Intermediate-energy Coulomb excitation of ^{104}Sn: Moderate $E2$ strength decrease approaching ^{100}Sn†

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In recent years, several experimental findings generated a large interest regarding the $E2$ strength pattern in the tin isotopes. While the neutron-rich isotopes with $A = 126, 128, 130$ follow the anticipated trend of smoothly decreasing $B(E2)\uparrow$ values towards the major shell closure well described by large-scale shell-model (LSSM) calculations[1,2], the proton-rich nuclei take a different path. Commencing with the stable $A = 114$ isotope a steadily growing deviation from the shell-model expectations was observed with almost constant $B(E2)\uparrow$ values for the $A = 106 - 112$ isotopes[1–3]. A first attempt for ^{104}Sn with limited statistics has recently been made[4]. The result of 0.10(4) e^2b^2 indicates a steep decrease of excitation strength in agreement with LSSM calculations. In a second measurement, a considerably larger value of 0.180(37) e^2b^2 was obtained[5]. Here, we report on the first $B(E2)\uparrow$ extraction of ^{104}Sn from absolute Coulomb excitation cross-sections at intermediate energies.

A ^{124}Xe primary beam was accelerated up to an energy of 345 MeV/nucleon and impinged on a 3 mm thick Be production target at the F0 focus of the BigRIPS fragment separator[6]. The $B\rho - \Delta E - B\rho$ method was applied to select and purify secondary beams of ^{104}Sn and ^{112}Sn in two subsequent measurements. The secondary beams were transported to the focal point F8, where a 557 mg/cm^2 thick Pb target was inserted to induce Coulomb excitation reactions. To detect γ-rays from the $2^+_1 \rightarrow 0^+_{gs}$ transitions, the reaction target was surrounded by the DALI2 array[7]. Reaction products were identified behind the reaction target by the ZeroDegree spectrometer[1].

A $B(E2)\uparrow$ value of 0.173(28) e^2b^2 was deduced for ^{104}Sn. The run with ^{112}Sn, which has a known $B(E2)\uparrow$ value, was used for feeding estimations. Our result is in agreement with the 0.180(37) e^2b^2 obtained in Ref.[5] with largely overlapping error bars, but deviates significantly from the value of 0.10(4) e^2b^2 obtained in Ref.[4]. The drop in excitation strength is much smoother than suggested in Ref.[4] and cannot be reproduced by present LSSM calculations using standard effective charges as well as proton and neutron excitation across the $N = Z = 50$ shell.

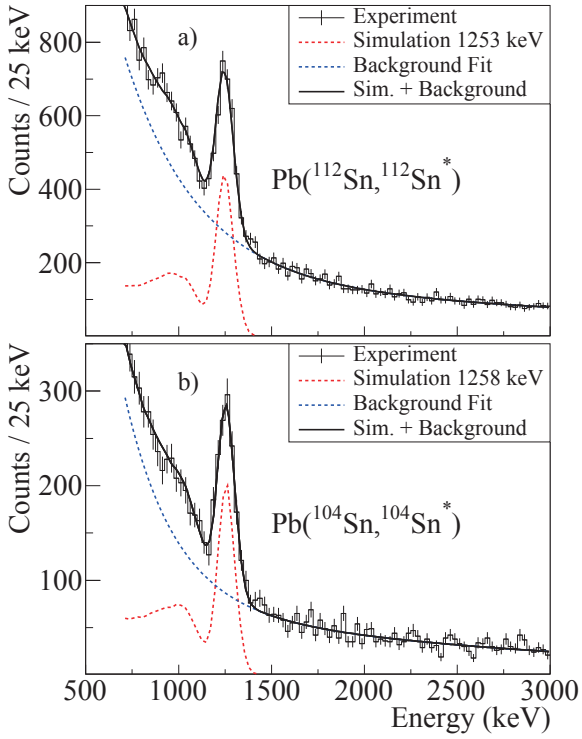

Fig. 1. Doppler corrected γ-ray spectra of ^{112}Sn (top panel a) and ^{104}Sn (bottom panel b). The observed $2^+_1 \rightarrow 0^+_{gs}$ transitions are compared to simulations.

† Condensed from the article in Phys. Rev. C 90, 061302(R) (2014).

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