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# Nucleosynthesis of nuclei near the N=50 neutron shell closure

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The origin of the elemental abundances from iron to uranium can be almost completely assigned to neutron capture reactions by two main stellar scenarios, each being responsible for the production of about one half of the abundances in the mass region A≥56. During explosive nucleosynthesis (occurring in supernovae events and/or neutron star mergers) short-lived and very neutron-rich nuclei are produced via the rapid neutron capture process (r process) [1].
The remaining half of the heavy elements is related to the slow neutron capture process (the s process), which produces nuclei with mass 88 ≤ A ≤ 210 during the advanced burning phases of stellar evolution [1]. Depending on the stellar mass, it operates in thermally pulsing low-mass Asymptotic Giant Branch (AGB) stars (main component) [2] or during core He and shell C burning in massive stars (weak component) [3].
The Solar System abundances of Sr, Y and Zr are relatively high. These elements are mostly synthesized by the s process in AGB stars (their production in massive stars is limited to a few percent of the total solar abundance [4]). Their abundances hence define the "ls" (light-s) s-process index routinely used to compare theoretical models to observations. The existence of this first peak is due to 88Sr, 89Y, and 90Zr, all having a magic number of neutrons (N=50), which implies that their neutron-capture cross sections are lower than those of neighbouring nuclei. As a result, they act as bottlenecks on the neutron-capture path, constraining the value of the total neutron flux necessary to proceed to the production of heavier elements up to the second s-process peak, corresponding to the next bottleneck at Ba, La, Ce, with neutron magic number of 82 (defining the heavy-s "hs" index).
Based on the characteristic features of the n_TOF facility at CERN [4], accurate measurements of the (n, ⍰) cross sections have been performed for the 88Sr, 89Y and all stable Zr isotopes as well as for the radioactive isotope 93Zr.
In this talk the results and the implication of the new cross sections will be presented.

References

[1] E.M. Burbidge, G.R. Burbidge, W.A. Fowler, and F. Hoyle, Rev. Mod. Phs., 29 547 (1957).
[2] R. Gallino, C. Arlandini, M. Busso, M. Lugaro, C. Travaglio, O. Straniero, A. Chieffi, and M. Limongi, Ap. J. 497, 388 (1998).
[3] C.M. Raiteri, M. Busso, R. Gallino, and G. Picchio, Ap. J. 371, 665 (1991).
[4] Proposal for a Neutron Time of flight Facility, CERN-SPSC 99-8, SPSC/P 310, 17 March 1999

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