Investigation of the ^{7}Li(p,n) neutron fields at high energies

Benjamin Brückner,[1] P. Erbacher,[1] K. Göbel,[1] T. Heftrich,[1] K. Khasawneh,[1] D. Kurtulgil,[1] C. Langer,[1] R. Nolte,[2] M. Reich,[1] R. Reifarth,[1] M. Weigand,[1] M. Wiescher,[3] and M. Volknandt[1]

[1] *Goethe University, Frankfurt am Main, Germany*

[2] *Physikalisch Technische Bundesanstalt, Braunschweig, Germany*

[3] *University of Notre Dame, Notre Dame, USA*

The neutron activation method has been proven to be a well-suited tool for the investigation of neutron capture cross sections relevant for the main s-process component. Neutrons can be produced via ^{7}Li(p,n) reaction facilitating Van de Graaf accelerators and metallic lithium targets. This can produce a Maxwellian spectrum of neutrons corresponding to a temperature of $k_BT = 25\,\mathrm{keV}$, mimicking the s-process scenario in low-mass asymptotic giant branch (AGB) stars. The weak s-process however takes place in massive stars at temperatures between 25 and 90 keV. Until now the recreation of quasi-stellar neutron spectra with higher energies via the ^{7}Li(p,n) reaction were unsuccessful. Simulations using the PINO[1] code however suggested that a Maxwellian spectrum corresponding to $k_BT = 90\,\mathrm{keV}$ can be resembled by a linear combination of various different neutron spectra. The resulting spectrum averaged cross sections can then be combined to a 90 keV Maxwellian Averaged Cross Section (MACS). In order to validate the PINO code at these higher energies, measurements were carried out at the PTB Ion Accelerator Facility (PIAF) in Braunschweig. The neutron fields could be measured using a pulsed proton beam and three ^{6}Li-glass scintillation detectors which were mounted at different angles. The neutron energy was determined by time-of-flight (TOF).

---

[1] R. Reifarth et. al., Nuclear Instruments and Methods in Physics Research A **608**, 139 (2009).