Stellar physics and galactic archaeology with high resolution spectroscopy

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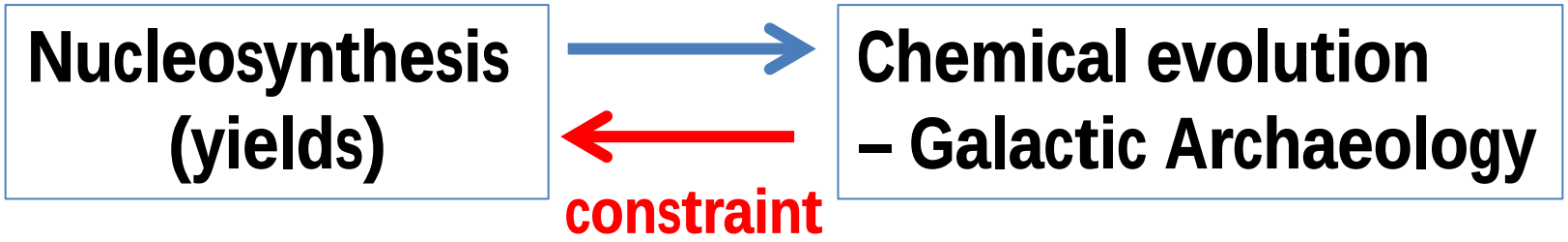
Stellar physics and galactic archaeology with high resolution spectroscopy

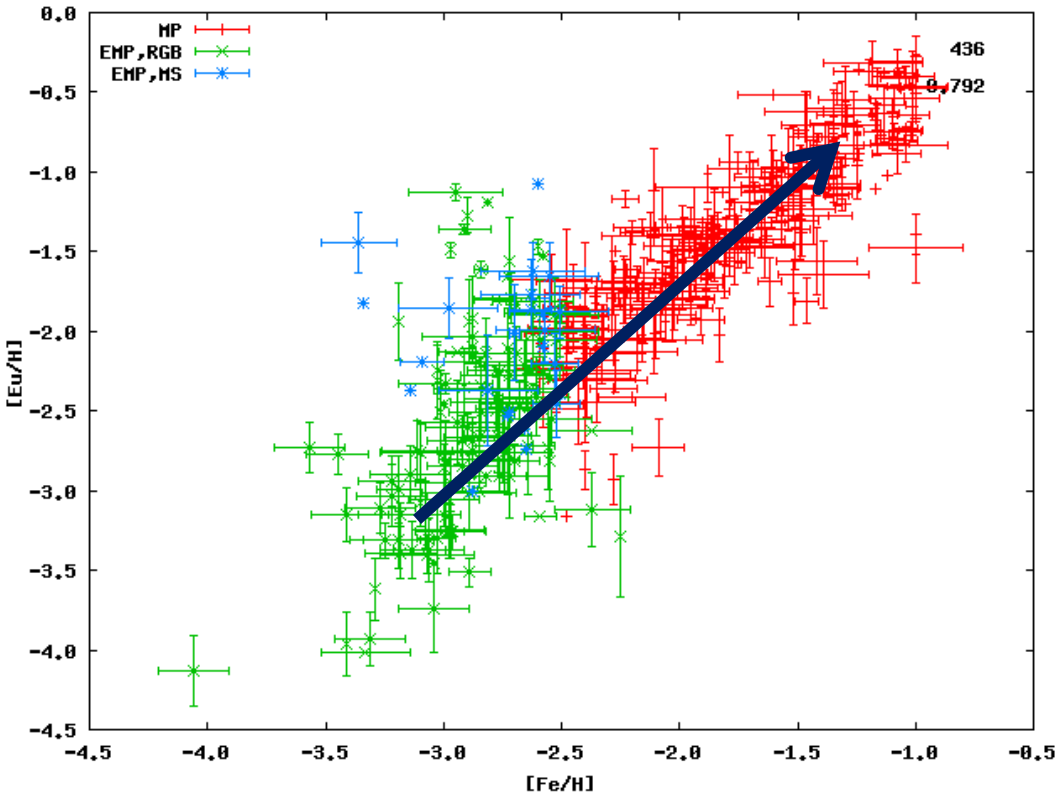


r-process

Abundance distribution of the r-process element Eu in Milky Way stars

Eu has been increasing with the increase of Fe

[Eu/H]

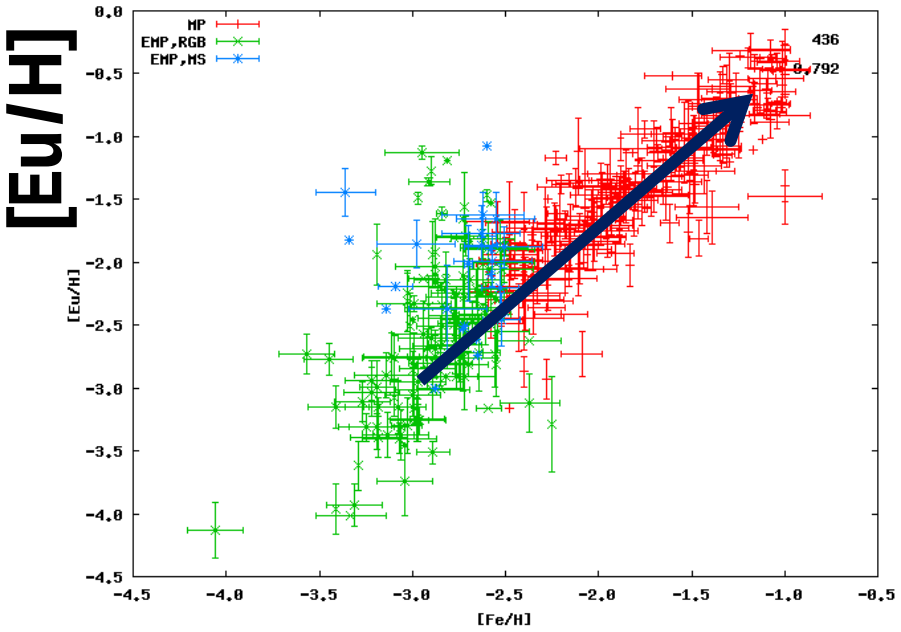


[Fe/H]

Abundance distribution of the r-process element Eu in dwarf galaxy stars

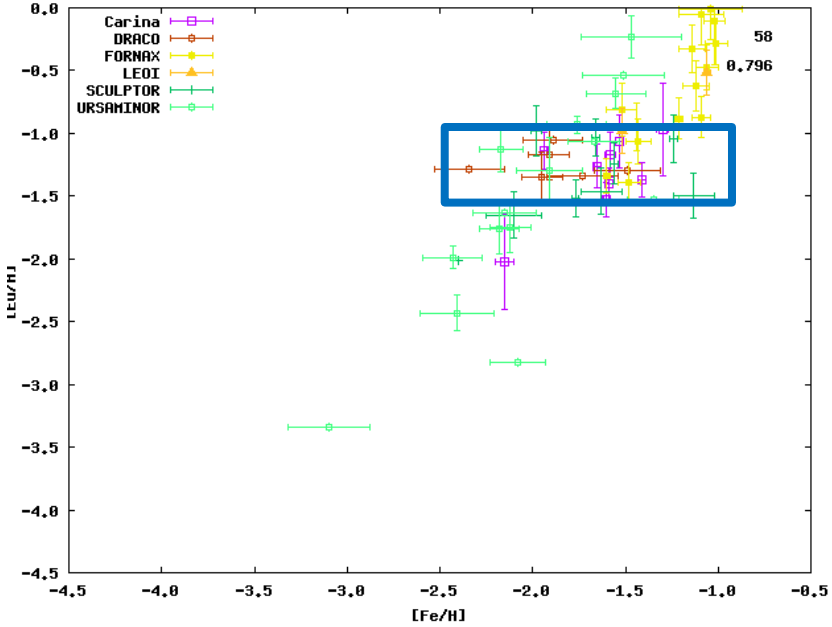
Constant Eu abundance ([Eu/H]) of stars in faint dwarf galaxies

Milky Way



[Fe/H]

Dwarf galaxies

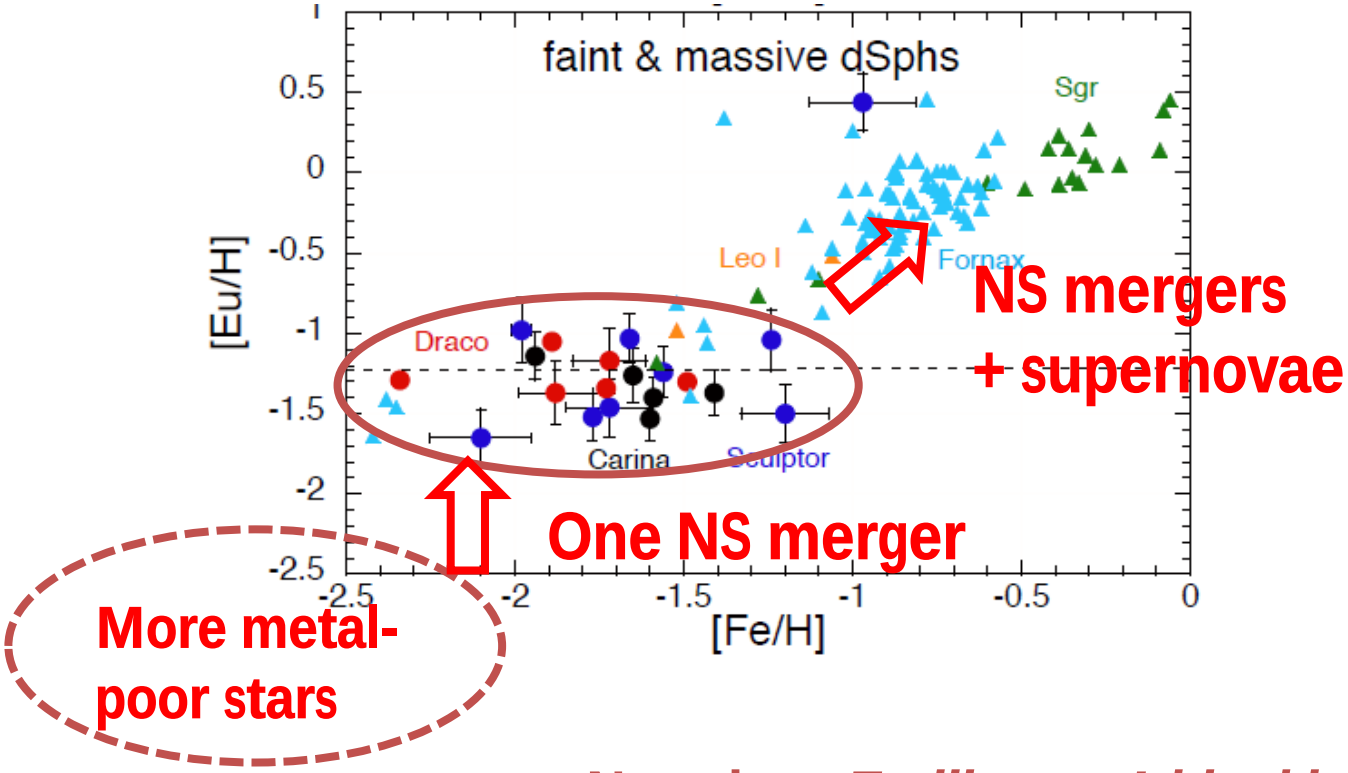


[Fe/H]

Heavy elements in dwarf galaxies

Constant Eu abundance ([Eu/H]) of stars in faint dwarf galaxies
→The abundance level determined by a single rare event (neutron-star merger)?

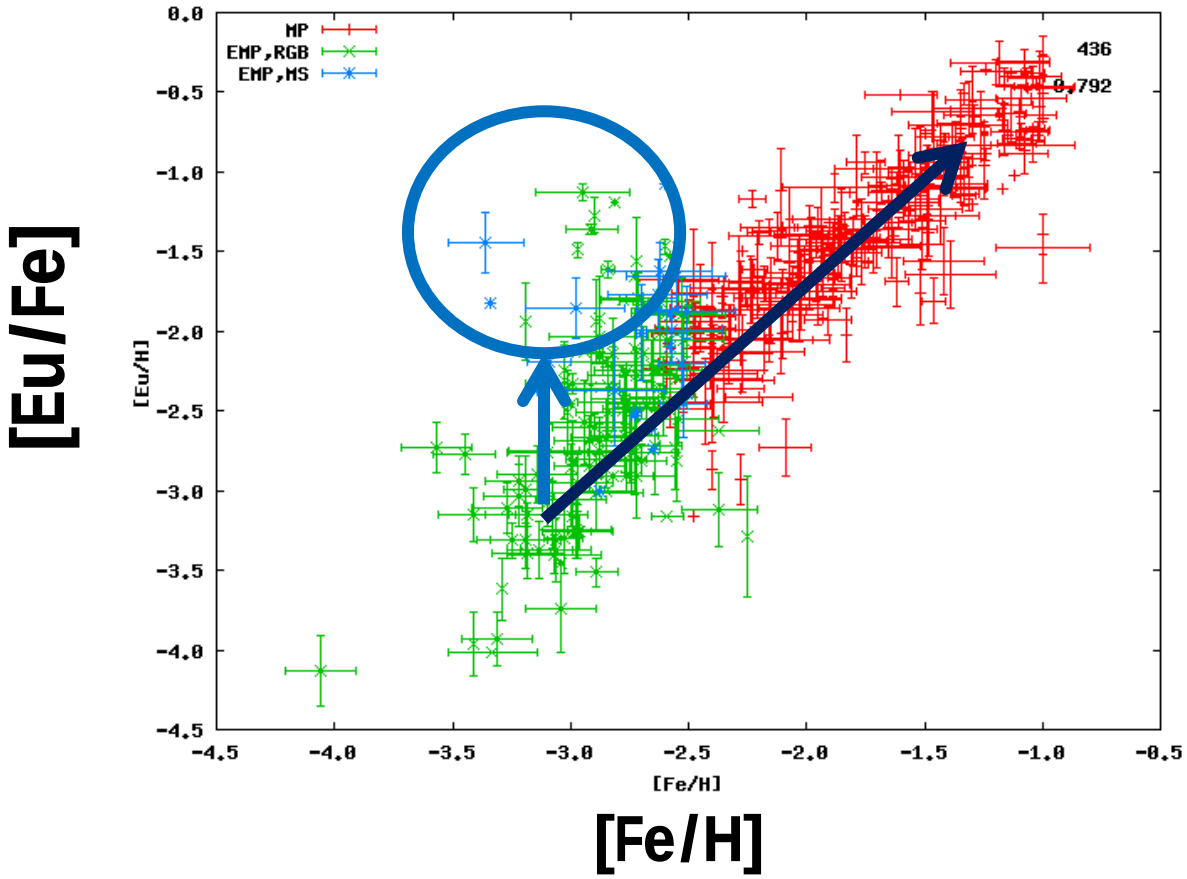
Tsujimoto & Shigeyama (2014)



→New data: *Tsuijimoto, Ishigaki et al. (2015)*

Abundance distribution of the r-process element Eu in Milky Way stars

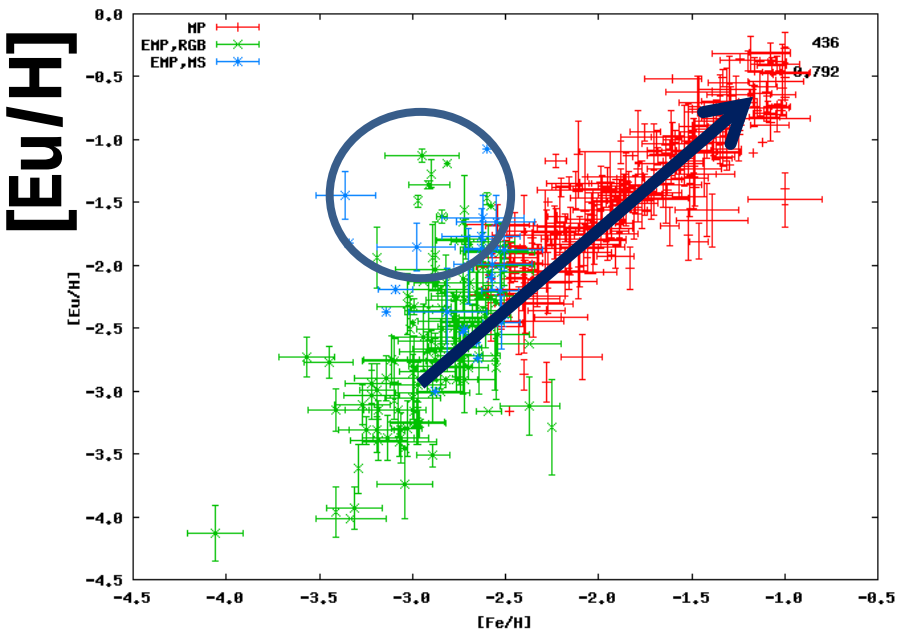
Existence of r-process-enhanced stars with [Fe/H]~-3



Abundance distribution of the r-process element Eu in dwarf galaxy stars

No sufficient data of Eu for dwarf galaxies...

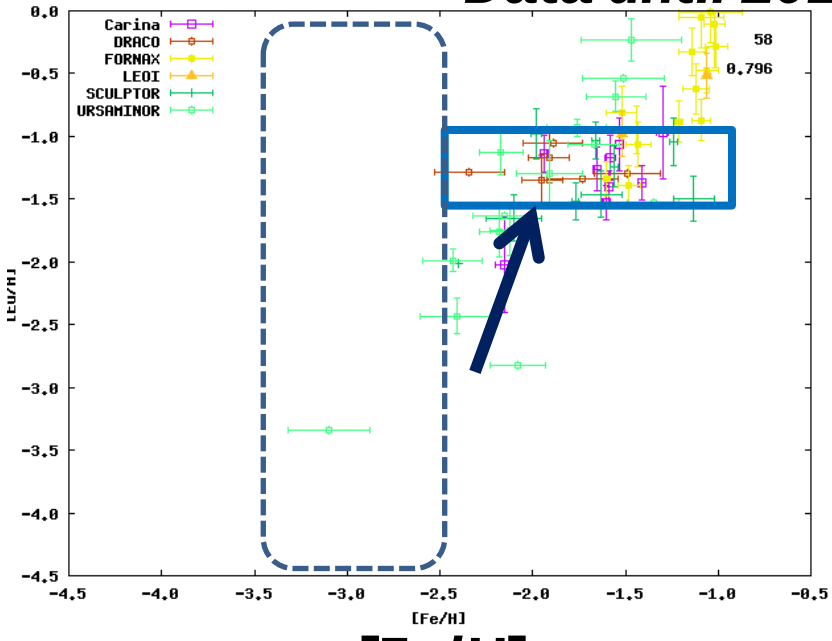
Milky Way



[Fe/H]

Dwarf galaxies

Data until 2015

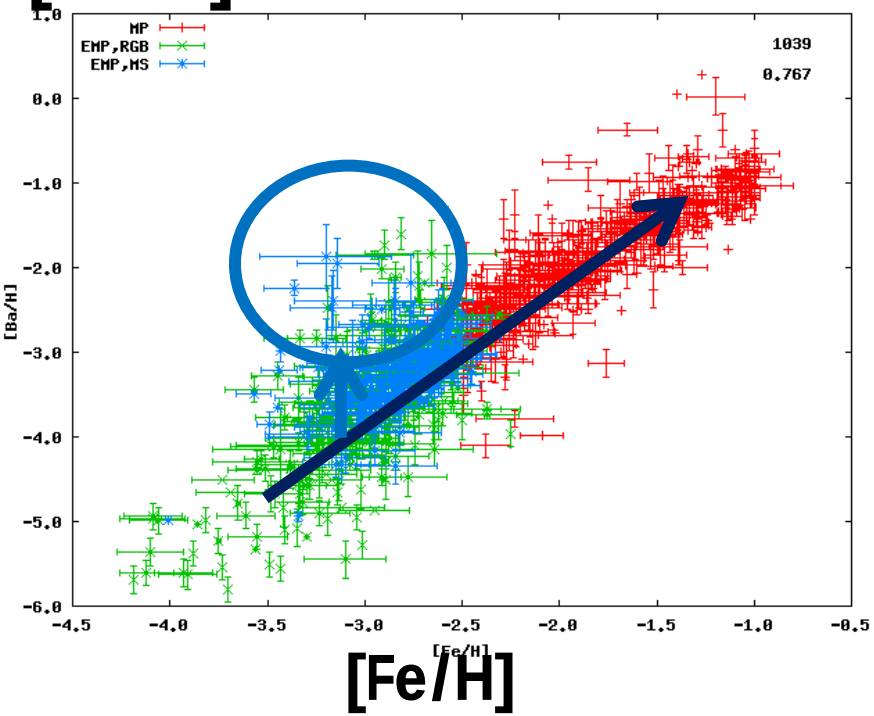


[Fe/H]

Abundance distribution of Ba in Milky Way and dwarf galaxy stars

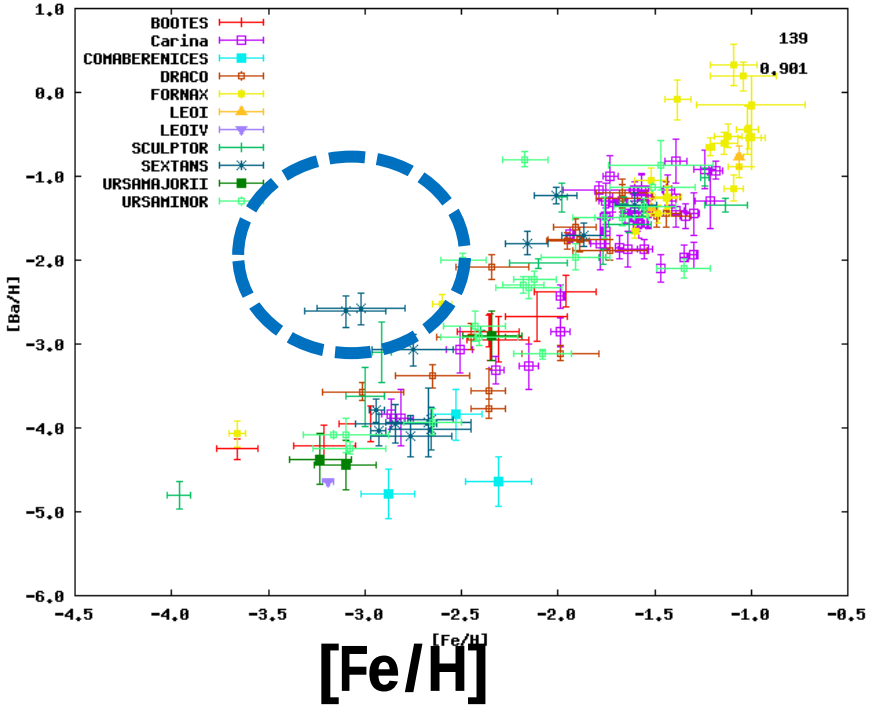
- Ba represents r-process elements at low metallicity
- No r-process-enhanced stars in dwarf galaxies?

Milky Way



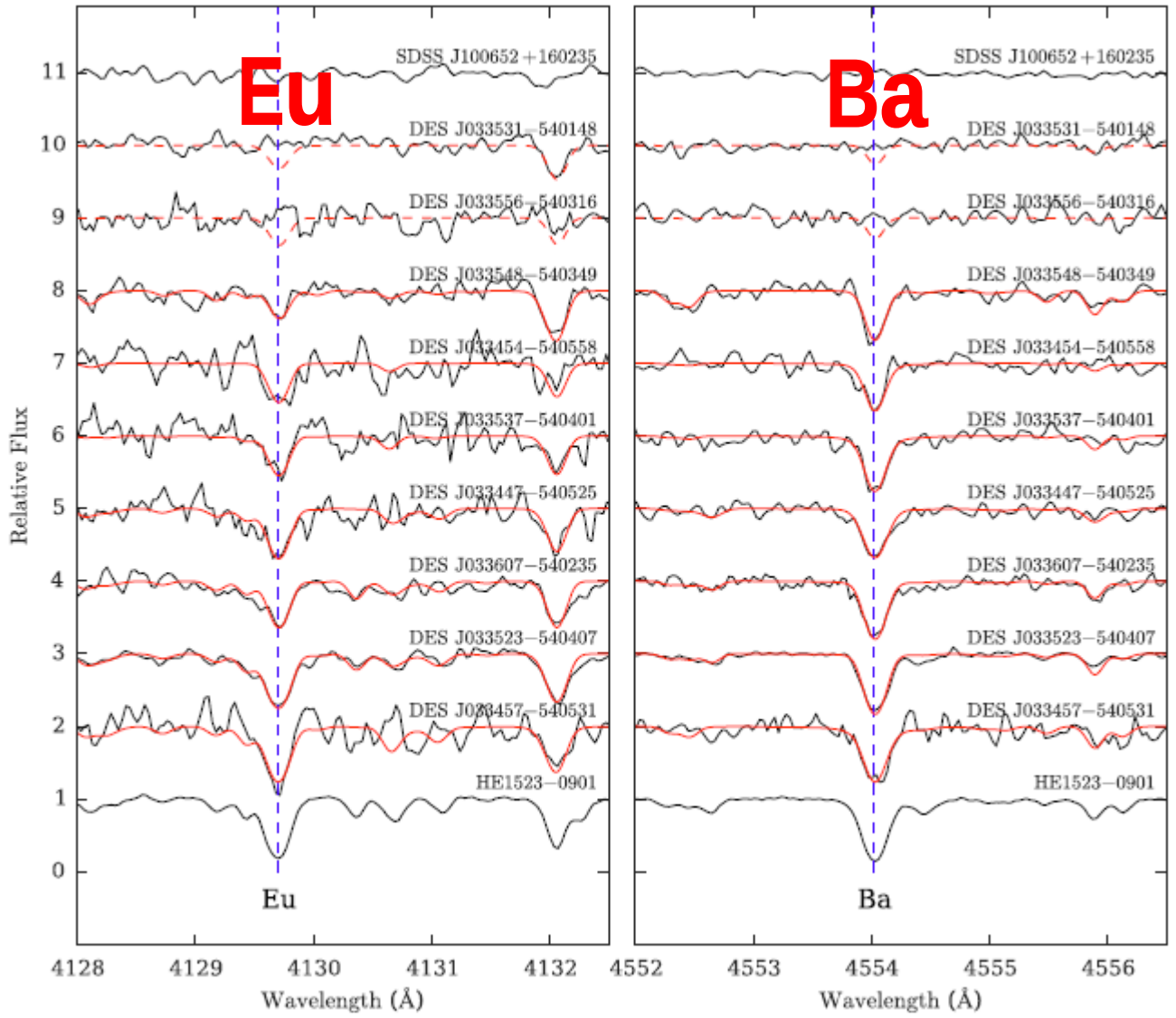
Dwarf galaxies

Data until 2015



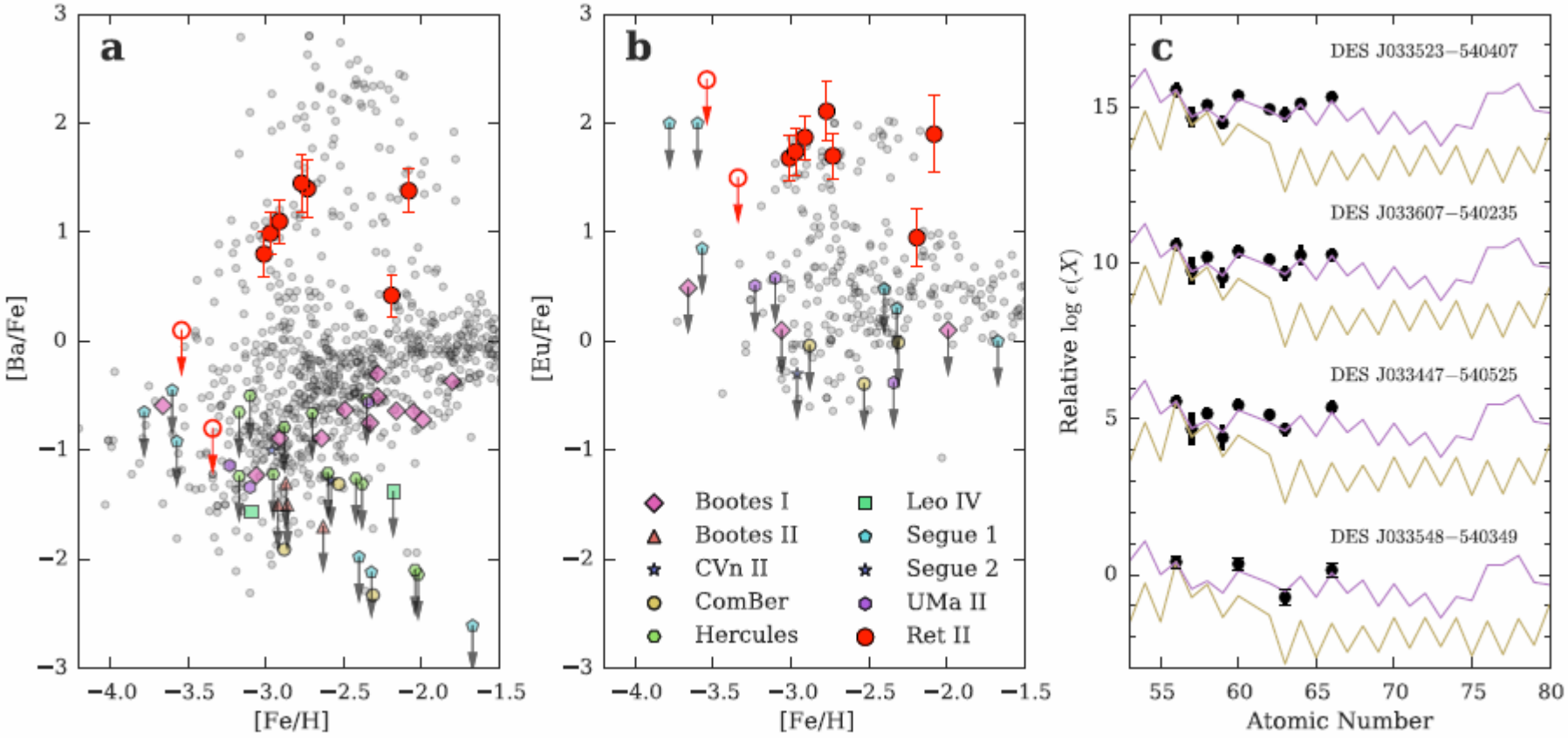
Discovery of an r-process-rich dwarf galaxy Reticulum II

Reticulum II ***Ji et al. (2016), Roederer et al. (2016)***



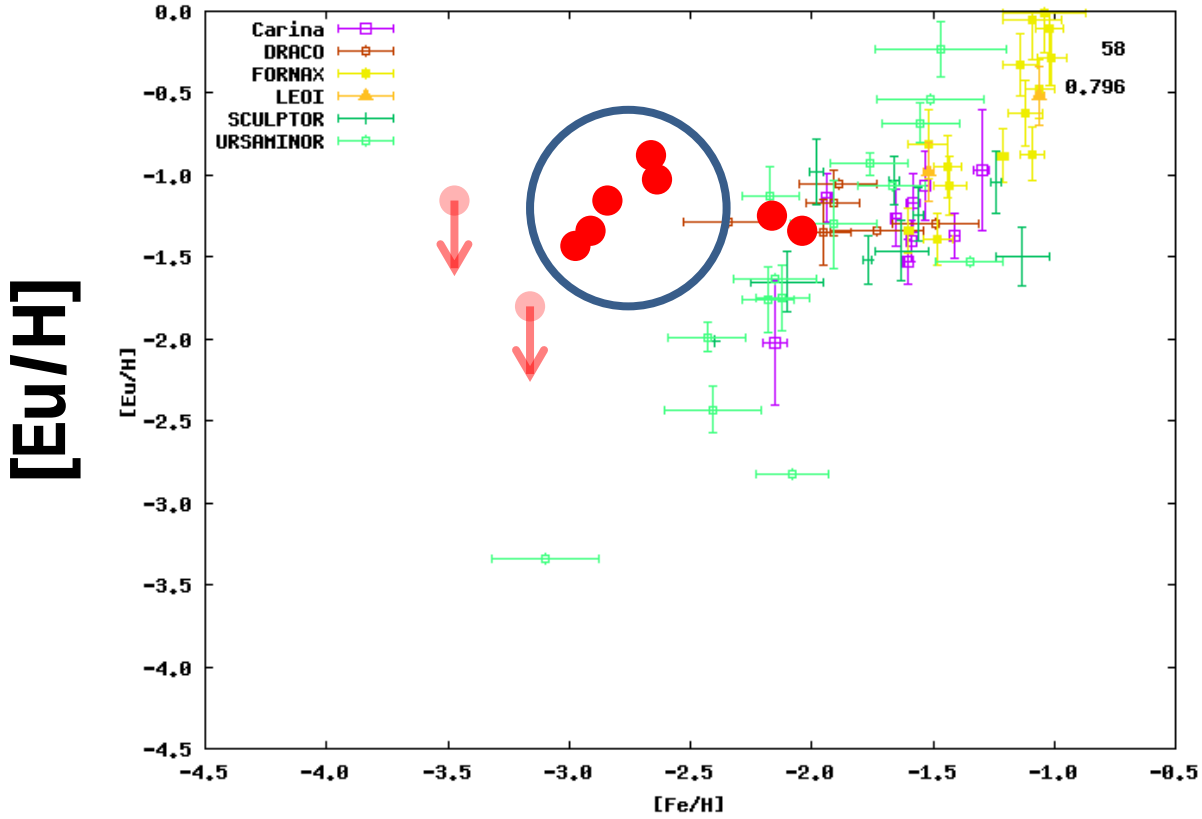
Discovery of the r-process-rich dwarf galaxy Reticulum II

Ji et al. (2016)



Abundance distribution of the r-process element Eu in dwarf galaxy stars

Reticulum II



[Eu/H]

[Fe/H]

Constraints on r-process from chemical abundances of dwarf galaxies

- **Constant Eu/H ratios in (faint) classical dwarf galaxies**
  Tsujimoto & Shigeyama (2014)
- **Existence of r-process-rich ultra-faint dwarf galaxies**
  Ji et al. (2016), Roederer et al. (2016)

→ r-process is a rare event compared to normal core-collapse supernovae with no (or little) contribution to Fe enrichment.

→ NS-NS mergers are promising sources

→ it works even at very low metallicity ([Fe/H]~-3)

→ difficulty in the NS-NS merger scenario?

Requirement for high resolution spectrometers on ELT

- R~50,000 or higher with wide wavelength coverage
- High sensitivity is essential
- Multi-object spectroscopy is preferable

Reticulum II (d=32kpc)

8-10m

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