



Contribution ID: 111

Type: Oral

## First $\beta$ -decay spectroscopy of $^{135}\text{In}$ and new $\beta$ -decay branches of $^{134}\text{In}$

Thursday, 16 June 2022 16:30 (20 minutes)

The  $\beta$  decay of the neutron-rich  $^{134}\text{In}$  and  $^{135}\text{In}$  was investigated experimentally with the aim of providing new insights into the nuclear structure of the tin isotopes above  $N = 82$ . Better understanding of exotic nuclides from the  $^{132}\text{Sn}$  region is required for accurate modeling of the rapid neutron capture nucleosynthesis process ( $r$  process), due to the  $A \approx 130$  peak in the  $r$ -process abundance pattern being linked to the  $N = 82$  shell closure [1, 2]. Because a vast number of nuclei involved in the  $r$  process are  $\beta$ -delayed neutron ( $\beta n$ ) emitters, new experimental data that can verify and guide theoretical models describing  $\beta n$  emission are of particular interest. Neutron-rich isotopes  $^{134}\text{In}$  and  $^{135}\text{In}$  –being rare instances of experimentally accessible nuclides for which the  $\beta n$  decay is energetically allowed [3] –constitute representative nuclei to investigate the competition between  $\beta n$  and multiple-neutron emission as well as the  $\gamma$ -ray contribution to the decay of neutron-unbound states.

The  $\beta$ -delayed  $\gamma$ -ray spectroscopy measurement was performed at the ISOLDE Decay Station. Three  $\beta$ -decay branches of  $^{134}\text{In}$  were established, two of which were observed for the first time [4]. Population of neutron-unbound states decaying via  $\gamma$  rays was identified in the two daughter nuclei of  $^{134}\text{In}$ ,  $^{134}\text{Sn}$  and  $^{133}\text{Sn}$ , at excitation energies exceeding the neutron separation energy by 1 MeV. The  $\beta n$ - and  $\beta 2n$ -emission branching ratios of  $^{134}\text{In}$  were determined and compared with theoretical calculations. The  $\beta n$  decay was observed to be dominant  $\beta$ -decay branch of  $^{134}\text{In}$  even though the Gamow-Teller resonance is located substantially above the two-neutron separation energy of  $^{134}\text{Sn}$ . Transitions following the  $\beta$  decay of  $^{135}\text{In}$  are reported for the first time, including  $\gamma$  rays tentatively attributed to  $^{135}\text{Sn}$  [4]. A transition that might be a candidate for deexciting the missing neutron single-particle  $\nu 1i_{13/2}$  state in  $^{133}\text{Sn}$  was observed in both  $\beta$  decays and its assignment is discussed. Experimental level schemes of  $^{134}\text{Sn}$  and  $^{135}\text{Sn}$  are compared with shell-model predictions, including calculations considering particle-hole excitations across the  $N = 82$  shell gap [5].

- [1] B. Pfeiffer, K. L. Kratz, F. K. Thielemann, and W. B. Walters, Nucl. Phys. A 693, 282 (2001).
- [2] M.R. Mumpower, R. Surman, G.C. McLaughlin, and A. Aprahamian, Prog. Part. Nucl. Phys. 86, 86 (2016).
- [3] M. Wang, W. J. Huang, F. G. Kondev, G. Audi, and S. Naimi, Chin. Phys. C 45, 030003 (2021).
- [4] M. Piersa-Silkowska et al. (IDS Collaboration), Phys. Rev. C 104, 044328 (2021).
- [5] H. Jin, M. Hasegawa, S. Tazaki, K. Kaneko, and Y. Sun, Phys. Rev. C 84, 044324 (2011).

**Primary authors:** PIERSA-SILKOWSKA, Monika (CERN); KORGUL, A. (University of Warsaw); BENITO, J. (Universidad Complutense de Madrid); FRAILE, L. M. (Universidad Complutense de Madrid); ON BEHALF OF THE IS610 COLLABORATION

**Presenter:** PIERSA-SILKOWSKA, Monika (CERN)

**Session Classification:** NS2022 Plenary

**Track Classification:** Oral Presentations