

# $(n,\gamma)$ cross sections of light $p$ nuclei: Towards an updated experimental database for the $s$ and $p$ process

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The nucleosynthesis of elements beyond iron is dominated by the  $s$  and  $r$  processes. However, a small amount of stable isotopes on the proton-rich side cannot be made by neutron capture and are thought to be produced by photodisintegration reactions on existing  $r$ - and  $s$ -seed nuclei in the so-called " $p$  process". Those 32 stable isotopes between  $^{74}\text{Se}$  and  $^{196}\text{Hg}$  are 10 to 100 times less abundant than the respective  $s$  and  $r$  nuclei. The currently most favored astrophysical site for the  $p$  process is the high-temperature environment of explosive burning in type II supernovae. The explosive shock front heats the outer O/Ne shell of the progenitor star to temperatures of 2-3 GK, sufficient for providing the required photodisintegrations.

So far most of the  $p$ -process reactions are not yet accessible by experimental techniques and have to be inferred from statistical Hauser-Feshbach model calculations. The parametrization of these models has to be constrained by measurements of stable proton-rich nuclei. A series of  $(n,\gamma)$  activation measurements on  $p$  nuclei, related by detailed balance to the respective photodisintegrations, were carried out at the Karlsruhe Van de Graaff accelerator using the  $^7\text{Li}(p,n)^7\text{Be}$  source for simulating a Maxwellian neutron distribution of  $kT=25$  keV. First results of our extended measuring program in the light ( $74\leq A\leq 132$ ) [1] and heavy ( $184\leq A\leq 196$ ) mass range are presented.

A status quo of  $(n,\gamma)$  rates for the 32  $p$  nuclei, and the influence of a variation of the neutron capture rate on the respective normalized overabundance factors [2] is shown. Up to now, experimental stellar neutron capture cross sections for 20 isotopes are available, but for eight of them with uncertainties  $>9\%$ .

Another aim of this work is the introduction of the "Karlsruhe Astrophysical Database of Nucleosynthesis in Stars" (KADoNiS) project (<http://nuclear-astrophysics.fzk.de/kadonis>). KADoNiS is an online database for experimental  $s$ - and  $p$ -process cross sections and reaction rates. It combines an updated sequel to the well-known Bao et al. compilation [3] for stellar  $(n,\gamma)$  cross sections in the  $s$  process with a newly created library for experimental  $p$ -process reaction rates. The update of Bao et al. is already online since June 2005, whereas the  $p$ -process database is expected to be launched by the end of 2005.

[1] I. Dillmann, M. Heil, F. Käppeler, T. Rauscher and F.-K. Thielemann, in preparation for Phys. Rev. C (2005).

[2] W. Rapp, Ph.D. thesis, Universität Karlsruhe, FZKA Report 6956 (2004)

[3] Z. Bao, H. Beer, F. Käppeler, F. Voss, K. Wisshak, and T. Rauscher, ADNDT **76**, 70 (2000).