The Stellar $^{72}\mathrm{Ge}(n,\gamma)$ Cross Section: A First Measurement at n_TOF

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The slow neutron capture process (s-process) is responsible for producing about half of the elemental abundances heavier than iron in the universe. Neutron capture cross sections on stable isotopes are a key nuclear physics input for s-process studies. The $^{72}\mathrm{Ge}(n,\gamma)$ Maxwellian Average Cross Section (MACS) has an important influence on production of isotopes between Ge and Zr in the s-process in massive stars [1] and so far only theoretical estimations are available [2].
An experiment was carried out at the neutron time-of-flight facility n_TOF [3] at CERN to measure the $^{72}\mathrm{Ge}(n,\gamma)$ reaction for the first time at stellar neutron energies. At n_TOF, neutrons over a large energy range (few meV to several GeV) are produced by spallation reactions of a highly energetic (20 GeV/c), pulsed proton beam impinging on a massive Pb target. The capture measurement was performed using an enriched $^{72}\mathrm{GeO_2}$ sample at a distance of 184 m from the spallation target (Experimental Area 1), which allows a measurement with high neutron energy resolution. The prompt gamma rays produced after neutron capture were detected with a set of liquid scintillation detectors (C_6D_6), which met the experimental requirements of low neutron sensitivity [4].
The neutron capture yield is derived from the counting spectra taking into account the neutron flux and the gamma-ray detection efficiency using the Pulse Height Weighting Technique [5]. The experiment, data analysis and preliminary results will be presented.

References

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