Abundance analysis of bright metal-poor stars from the Hamburg/ESO survey

or

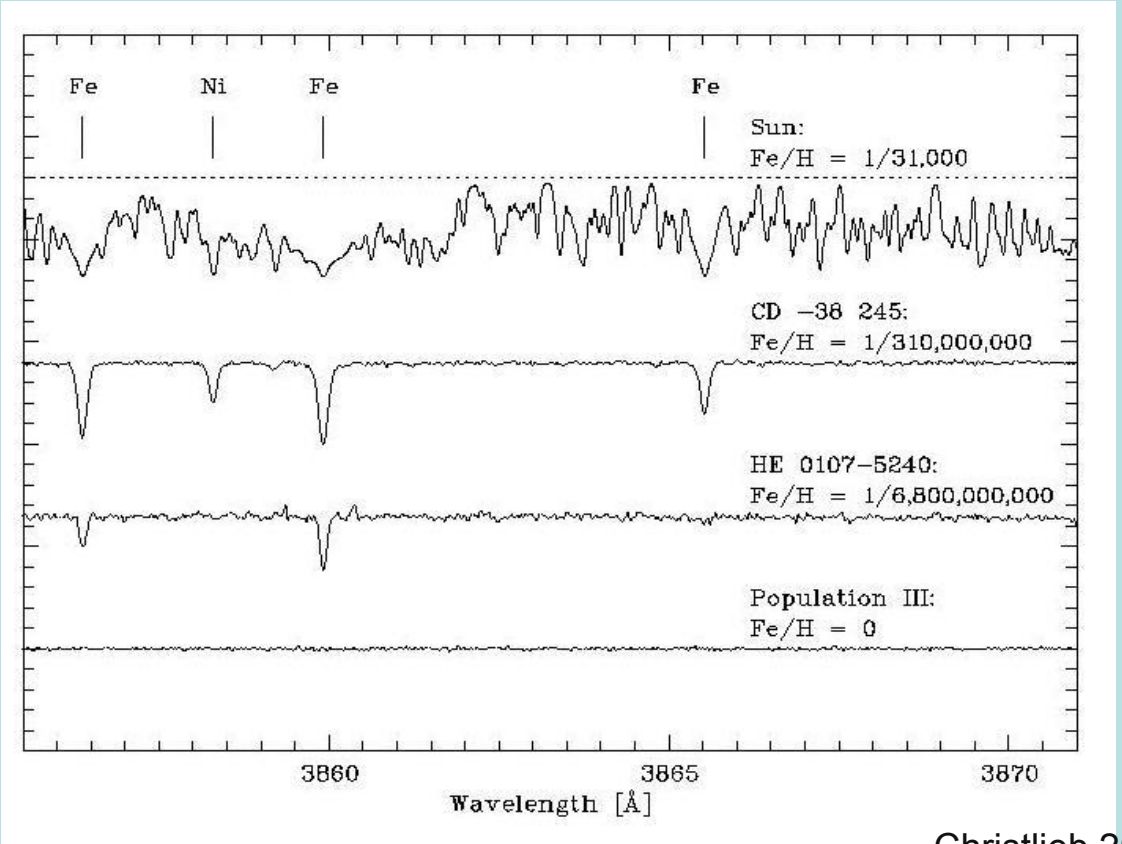
The oldest stars in the Galaxy

Anna Frebel

University of Texas at Austin

anna@astro.as.utexas.edu

Spectral Comparison



[Fe/H]=0

[Fe/H]=-4

[Fe/H]=-5.3

Pop III star
(just noise…?!?)

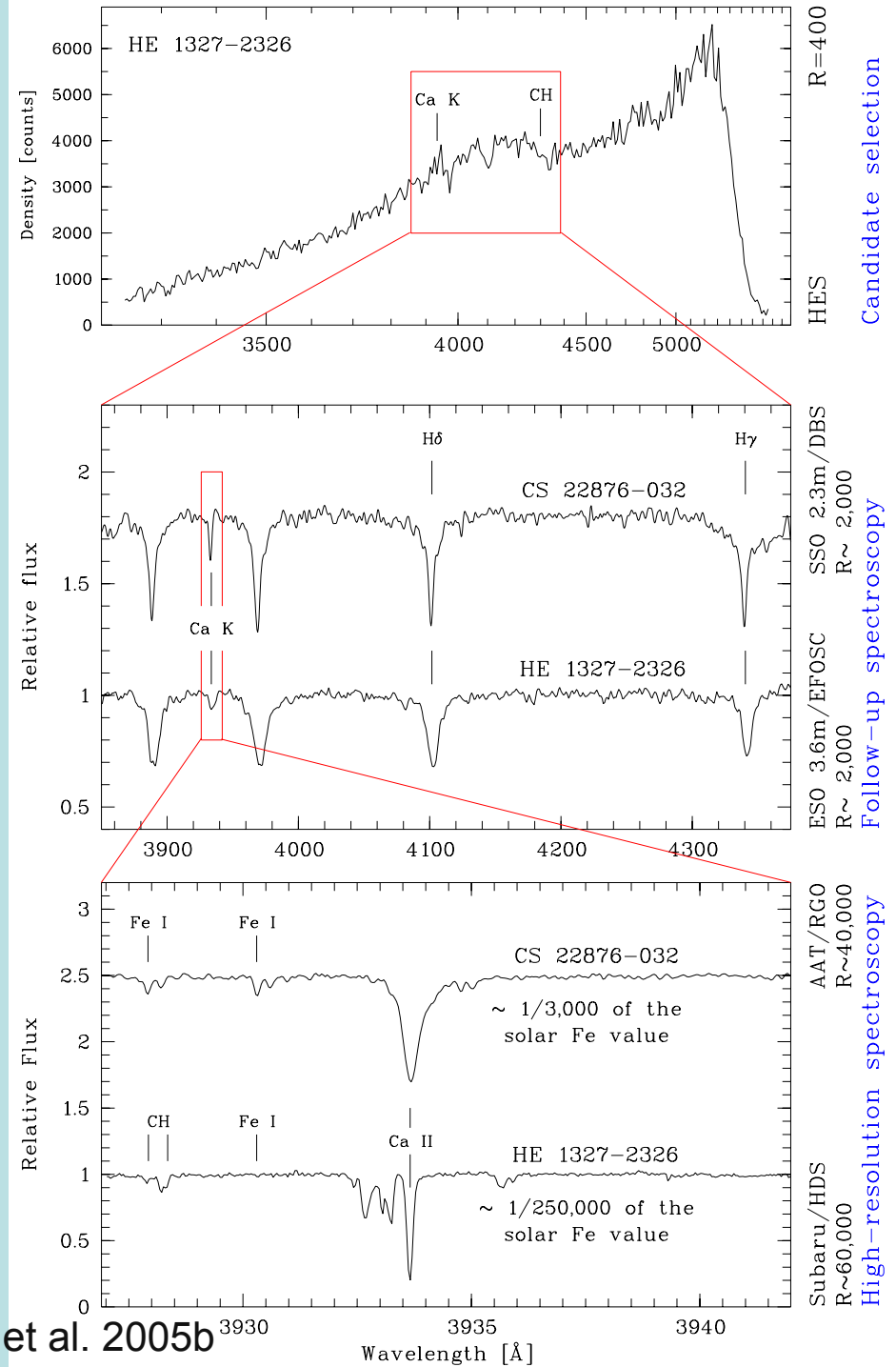
Christlieb 2003

Three Observational Steps to Find Metal-Poor Stars

1. Sample selection and visual inspection:
   Find appropriate candidates

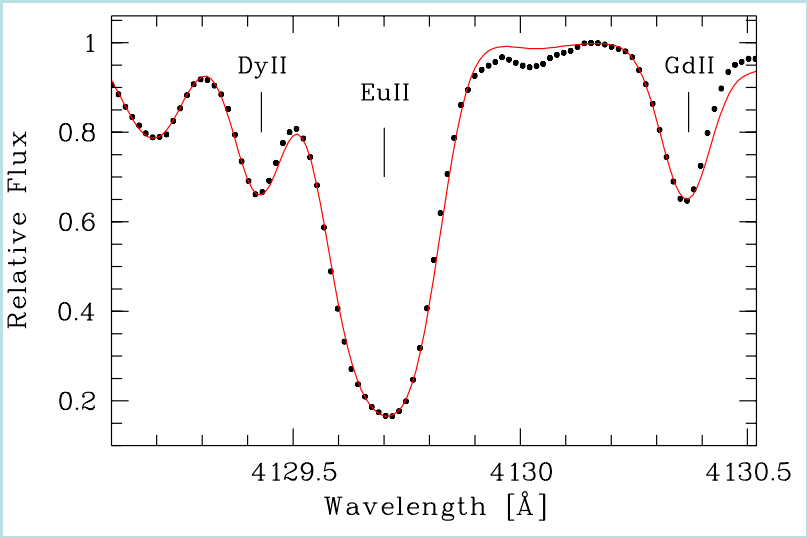
2. Follow-up spectroscopy (medium resolution):
   Derive estimate for [Fe/H] from the Ca II K line

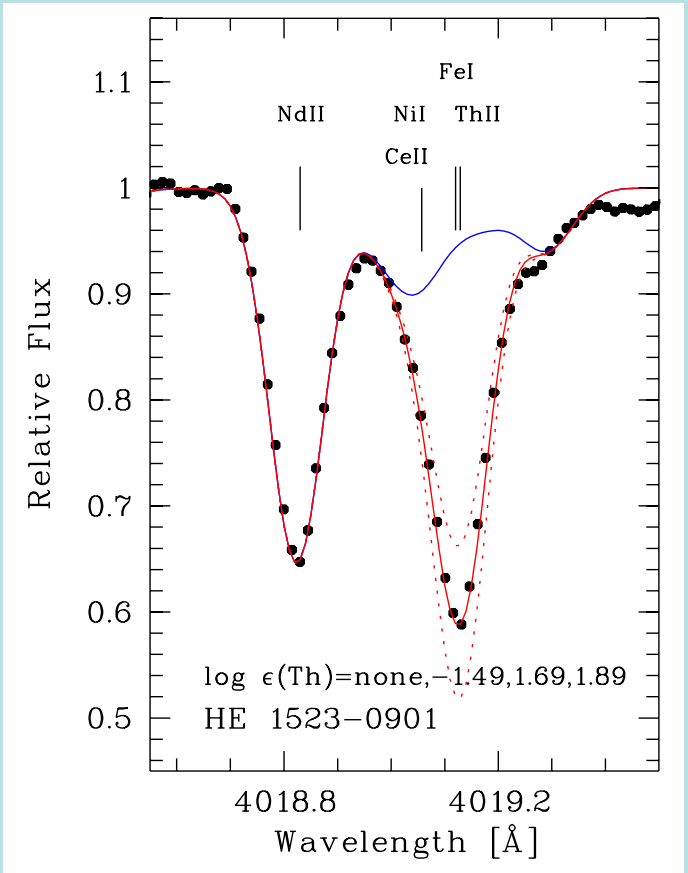
3. High-resolution spectroscopy:
   Detailed abundances analysis



Frebel et al. 2005b

Abundances of HE 1523−0901





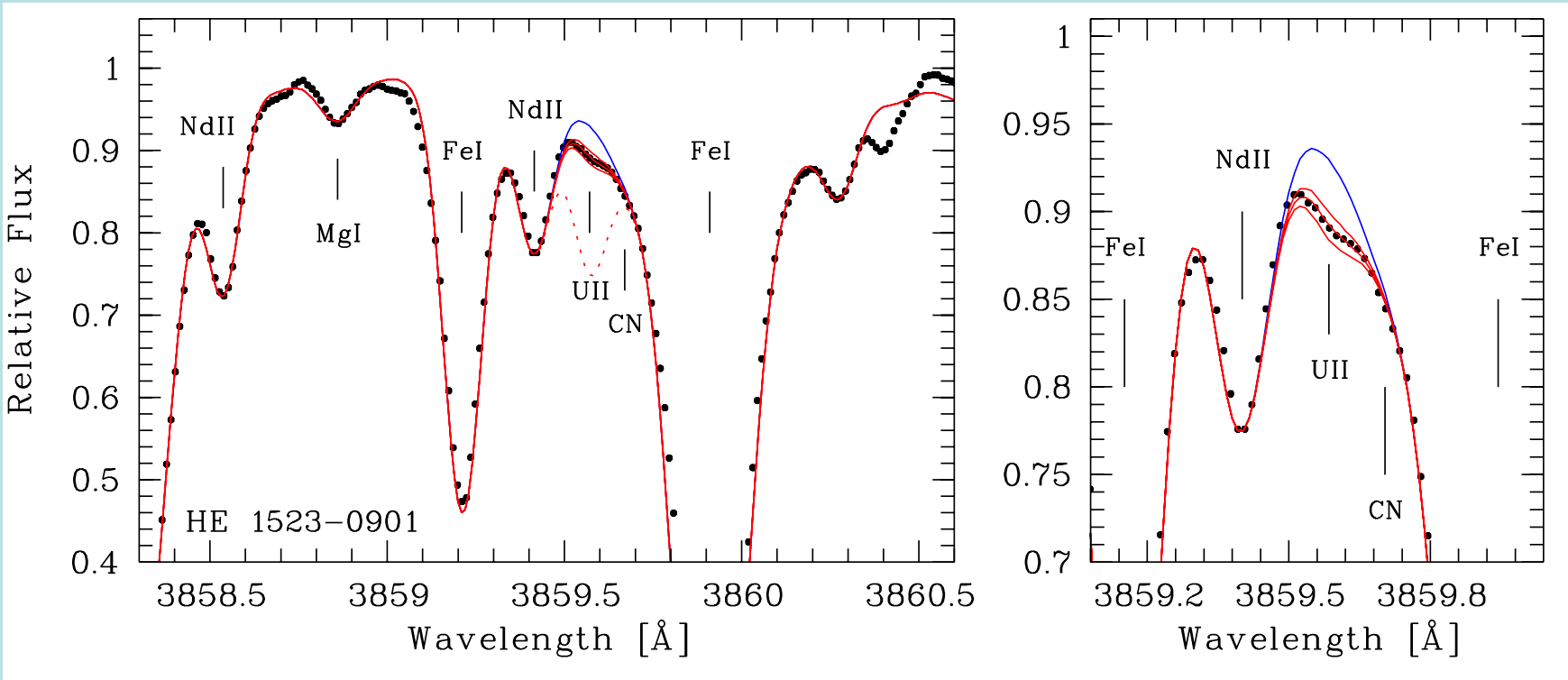
Frebel et al. (2007), in prep.

r-Process Enhanced Stars

(rapid neutron-capture process)

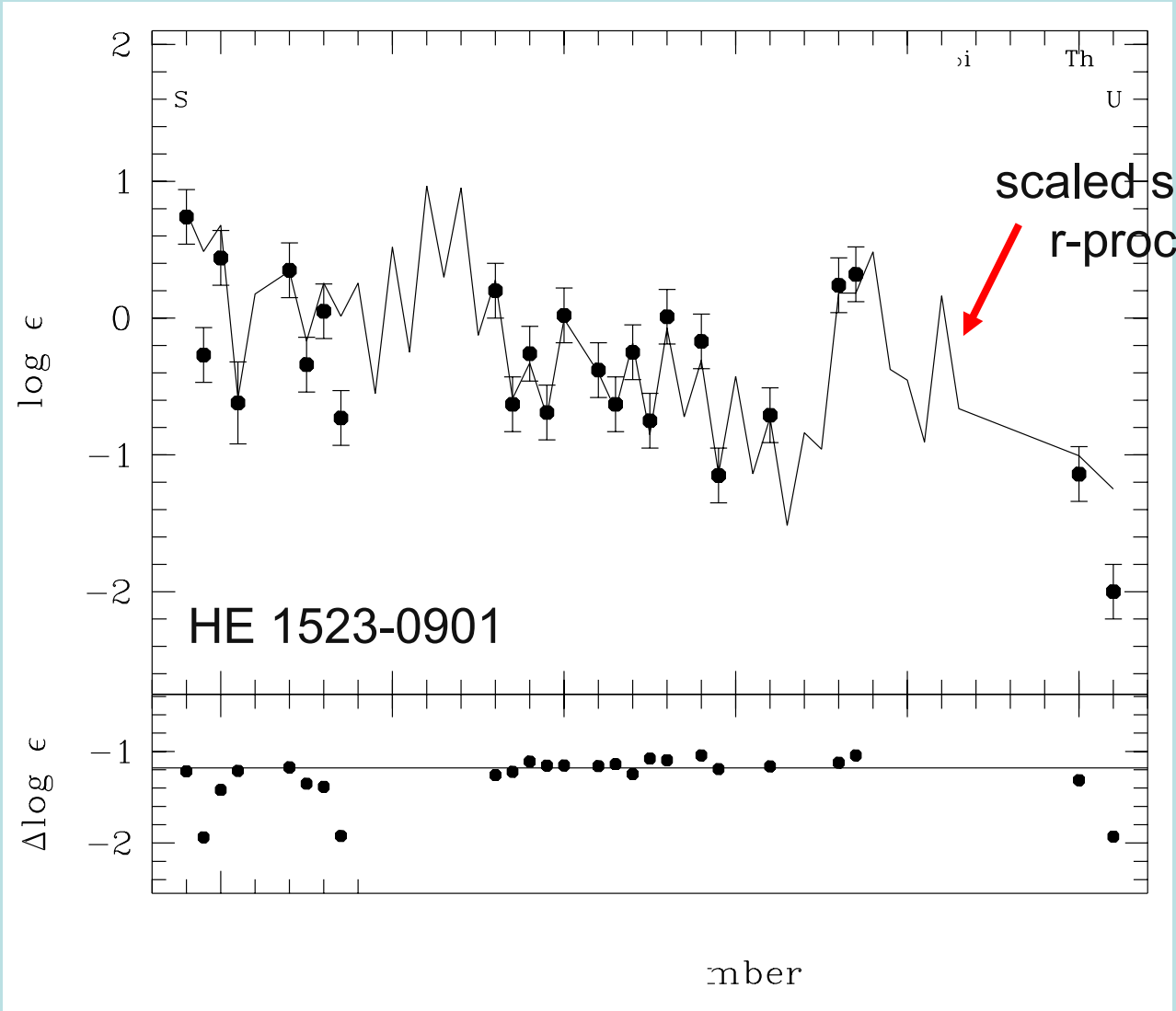
- Responsible for the production of heavy elements
- ~5% among metal-poor stars with [Fe/H] < – 2.5
  => Only ~12 stars known so far with [r/Fe] > 1.0
- Chemical “fingerprint” of previous nucleosynthesis event
- Possible production sites: SN type II, neutrino-driven winds
- Nucleo-chronometry: with Th, U and stable r-process elements (Eu, Os, Ir)

U II at 3859Å



Frebel et al. (2007), ApJL submitted

The r-Process Pattern



The Age of HE 1523−0901

Ratio	Age
Th/Eu	11.5 ±4.7
Th/Os	10.7 ±4.7
Th/Ir	15.0 ±4.7
U/Eu	13.2 ±2.2
U/Os	12.9 ±2.2
U/Ir	14.1 ±2.2
U/Th	13.0 ±3.3
average	**13.2±1.1±2.0 Gyr**

Age: