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Fast-timing and high-resolution spectroscopy investigation of the 128Cd -> 128In -> 128Sn beta-decay chain

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The isotopic chains close to the magic proton number $Z = 50$ have motivated an extensive experimental and theoretical effort during the last decades. Their simple structure provides an excellent ground to study shell-evolution along the chain, as well as to understand the interplay between single particles and collective degrees of freedom. The systematic study of their excited structure, and in particular, the measurement of lifetimes, provides key observables to get a deeper insight into the structure of these nuclei. Through lifetime measurements, it is possible to extract the electromagnetic strengths, $B(XL)$, providing valuable information that can be used to test the validity of shell-model calculations.

The result obtained during the experimental campaign was performed at the ISOLDE Decay Station (IDS). High purity Cd ($Z = 48$) beams were produced after the fission of a thick UC_x target, selectively ionized by the ISOLDE Resonance Ionization Laser Ion Source (RILIS) and separated in mass using the General Purpose Separator (GPS) ISOLDE mass separator.

High-resolution gamma spectroscopy using six highly efficient clover-type HPGe detectors was used to build a new level scheme. The Advanced Time-Delayed $\beta\gamma\gamma$(t) [1,2] method is employed in order to access lifetimes down to the 10 ps range. This technique makes use of a compact fast-timing setup with two γ-$LaBr_3$(Ce) detectors and three fast \(\beta \)-detectors. This method is the most suited to measure lifetimes in the sub-nanosecond range and dealing with the large amount of low-lying isomers that are common in this region.

In this work, we have revisited the excited structure of the β-decay chain ^{128}Cd$\rightarrow^{128}$In$\rightarrow^{128}$Sn [3,4,5]. This analysis has allowed us to expand the known level schemes, and moreover, lifetimes in the sub-nanosecond range have been directly measured for the first time in ^{128}In and ^{128}Sn. We will report on the experimental results derived from this analysis and provide a discussion of the deduced $B(XL)$ in comparison with theoretical calculations.

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