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Interplay between quadrupole and pairing correlations close to ^{100}Sn from lifetime measurements

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The tin nuclei, representing the longest isotopic chain between two experimentally accessible doubly-magic nuclei, provide a unique opportunity for systematic studies of the evolution of basic nuclear properties when going from very neutron-deficient to very neutron-rich species. A little over a decade ago, they were considered a paradigm of pairing dominance: the excitation energies of the first 2^+ and 4^+ states are rather constant along the Sn isotopic chain, and the $B(E2; 2^+ \rightarrow 0^+)$ values for isotopes with A>116 present a parabolic behavior expected for the seniority scheme. On the other hand, the $B(E2; 2^+ \rightarrow 0^+)$ values measured for neutron-deficient Sn isotopes remain constant with N. Unfortunately, the lack of information on $B(E2; 4^+ \rightarrow 2^+)$ strengths in light Sn nuclei, combined with large experimental uncertainties on the $B(E2; 2^+ \rightarrow 0^+)$ values, prevent firm conclusions on the shell evolution in the vicinity of the heaviest proton-bound N=Z doubly-magic nucleus ^{100}Sn.
To remedy this, the first lifetime measurement in neutron-deficient tin isotopes was carried out using the Recoil Distance Doppler-Shift method, providing a complementary solution to the previous Coulomb-excitation studies. Thanks to the unusual application of a multi-nucleon transfer reaction, together with unprecedented capabilities of the powerful AGATA and VAMOS++ spectrometers, the lifetimes of the 2^+ and 4^+ states in ^{106,108}Sn have been directly measured for the very first time.
Large-scale shell-model calculations were performed to account for the new experimental results. In particular, the comparison of the $B(E2; 4^+ \rightarrow 2^+)$ values with the theoretical predictions shed light on the interplay between quadrupole and pairing forces in the vicinity of ^{100}Sn. An interpretation has also been proposed for the anomalous $B(E2; 4^+ \rightarrow 2^+)/B(E2; 2^+ \rightarrow 0^+)$ ratio observed not only for the Sn isotopes, but also in other regions of the nuclear chart.

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