



Contribution ID: 35

Type: **Contributed Oral Presentation**

Experimental study of photoactivation in proton-enriched ^{113}In , ^{112}Sn , and ^{114}Sn nuclei and their contributions to the γ -process.

Thursday, 29 May 2025 11:25 (15 minutes)

The vast majority of chemical elements and their stable isotopes observed in nature, located in the medium- and heavy-mass regions, were synthesized in hot stars as a result of nuclear reactions. The processes responsible for synthesizing most of the nuclei of these isotopes are called rapid (r -process) and slow (s -process) neutron capture processes, i.e., (n,γ) -reactions [1]. However, within the medium- and heavy-mass regions, there are 35 p -nuclei, including the ^{113}In , ^{112}Sn , and ^{114}Sn nuclei. A dominant role in the formation of p -nuclei is played by low-energy photonuclear reactions such as (γ,n) , (γ,p) , and (γ,α) .

To model the natural abundances of p -nuclei, knowledge of a large array of reaction rates is required, which can be obtained from cross-sections or yields. Using bremsstrahlung γ -quanta from a tantalum converter, an irradiated beam of the Linear electron accelerator at the National Science Center “Kharkiv Institute of Physics and Technology”, and the activation technique with high-energy gamma spectrometry, we measured the cross-sections of the reactions $^{113}\text{In}(\gamma,n)^{112m}\text{In}$, $^{113}\text{In}(\gamma,n)^{112g}\text{In}$, $^{112}\text{Sn}(\gamma,n)^{111}\text{Sn}$, $^{112}\text{Sn}(\gamma,p)^{111m}\text{In}$, $^{112}\text{Sn}(\gamma,p)^{111g}\text{In}$, and $^{114}\text{Sn}(\gamma,n)^{113}\text{Sn}$ in the energy range from the threshold up to 15 MeV.

The results of the experimental measurements are compared with existing data in the literature and with calculations from the statistical theory of nuclear reactions, implemented in the computer codes NON-SMOKER [2] and TALYS [3] (v. 2.0), using different models for nuclear level density and radiative strength functions. A series of measurements of the energy spectra of γ -decay quanta with different cooling times and the individual decay scheme of the ^{111}Sn nucleus allowed us to calculate new values of the branching coefficients for the nine strongest transitions accompanying the decay of ^{111}Sn . These values differ from the baseline values currently adopted, with an average weighted coefficient of $1.38 (\pm 0.08)$.

This finding suggests the need to revise certain published experimental cross-section values for nuclear reactions in which the ^{112m}In and ^{111}Sn nuclides are the residual product.

Primary author: Dr CHEKHOVSKA, Anastasiia (Institute for Basic Science, National Science Center “Kharkiv Institute of Physics and Technology”)

Co-authors: Dr SEMISALOV, Igor (National Science Center “Kharkiv Institute of Physics and Technology”); Dr SKAKUN, Yevgen (National Science Center “Kharkiv Institute of Physics and Technology”)

Presenter: Dr CHEKHOVSKA, Anastasiia (Institute for Basic Science, National Science Center “Kharkiv Institute of Physics and Technology”)

Session Classification: Parallel Session

Track Classification: Nuclear Reactions