

Recent results on level structures and lifetimes in ^{130}Cd and ^{98}Cd and their analogies

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The search for the mechanisms to drive the possible shell evolution phenomena is ongoing. Originally and up to date, two mechanisms are considered. The first one, is the so called monopole migration [1], which acts for both proton and neutron-rich nuclei, and the second one, the shell quenching due to a softening of the potential shape that results from the presence of an excessive number of neutrons in very neutron-rich nuclei [2]. These mechanisms modify the known magic numbers as a consequence of shifting effective single-particle levels when going towards either the proton or the neutron drip lines. In medium-heavy nuclei the effort to establish shell evolution concentrates around the ^{100}Sn and ^{132}Sn doubly magic nuclei. The Sn isotopes form the longest isotopic chain in the nuclear chart accessible to current experimental study and thus provide a stringent testing ground for nuclear structure models within a large isospin span. A remarkable similarity was found between the decay of $8+$ isomers in ^{98}Cd [3] and ^{130}Cd [4], both of which have a pure $g_{9/2-2}$ proton-hole configuration. However, the analogue of the known core excited isomer in ^{98}Cd [5] was not observed so far in ^{130}Cd , within experimental sensitivity, thus underlining the differences in the underlying neutron single-particle structure. The understanding of analogies in the structure of both regions of nuclei and the evolution of the $N=82$ shell gap below ^{132}Sn is of importance in predicting the path of the rapid-neutron capture process which partially drives the production of elements heavier than Fe in nature. A handful of additional information on these two regions and for those two particular nuclei was obtained recently in spectroscopy studies [6,7], and newly, evaluating experimental information collected in various experimental campaigns including EURICA [8], HiCARI [9], and DESPEC [10] in yet unpublished data subsets. The most recent results include identification of new 2-hole level structures, and most importantly, the lifetime information for most of the levels in both nuclei, even if not all with high precision. The results will be discussed and compared with large-scale shell- model calculations using various sets of the realistic residual two-body interaction.

- [1] T. Otsuka et al., Phys. Rev. Lett. 95, 232502 (2005).
- [2] J. Dobaczewski, I. Hamamoto, W. Nazarewicz and J.A. Sheik, Phys. Rev. Lett. 72, 981 (1994). [3] M. Górska et al., Phys. Rev. Lett. 79, 2415 (1997).
- [4] A. Jungclaus, et al., Phys. Rev. Lett. 99, 132501 (2007).
- [5] A. Blazhev et al., Phys. Rev. C 69, 064304 (2004).
- [6] J. Park et al., Phys. Rev. C 96, 044311 (2017).
- [7] S.Y. Jin et al., Phys. Rev. C 104, 024302 (2021).
- [8] A. Jungclaus, et al., submitted for publication in Phys. Rev. Lett.
- [9] M. Armstrong et al, in preparation.
- [10] G. Zhang et al., in preparation.

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