Imprints of fission in r-process abundance patterns

Marius Eichler[1]

[1] *Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstr. 2, DE-64289 Darmstadt, Germany*

About half of the heavy elements in the universe are produced by the *rapid neutron capture process* (r-process). While recent multi-messenger detections of compact binary mergers have confirmed neutron star mergers (NSMs) as an r-process site, it is currently unclear if this scenario can account for all the enrichment of heavy r-process nuclei in the galaxy, especially at low metallicities. Theoretical models show that the heaviest r-process nuclei can possibly be produced also in other astrophysical scenarios, such as magneto-rotationally driven supernovae (MRSNe) or disks forming around collapsars. Distinguishing these scenarios by means of their nucleosynthetic signatures proves extremely challenging, since the properties of the neutron-rich nuclei involved are unknown, in addition to the uncertainties in hydrodynamical conditions of the ejecta.

Most models, however, agree that the ejecta from NSMs include components that are neutron-rich enough for fission cycling, while outflows from MRSNe are generally less neutron-rich. In our theoretical nucleosynthesis calculations, r-process abundances derived from neutron-rich conditions with the inclusion of fission cycling can be systematically distinguished from an r-process where fission is insignificant. Here we will discuss the signatures of fission in the r-process and assess their robustness against the nuclear and hydrodynamical uncertainties.