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Decay spectroscopy of neutron-rich isotopes for astrophysics[1]

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A large fraction of the isotopes for rapid neutron capture-(r) process nucleosynthesis are not yet experimentally accessible and are located in the "Terra Incognita". With the next generation of fragmentation and ISOL facilities presently being built or already in operation, one of the main motivation of all projects is the investigation of very neutron-rich isotopes at and beyond the border of presently known nuclei. However, reaching more neutron-rich isotopes means also that beta-delayed neutron-emission becomes the dominant decay mechanism. Beta-delayed neutron emitters play an important, two-fold role in the stellar nucleosynthesis of heavy elements in the r process. On one hand they lead to a detour of the material beta-decaying back to stability. On the other hand, the released neutrons increase the neutron-to-seed ratio, and are re-captured during the freeze-out phase and thus influence the final solar r-abundance curve. For this reason the neutron branching ratio of very neutron-rich isotopes is a crucial parameter in astrophysical simulations. The investigation of beta-delayed neutron-emitters has recently experienced a renaissance. I will show some results from the measurement of the heaviest beta-delayed neutron emitters identified so far with the BELEN setup at GSI Darmstadt [R. Caballero-Folch et al., subm. to PRL (2015)]. Other high-accuracy measurements of neutron branching ratios of isotopes labelled by the IAEA as "high priority" have been carried out at the IGISOL facility in Jyvaskyla/ Finland. And last but not least I will talk about two neutron detection setups which will start taking data in 2016- the BRIKEN array at RIKEN/ Japan and the GRIFFIN gamma-spectrometer with its neutron detector DESCANT at TRIUMF/ Canada.

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