The lightest neutron-capture elements from Ge to Ba in very metal-poor stars

Different teams working on this subject: "r-process alliance" (Roederer et al.) etc... our group GEPI+IAG et al. "japanese group" (Wanajo et al.)





Neutron capture elements in very metal-poor stars

The EMP ([Fe/H]<-3) and VMP ([Fe/H]<-2) stars are very old They were formed in the first Gyr of the Galaxy matter enriched only by the ejecta of massive stars with a lifetime <1 Gyr

The "heavy" elements could be created by neutron captures: -the **main r** process (merging of NS) -the **weak-s** process (massive rotating stars) -the **weak-r** process (Proto neutron stars wind in core collapse supernovae)

[the low mass AGB stars had no time to enrich the matter through the main "s" process.]

What can we learn from the Extremely metal-poor stars ?



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35 giants **17** turnoff stars observed. Field stars <u>without carbon enrichment</u> [Fe/H]<-2.5 (high resolution high S/N spectra) François et al. 2007

→ at a given metallicity large dispersion of the ratios [Sr/Fe], [Ba/Fe] etc.... (unlike [Ca/Fe]..., etc...)



What can we learn from the Extremely metal-poor stars ?

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Remark: if $-2.0 \ge [Fe/H] \ge -1.0$ all the stars are located inside the yellow squares... (see François et al. 2007)





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If [Fe/H]<2.5: scatter of [Sr/Ba] ✓ when [Ba/Fe] ✓ good correlation between Sr, Y, Zr, Mo, Ru, Pd, Ag

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II The neutron-capture elements from Ge to Sr $(32 \le Z \le 56)$

In the far UV it is possible to measure the abundance of the lightest heavy elements only possible in metal-poor **turnoff stars** the UV flux of the cool giants is too low !





ongoing work Barbuy-Peterson-Spite **PRELIMINARY RESULTS** !

II The neutron-capture elements from Ge to Sr $(32 \le Z \le 56)$



blue line : main r-process (from Wanajo in Siqueira Mello et al. 2013) red line : weak-r process (from Wanajo, 2013)

Cd, Sn explained by the main r-process How are formed Ge As Se ? weak-r -no, weak-s, i



?

III How to increase the sample of turnoff stars ?

We must observe with the HST fainter stars but at lower resolution

 \rightarrow Need of precise gf values in the UV to disentangle the blends ...

or wait for LUVOIR !

Thank you very much !



PSL XX