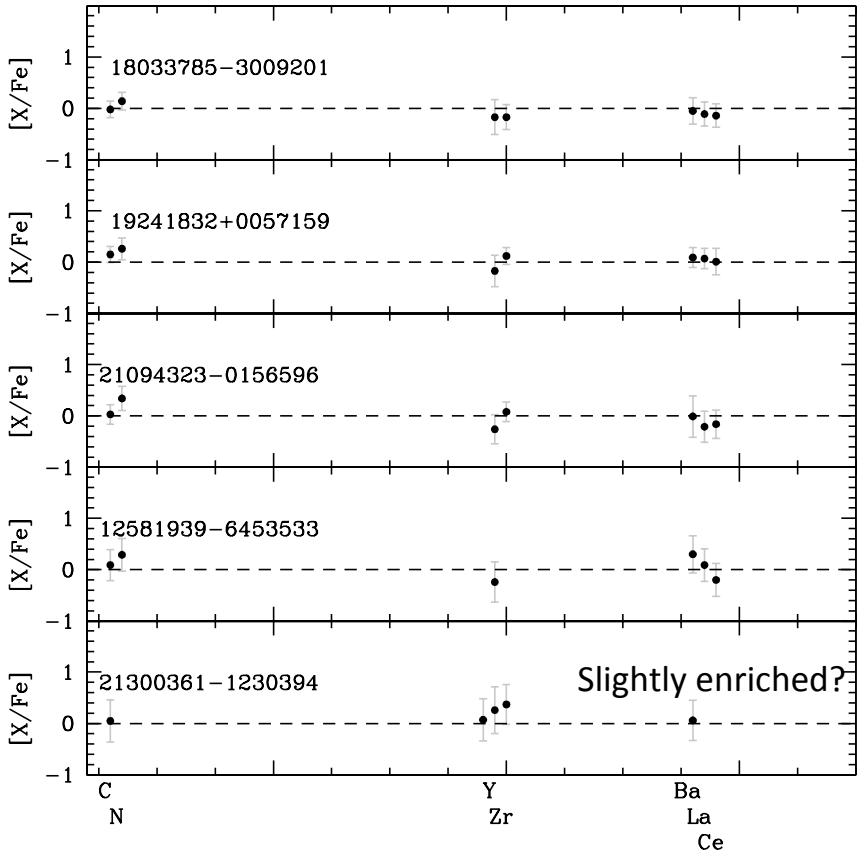


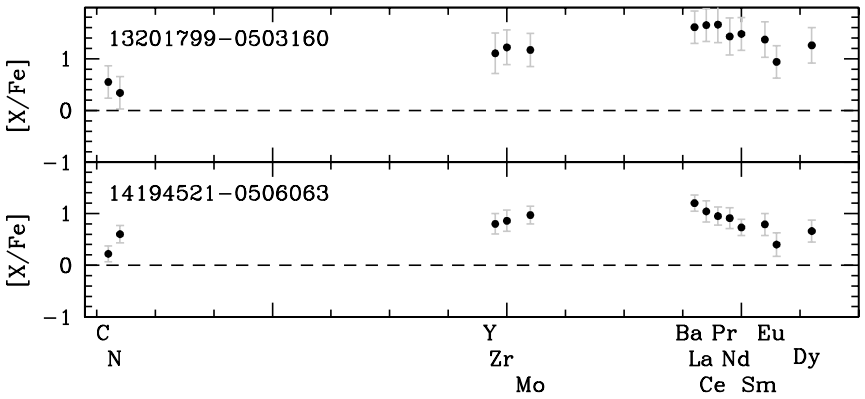
GES parameters + solar-scaled composition

WG14 parameters + re-determined CNO

GES C-enriched candidates: abundances

GES atomic and molecular linelists
Careful selection of spectral lines





Non-enriched objects

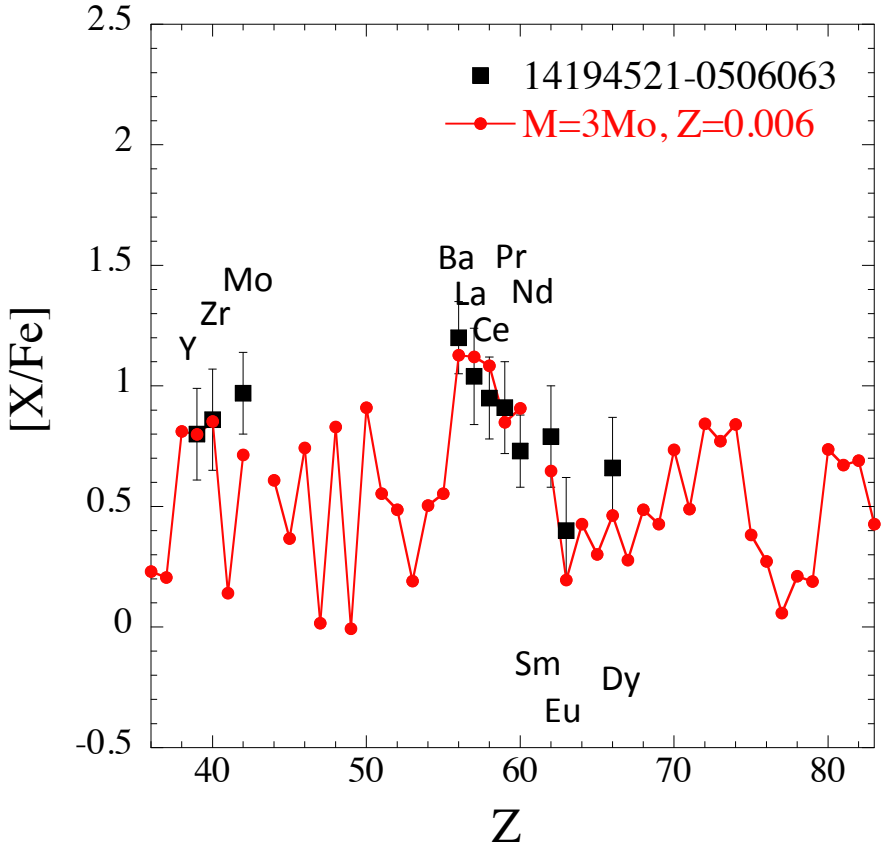
s-process enriched objects

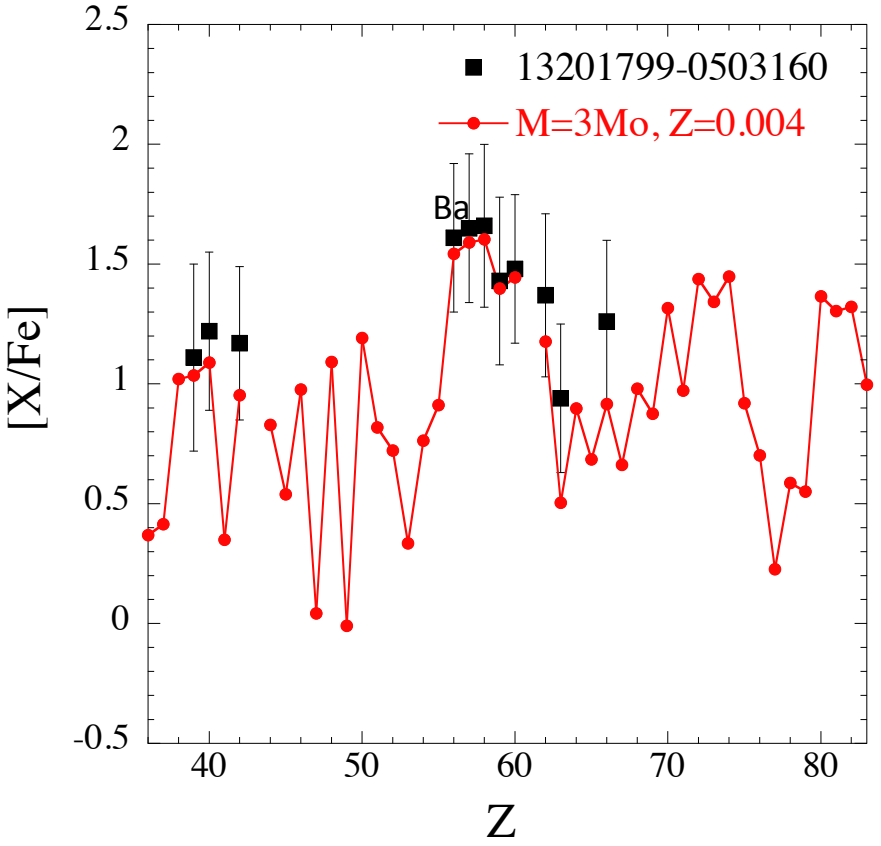
→ Extrinsic stars, previously unknown in the literature

GES extrinsic stars: abundances

Comparison with s-process nucleosynthesis predictions (S. Goriely)

- Partial mixing of protons below the convective envelope: λ_{pm} = 10%
- Exponentially decreasing neutron density profile (Goriely & Mowlavi 2000)
- Vassiliadis & Wood (1993) mass loss rate





→ s-process abundance profile predictions
agree remarkably well with abundance determinations of GES extrinsic stars

GES extrinsic stars: binarity

- Radial velocities:

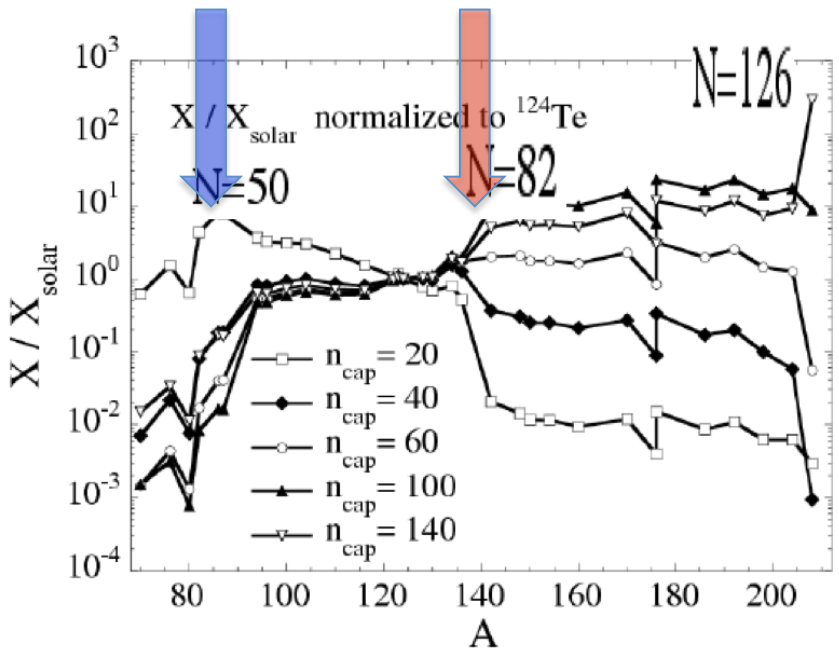
CNAME	Date	Vr(km/s)	Err_Vr(km/s)	Ref.	
GES 13201799-0503160	2008-03-1	2.6	0.9	Kordopatis et al. 2013	→ binary
	2012-06-22	42.18	0.6	GES	
GES 14194521-0506063	2011-2012	6	7	Newton et al. 2014	→ Binary (?)
	2012-05-29 to 2012-06-21	-20.4	0.6	GES	

→ Extrinsic stars:
owe their overabundances to a mass transfer from a TPAGB star

Extrinsic stars: why are they interesting?

1st peak:
Light s
Sr, Y, Zr

2nd peak:
Heavy s
Ba, La, Ce



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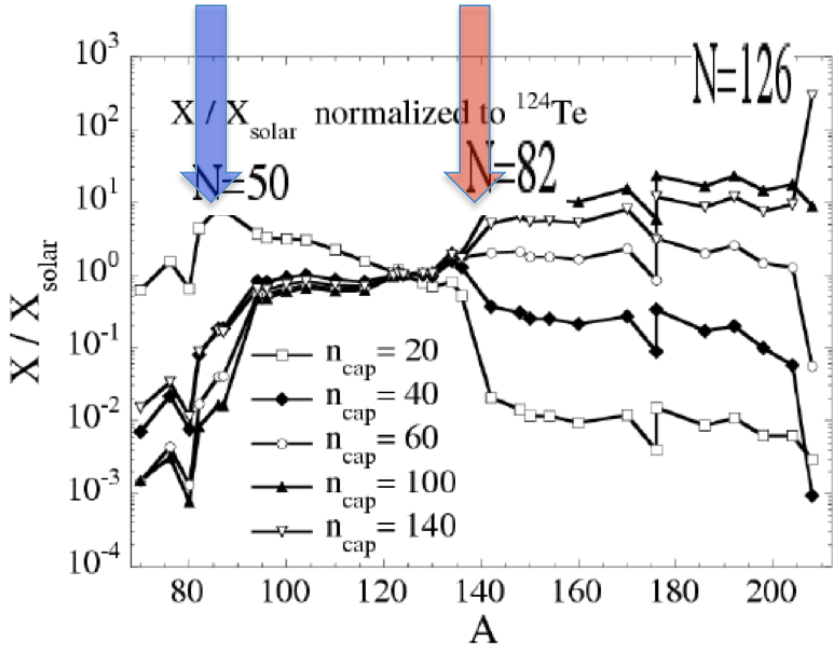

[hs/ls] is expected to depend on:

- [Fe/H]
- Stellar mass
- Partial mixing parameters
- Time spent on the AGB (mass loss)

→ efficient nucleosynthesis probe

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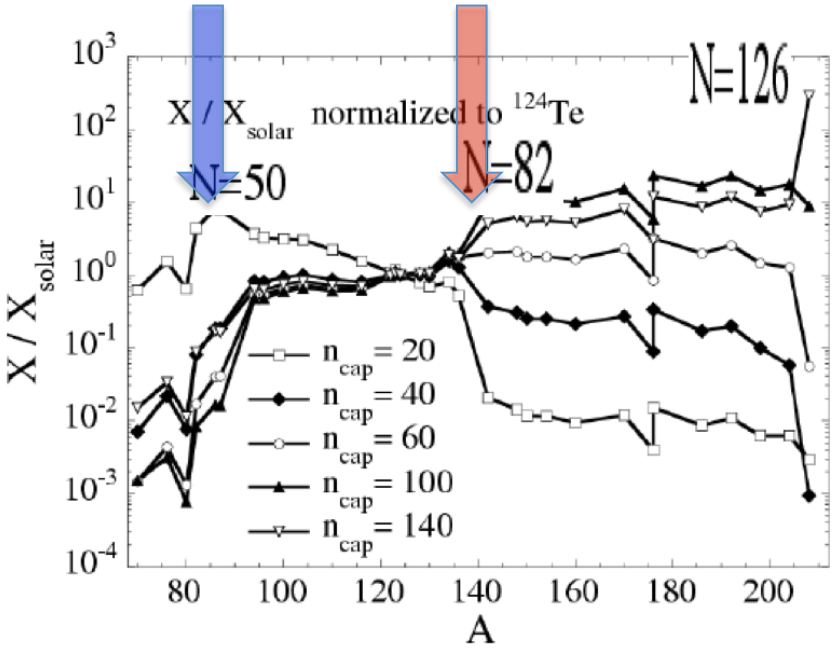

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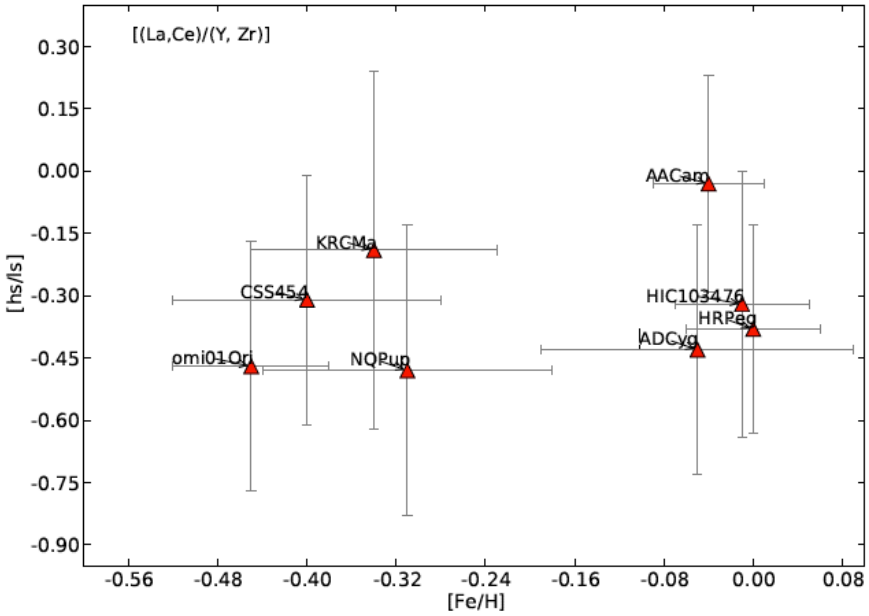
However: No observed correlation
[hs/ls] vs [Fe/H]
observed for AGB stars!



Instrinsic S stars
(HERMES (Mercator) spectra)
Van Eck &Neyskens in prep.

Extrinsic stars: why are they interesting?

→ But strong correlation observed for extrinsic stars

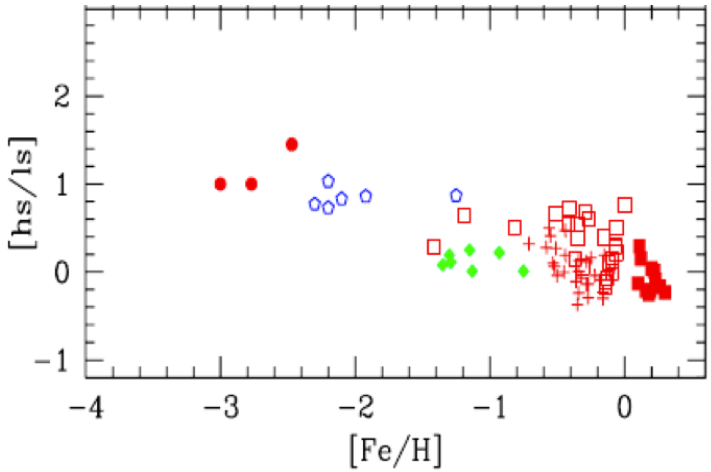


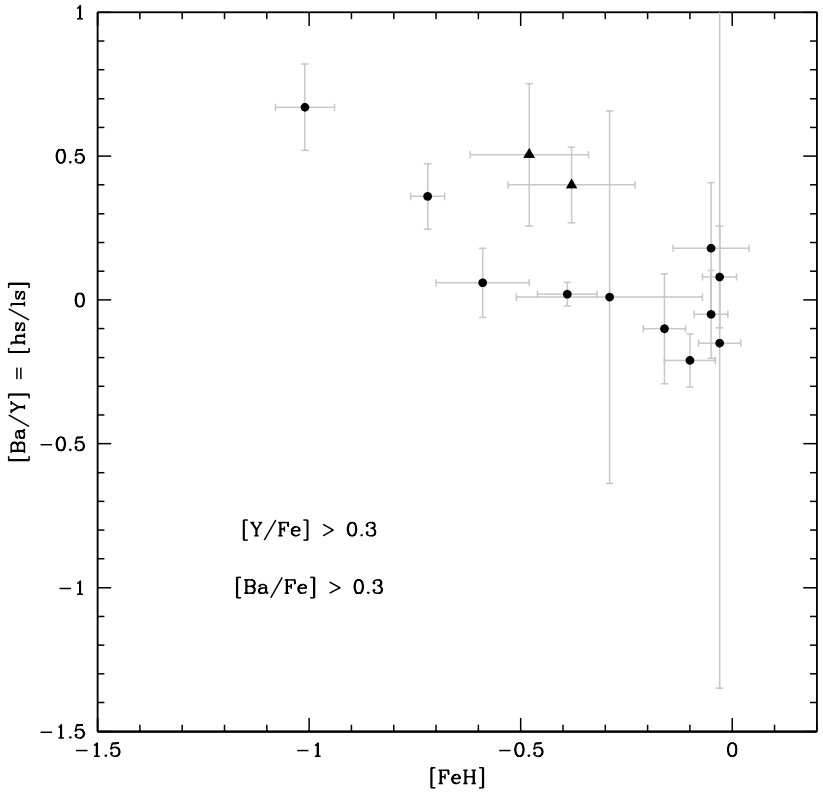
Fig. 9. Diagram of [s/Fe] *versus* [Fe/H] (top) and [hs/ls] *versus* [Fe/H] (bottom) for several classes of chemically peculiar binary stars. Metal-rich barium stars (*filled red squares*); barium giants previously analyzed (*red open squares*); barium dwarfs (*plus red crosses*); CH stars (*blue open polygons*); yellow symbiotic (*green symbols*) and CEMP-s stars which are *members* of binary systems (*red filled circles*)

Ba, yellow symbiotics, CH, CEMP-s
Pereira et al., 2001A&A 533, A51

Extrinsic stars bear the signature of an AGB-completed s-process
→ efficient s-process nucleosynthesis probes

Extrinsic stars: why are they interesting?

→ And correlation observed for extrinsic GES stars



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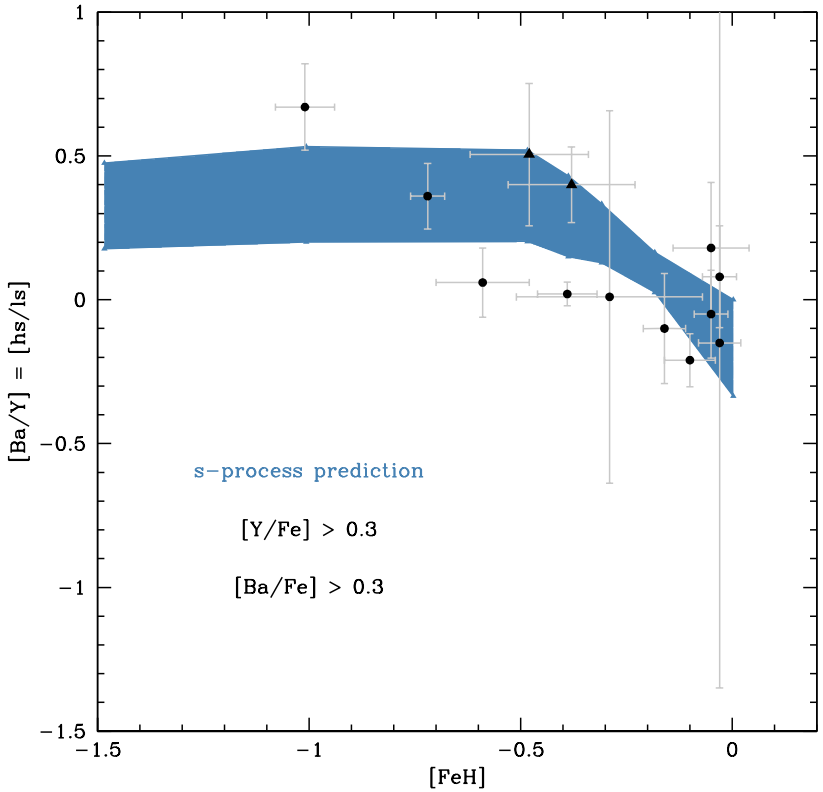

S. Goriely, L. Siess

→The high precision of GES abundances will allow to detect a possible second parameter in the [hs/ls] vs [Fe/H] correlation

Conclusions

- Extrinsic stars uncovered and characterized within the GES
- Complementary approaches of WG11 and WG14
- Binarity checked (already confirmed in some cases)
- Contrarily to
  - AGB stars (very cool, crowded spectra)
  - or post-AGB stars (are they really post-"TPAGB"?)

  extrinsic stars are ideal probes of AGB nucleosynthesis
- Follow-up observations