

# Physics Cases and Instrumentation for the EURISOL-DF, next step towards Eurisol



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Type: **The formation and structure of r-process nuclei**

## Experimental studies related to the r and i-process nucleosynthesis

The r-process nucleosynthesis is responsible for the production of about half of the nuclei beyond Fe in the universe. The location for their formation is still debated, but seems to originate from neutron star mergers. From the observation of r abundance peaks connected to shell closure, it is clear that the structure of some key nuclei located there plays an essential role to understand the r-process nucleosynthesis, to better constrain its condition in terms of time scale, temperature and neutron density. Recent observations in metal-poor stars, as well as in few dwarf galaxies, reveal (weakly mixed) signatures of early r-process signatures, which should be confronted to stellar processes and chemical evolution. Besides the main component of the r process, an intermediate component (i process) has been identified recently, pointing to the production of nuclei in neutron density conditions between the slow process and the r process. If confirmed, this discovery will enlarge the need of experimental nuclear data in between the valley of stability and the nuclear drip line. After a brief introduction on the recent stellar observations and on the processes that can produce and eject neutron-rich nuclei, I will focus on the properties that should and can be studied in terrestrial laboratories to reach a better understanding of r and i process nucleosynthesis, such as in particular neutron capture cross sections and beta-decay studies.

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