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r-Process sites and their role in producing the heaviest elements and their radioactive isotopes

Various nucleosynthesis studies have predicted the ejection of rapid neutron capture r-process elements. They include (i) core-collapse supernovae with a very weak r-process, possibly producing trans-Fe elements Sr, Y, Zr (and continuing to slightly higher mass numbers), (ii) quark-deconfinement supernovae with a weak r-process contribution (including Eu in small amounts), (iii) magneto-rotational supernovae with weak to moderate r-process contributions (including Eu in moderate to slightly larger but varying amounts), (iv) neutron star mergers with a strong r-process (probably also producing radioactive actinide isotopes), and finally (v) collapsars or massive neutron star mergers with a very strong r-process from black hole accretion tori.
Only one of these sites (neutron star mergers) has shown proven evidence for a (strong) r-process. Is it possible to verify the imprint of the other possible sources to galactic evolution by analyzing the abundances of very metal-poor (VMP) halo stars? We utilize statistical methods to analyze the observational abundance patterns from trans-Fe elements up to the actinides and come to the conclusion that one can identify at least four categories of astrophysical events which must have contributed with different abundance patterns, ejecta amounts, and occurrence frequencies, probably related to the above mentioned sites. Especially the relations of r-I and r-II stars to an actinide boost seem to point to specific sites.

Length of presentation requested

Oral presentation: 17 min + 3 min questions

Please select between one and three keywords related to your abstract

Nucleosynthesis

2nd keyword (optional)

Stellar explosions and mergers - theory

3rd keyword (optional)

Chemical Evolution

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