Observations - discussion

Open questions:

- Are mergers the dominant source of heavy r-process elements?
- Only source?

Limited r-process stars: blue kilonova

- Only source?

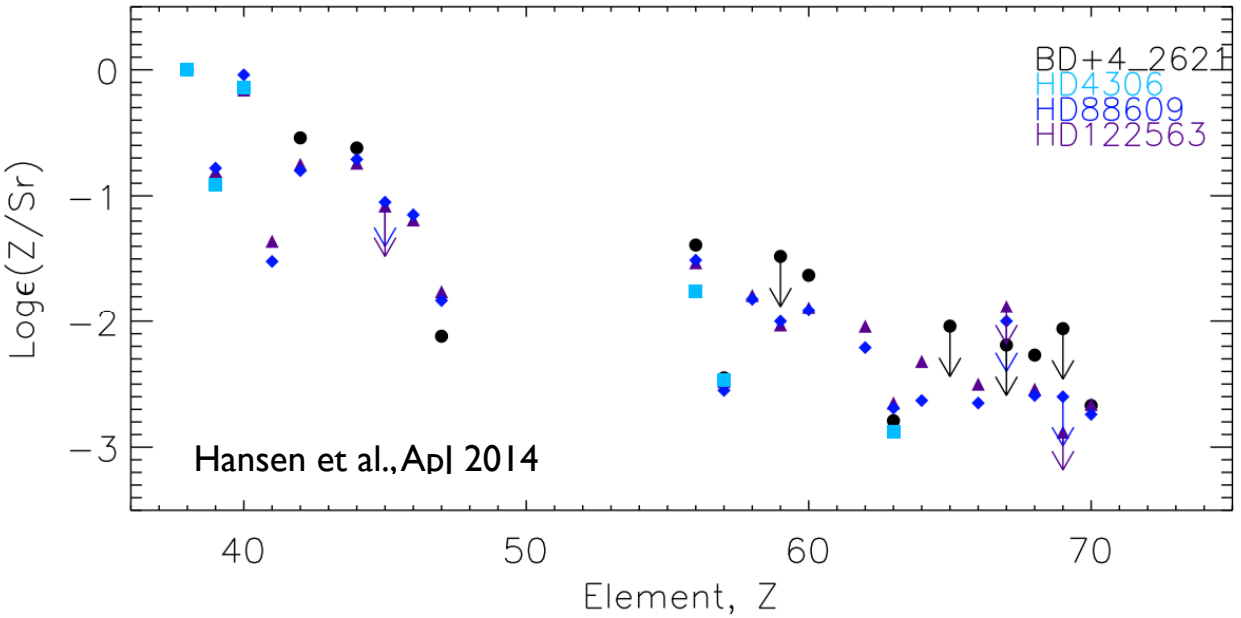


Figure 3. Abundances normalized to Sr for four well-known L-component stars. (A color version of this figure is available in the online journal.)

Limited r-process stars: blue kilonova

- Only source? can the high Ye component explain the robustness?

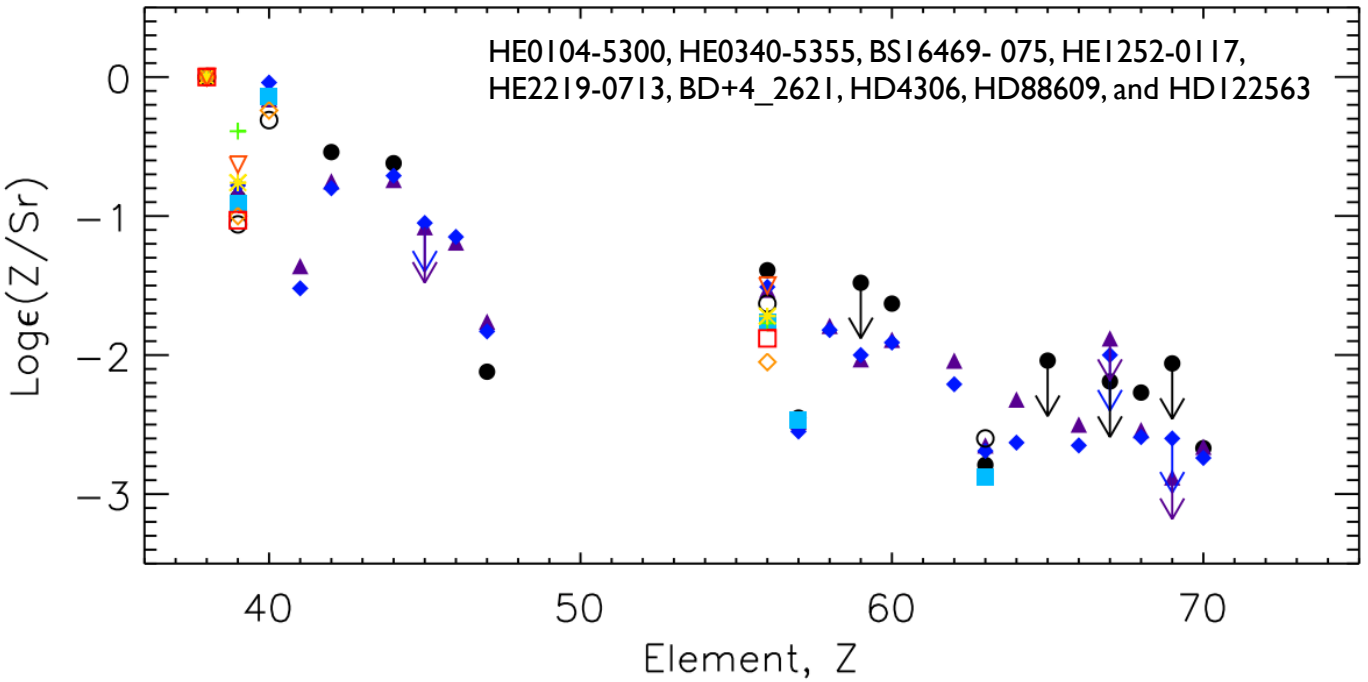


Figure 10. Abundances normalized to Sr for L-component stars and candidate stars with promising L-component patterns.

Simple linear combination of limited r-process pattern + r-process-enhanced pattern can explain ALL metal-poor star observations (Hansen et al., ApJ 2014)

Limited r-process stars: blue kilonova

- Only source? population statistics

- In the last 10 years a large number of high resolution abundances have been obtained
- ~900 metal-poor stars high-res data
- Fraction of metal-poor stars that are limited r-process stars is 30-40% at [Fe/H] $\simeq -3.0$
- Need larger statistics (observational bias?)
- No Sr-enhanced star with [Fe/H]<-3.5

Heavy r-process elements: red kilonova

- Only source?

Low metallicity Eu-enriched stars

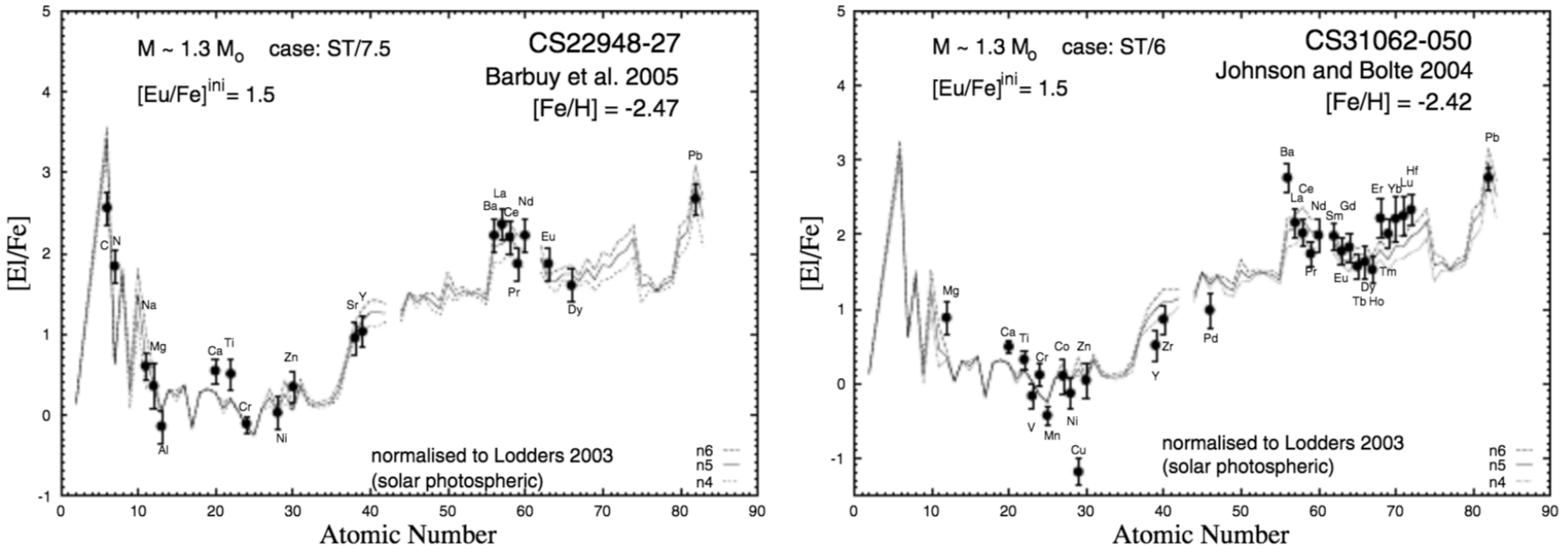


Figure 1. Panel a): Comparison between the [El/Fe] abundances in CS 22948-27 with s+r process predictions. Panel b): The same for the CS 31062-050. Symbols n_i indicate the number of thermal pulses with third dredge up.

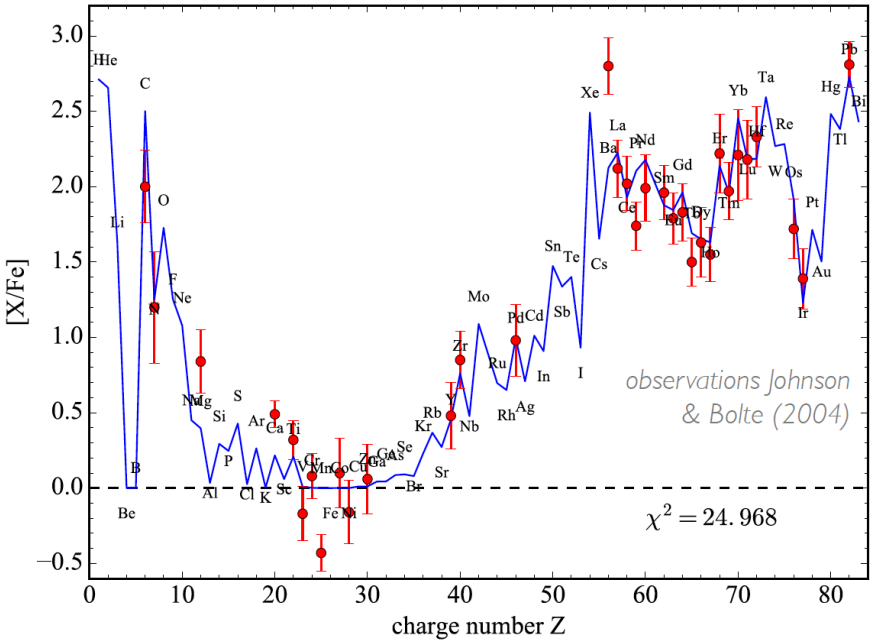
Heavy r-process elements: red kilonova

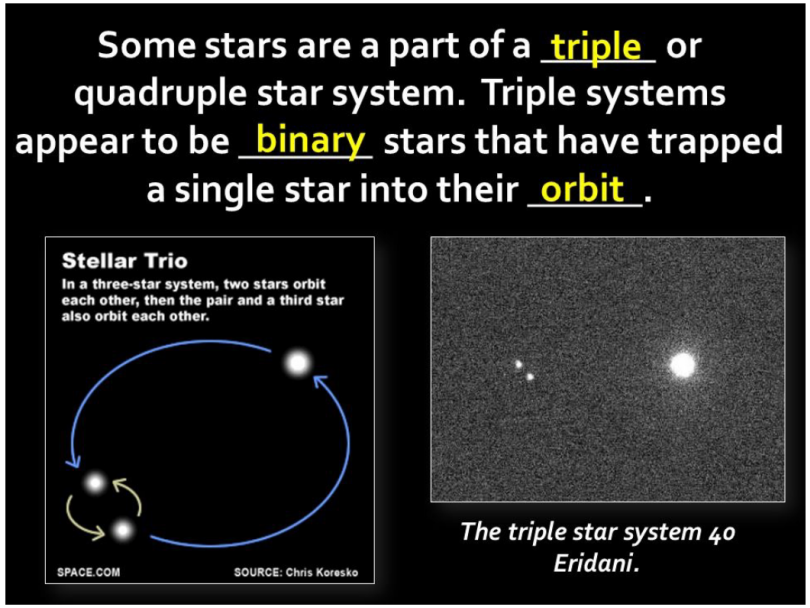
- Only source?

F. Herwig and collaborators

We propose the first simulation based formation scenario for CEMP-i stars. The i-process nucleosynthesis can explain the abundances of heavy elements observed in the CEMP-i star CS31062-050 if in the past it had been a distant companion of a close binary system with a RAWD that exploded as a SN Ia, and, as a result, the star CS31062-050 left the triple system.

Low-Z iRAWD multi-zone simulation

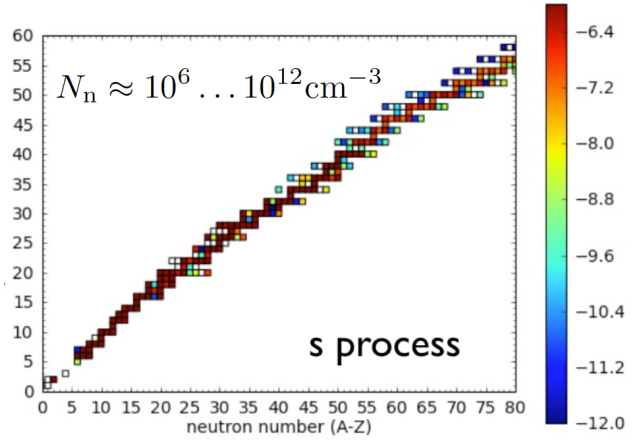


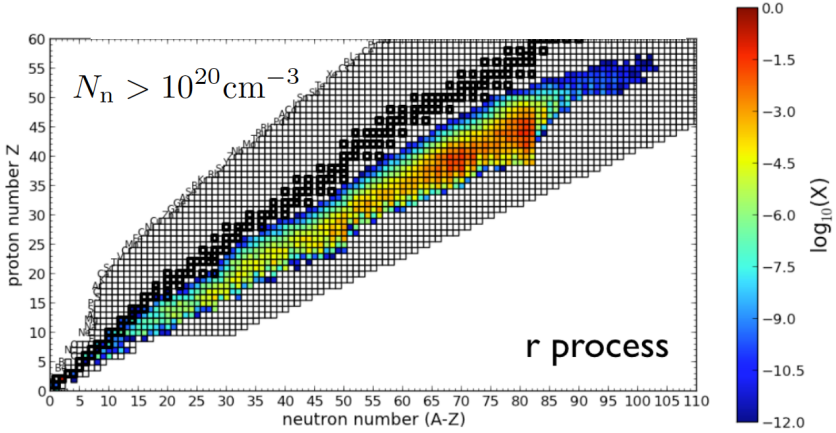


Heavy r-process elements: red kilonova

- Only source?

Three neutron-capture regimes: s- i- and r-process

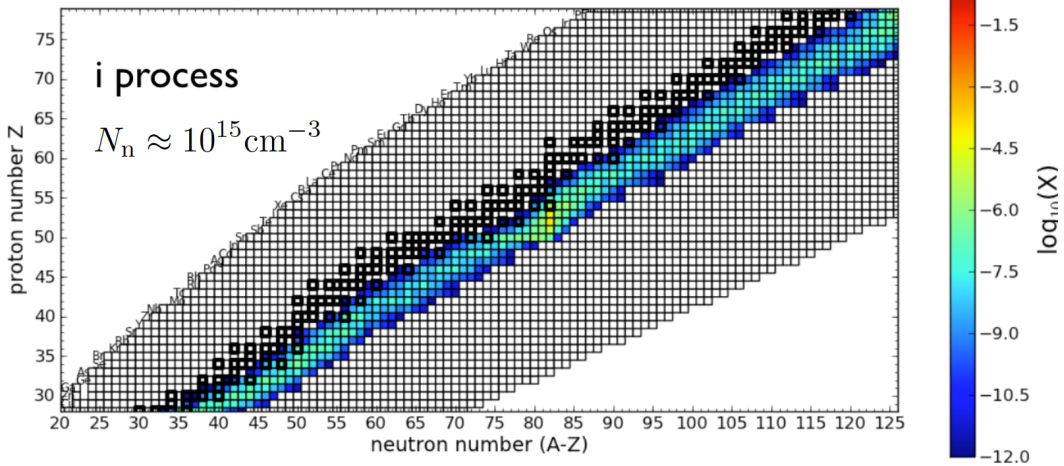




NuGrid 1-zone simulations

i process

- neutron density intermediate between slow and rapid
- primarily associated with JINA-CEE research



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Heavy r-process elements: red kilonova

- Only source?