

# Bringing back core-collapse supernova explosions as r-process site

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Canonical core-collapse supernova explosions, driven by the neutrino-heating mechanism, are presently ruled out as nucleosynthesis site for the production of heavy elements. Detailed numerical studies, with accurate neutrino transport and a sophisticated treatment of weak processes included, have shown that the ejected material does not yield sufficient neutron excess [1] for the production of elements with atomic numbers greater than  $32 < Z < 50$  [2], known as light neutron-capture elements. Here, we will review this caveat in the light of observations of metal-poor star (metallicity as stellar age tracer), dwarf galaxies and deep sea sediments. Based on new insights, we revisit the possibility that a few rare supernova explosion events can account for a strong r-process, i.e. the production of elements up to mass numbers of  $A \approx 195$  (third r-process peak). Therefore, it has been shown recently that the appearance of exotic phases of hot and dense matter, associated with a 1st-order phase transition from ordinary nuclear matter to the quark-gluon plasma at the supernova interior, triggers the onset of energetic supernova explosions of massive stars with zero-age main sequence masses of  $40\text{--}50 M_{\odot}$  [3]. Moreover, these events yield a strong r process, which we will present and discuss here for the first time.

Keywords: core-collapse supernovae - equation of state - nucleosynthesis

## References

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**Primary author:** FISCHER, Tobias (University of Wrocław)

**Co-authors:** BLASCHKE, David Bernhard (University of Wrocław); MARTINEZ-PINEDO, Gabriel (University of Darmstadt); WU, Meng-Ru (Institute of Physics, Academia Sinica, Taipei); BASTIAN, Niels-Uwe Friedrich (University of Wrocław)

**Presenter:** FISCHER, Tobias (University of Wrocław)

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