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Gamma and Fast-timing Spectroscopy Around 132Sn From the Beta-decay of In Isotopes

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During the last two decades there has been a substantial effort directed to gather information about the region around the neutron-rich 132Sn[1]. Nuclei in the regions of shell closures with a large N/Z ratio such as 132Sn are of great interest to test nuclear models and provide information about single particle states. More stringent tests of the models can be provided by the reduced transition probabilities connecting nuclear states.
In this work we have used fast-timing and gamma spectroscopy to study five Sn nuclei, including the doubly magic 132Sn, the two neutron hole 130Sn and two-neutron particle 134Sn, and the one-neutron hole 131Sn and one-neutron particle 133Sn. The Sn isotopes were studied at the ISOLDE facility, where their excited states were populated in the beta-decay of In isomers, produced in a UCx target unit equipped with a neutron converter. The In isomers were ionized using the ISOLDE Resonance Ionization Laser Ion Source (RILIS), which for the first time allowed isomer-selective ionization. The measurements took place at the new ISOLDE Decay Station (IDS), equipped with four highly efficient clover-type Ge detectors, along with a compact fast-timing setup consisting on two LaBr3(Ce) detectors and a fast beta detector. The setup incorporated a tape transport system to remove longer-lived activities.
Indium isotopes with masses ranging from 130 to 134 were produced. The RILIS isomer selectivity made it possible to produce odd-mass In isotopes with a clean separation between the 9/2+ and ½- beta-decaying isomers. For the even isotopes, such as 130In, it was also possible to separate the 5+, 10- and 1- isomers. We report on the lifetime of the 331-keV 1/2+ level in 131In, which provides information on the M1 transition to the ground state and on its degree of forbiddeness, similar to what has been recently been measured in [2]. In addition we explore the presence of the h11/2 single particle level at 65.1 keV[3] using coincidences. For 133Sn we discuss the identification of the 1363-keV level as the 2p1/2 single-particle state, and on the search for the missing 13/2+ state [4]. We also report on the search for the particle-hole multiplet states that have not been identified yet in the even Sn isotopes, in particular in 132Sn.
References:
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Primary authors: KORGUL, Agnieszka (University of Warsaw); Mr BENITO GARCÍA, Jaime (Universidad Complutense de Madrid); FRAILE, Luis M (Universidad Complutense de Madrid); PIERSA, Monika (University of Warsaw)

Co-authors: NEGRET, Alexandru (IFIN-HH Bucharest); VILLA, Amaia (Universidad Complutense de Madrid); TURTURICA, Andrei (IFIN-HH Bucharest); Dr ILLANA SISON, Andres (Ku Leuven); Dr MARSH, Bruce (CERN); Dr OLAIZOLA, Bruno (TRIUMF); MAZZOCCHI, Chiara (University of Warsaw); SOTTY, Christophe (IFIN-HH Bucharest); HENRICH, Corinna (TU Darmstadt); COSTACHE, Cristian (IFIN-HH Bucharest); MARTÍNEZ, Cristina (Universidad Complutense de Madrid); GALAVIZ, Daniel (University of Lisboa); FEDOROV, Dimitri (CERN); RAPISARDA, Elisa (ISOLDE-CERN); ROTARU, Florin (IFIN-HH Bucharest); SIMPSON, Gary (LPSC Grenoble); BEN-

ZONI, Giovanna (INFN Milano); CORREIA, Guilherme (CERN/Lisbon); FERNÁNDEZ-MARTINEZ, Guillermo (TU Darmstadt); Dr FYNBO, Hans (Department of Physics and Astronomy, Aarhus University, Denmark); DE WITTE, Hilde (KU Leuven); LAZARUS, Ian (STFC); MARROQUÍN, Irene (IEM CSIC Madrid); KURCEWICZ, Jan (ISOLDE-CERN); RÉGIS, Jean-Marc (IKP Köln); CRESSWELL, John (STFC); Mr KONKI, Joonas (University of Jyväskylä); UDÍAS, Jose Manuel (Universidad Complutense de Madrid); JOHNSTON, Karl (ISOLDE-CERN); CHRYSALIDIDS, Katerina (CERN); MIERNIK, Krzysztof (University of Warsaw); RAZVAN, Lica (ISOLDE-CERN); STAN, Lucian (IFIN-HH Bucharest); Prof. G. BORGE, Maria J (CERN); CARMONA, Mariano (Universidad Complutense de Madrid); HUYSE, Mark (KU Leuven); KICINSKA-HABIOR, Marta (University of Warsaw); Dr MADURGA, Miguel (Joint Institute for Nuclear Physics and Applications UTK); STANOIU, Mihai (IFIN-HH Bucharest); LUND, Morten (STFC); MARGINEAN, Nicolae (IFIN-HH Bucharest); WARR, Nigel (IKP Köln); TENGBLAD, Olof (IEM CSIC Madrid); RAHKILA, Panu (JYFL); GREENLEES, Paul (JYFL); STAN, Paulaskalas (U Tennessee); VAN DUPPEN, Piet (KU Leuven); MIHAI, Radu (IFIN-HH Bucharest); ROSSEL, Ralf Erik (CERN); MARGINEAN, Raluca (IFIN-HH Bucharest); ÁLVAREZ, Raquel (Universidad Politécnica de Madrid); Prof. GRZYWACZ, Robert (University of Tennessee); Dr ROTHE, Sebastian (CERN, Geneva, Switzerland); PASCU, Sorin (IFIN-HH Bucharest); MAREK, Stryjczyk (University of Warsaw); BERRY, Thomas (University of Surrey); Mr DAY GOODACRE, Thomas (CERN); KARANYONCHEV, Vasil (IKP Köln); PUCKNELL, Victor (STFC); Mrs VEDIA, Victoria (Universidad Complutense); SÁNCHEZ-TEMBLEQUE, Víctor (Universidad Complutense de Madrid); WALTERS, William (University of Maryland); JANAS, Zenon (University of Warsaw)

Presenter: Mr BENITO GARCÍA, Jaime (Universidad Complutense de Madrid)

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