First measurement of the quadrupole moment of the 2_1^+ state in ^{108}Sn and ^{110}Sn

R. A. LOPEZ[1], J. PARK[1,2,3], J. CEDERKÄLL[1,4] FOR THE IS562 EXPERIMENT AT ISOLDE

1. Lund University, Sweden, 2. Institute of Basic Science, Republic of Korea, 3. Hope College, USA, 4. CERN, Switzerland

Objective

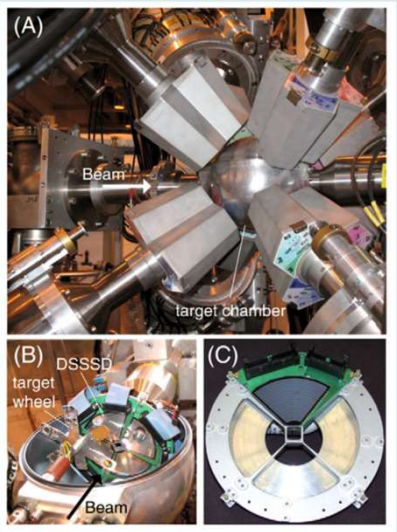
Accurately reproducing B(E2; $2_1^+ \rightarrow 0_1^+$) values for the neutron-deficient tin isotopes has historically proven difficult. More recent theoretical work suggests that the enhancement in B(E2) values can be explained by proton excitations across the Z = 50 shell gap. One experimental signature of this effect is a shape change in the 2_1^+ state, going from oblate in ^{110}Sn to prolate in ^{108}Sn.

In this work, we studied Coulomb excitation reactions using the Miniball detector at ISOLDE, CERN, to verify the nuclear shapes.

Experimental Setup

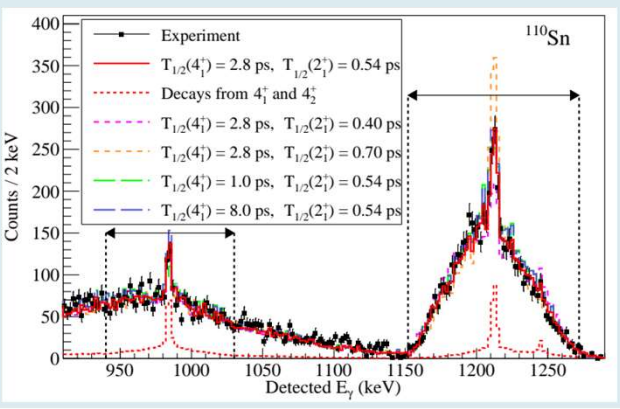
Experiment used the Miniball setup (an HPGe array + CD Si detector).

The Sn beams were produced via spallation reaction: p (@1.4 GeV) + LaC_x target, and post-accelerated up to 4.4 MeV/u.



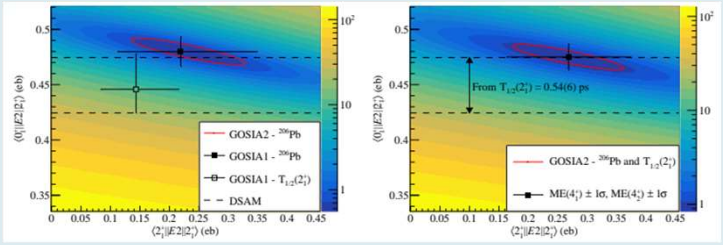
Analysis Method

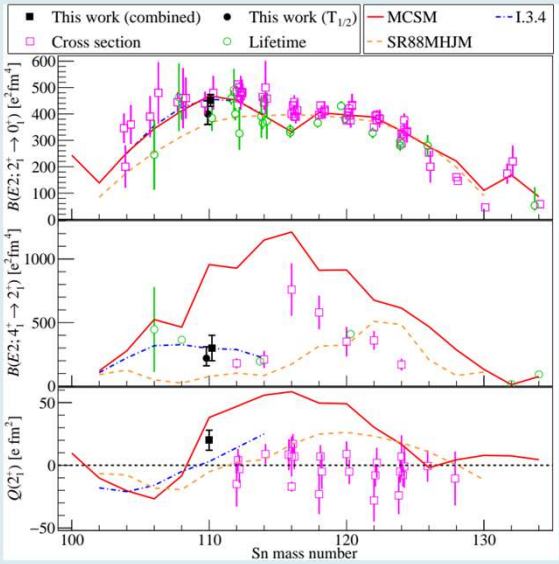
The analytical procedure consisted of running the semiclassical Coulomb excitation code GOSIA iteratively. The analysis was then further constrained by extracting the lifetime of the state via DSAM.

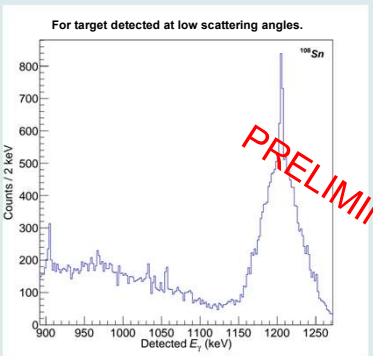


Results

For ^{110}Sn, the quadrupole moment, $Q(2_1^+)$, was found to be clearly oblate by more than 2 sigma, irrespective of normalization choice. Furthermore, B(E2) values were found with higher precision.







Transition	Total Counts
1206 keV $2_1^+ \rightarrow 0_1^+$	92150 ± 303.6
905 keV $4_1^+ \rightarrow 2_1^+$	50 ± 7.1
1273 keV ? $4_2^+ \rightarrow 2_1^+$	9 ± 3

Conclusions

We have found the nuclear shape of the 2_1^+ in ^{110}Sn to be clearly oblate. Furthermore, it has the highest positive $Q(2_1^+)$ value observed in Sn isotopes. The analysis of ^{108}Sn is ongoing.

Acknowledgement

This work was supported by the Swedish Research Council under the grants 2021-00174-VR, 2021-04575-VR, 2017-00637-VR and 2017-03986-VR, by the Institute for Basic Science, Republic of Korea, under grant IBS-R031-D1 and the European Union's Horizon Europe Framework research and innovation programme under grant agreement no. 101057511.