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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], the most exotic doubly-magic nucleus presently at reach. Nuclei with a large N/Z ratio in this area of the table of isotopes are of great interest to test nuclear models and provide information about single particle states. Stringent tests of the models can be provided by the reduced electromagnetic transition probabilities connecting nuclear states.
In this work we have used fast-timing and gamma spectroscopy to investigate 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 of indium. 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 131Sn, 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 for 129Sn [2]. We also report on the expanded level scheme of the 131Sn and the preliminary lifetimes of excited states populated in the decay of the 131In (21/2+) isomer.
The 132Sn was studied by means of the beta-decay of 132In, and also from the beta-n decay of the 133In 1/2− isomer and the 133In 9/2+ g.s. separately. We present the new level scheme, which have been enlarged with more than 8 new levels and 40 gamma transitions. A crosscheck of previously measured known lifetimes is also provided [3].

References

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