# The r-process nucleosynthesis during the decompression of cold neutronised matter

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The rapid neutron-capture process, or r-process, is known to be of fundamental importance for explaining the origin of approximately half of the $A > 60$ stable nuclei observed in nature. In recent years nuclear astrophysicists have developed more and more sophisticated r-process models, eagerly trying to add new astrophysical or nuclear physics ingredients to explain the solar system composition in a satisfactory way. The r-process remains the most complex nucleosynthetic process to model from the astrophysics as well as nuclear-physics points of view. The identification of the astrophysical site for the r-process remains clearly and by far the most unsatisfactorily understood facet of the r-process modelling,

The present contribution emphasizes some important future challenges faced by nuclear physics in this problem, particularly in the determination of the radiative neutron capture rates by exotic nuclei close to the neutron drip line and the fission probabilities of heavy neutron-rich nuclei. These quantities are particularly relevant to determine the composition of the matter resulting from the decompression of initially cold neutron star matter. New detailed r-process calculations are performed and the final composition of ejected inner and outer neutron star crust material is estimated. We discuss the impact of the many uncertainties in the astrophysics and nuclear physics on the final composition of the ejected matter.