Activation of p-process Nuclei by Photodissociation

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A new facility for the production of polarised bremsstrahlung has been built at the superconducting electron accelerator ELBE of the Forschungszentrum Rossendorf. The bremsstrahlung facility and the detector setup are designed such that the background radiation due to scattering of photons and production of neutrons is minimised allowing for experiments close to and above particle separation energies in nuclei.

Recently, a research program has been started to experimentally study the near-threshold photodissociation of nuclides in the chain of cosmic heavy element production with bremsstrahlung. An important prerequisite for such studies is the good knowledge of the bremsstrahlung distribution and experimental as well as theoretical investigations were performed. First data were obtained for the astrophysically important target nucleus ^{92}Mo by observing the radioactive decay of the nuclides produced by its irradiation at endpoint energies between 11.8 and 13.8 MeV. Current astrophysical network calculations underestimate the observed cosmic abundance by almost one order of magnitude [1]. The photodissociation reactions studied were ^{92}Mo(γ,p)^{91}Nb, ^{92}Mo(γ,n)^{91}Mo, and ^{92}Mo(γ,α)^{88}Zr, while ^{197}Au(γ,n)^{196}Au was taken as a reference reaction .

The results are compared to recent calculations of Rauscher *et al.* [2]. Studies on the electromagnetic dipole strength of the nuclei ^{92,98,100}Mo up to the particle separation energies complement these experiments with emphasis on the nuclear level-density distribution for different N/Z ratios.

[1] A. Arnould and S. Goriely, Physics Reports, 382 (2003) 1

[2] T. Rauscher, F.-K. Thielemann, Atomic Data and Nuclear Data Tables, 88 (2004) 1