Quadrupole transition strengths in light Sn nuclei studied in Coulomb excitation

C. Fahlander□, J. Cederkäll†,□, A. Ekström□, M. Hjorth-Jensen□, F. Ames‡, P. A. Butler§, T. Davinson¶, J .Eberth□, G. Georgiev†, A. Gorgen††, M. Górska‡‡, D. Habs§§, M. Huyse¶¶, O. Ivanov¶¶, J. Iwanicki□□, O. Kester‡‡, U. Köster†, B. A. Marsh†††,‡‡‡ , P. Reiter□, H. Scheit§§§, D. Schwalm§§§, S. Siem¶¶¶, I. Stefanescu¶¶, G. M. Tveten¶¶¶, J. Van de Walle¶¶, P. Van Duppen¶¶, D. Voulot‡‡‡, N. Warr□, D. Weisshaar□, F. Wenander‡‡‡ and M. Zielinska□□

□ *Department of Physics, University of Lund, Box 118, SE-221 00 Lund, Sweden*
† *PH Department, CERN 1211, Geneva 23, Switzerland*
□ *Physics Department and Center of Mathematics for Applications, University of Oslo, Norway*
‡ *TRIUMF, Vancouver, Canada*
§ *Oliver Lodge Laboratory, University of Liverpool, United Kingdom*
¶ *Department of Physics and Astronomy, University of Edingburg, United Kingdom*
□ *Institute of Nuclear Physics, University of Cologne, Germany*
†† *CEA Saclay, DAPNIA/SPhN, gif-sur-Yvette, France*
‡‡ *Gesellschaft für Schwerionenforschung, Darmstadt, Germany*
§§ *Physics Department, Ludwig-Maximilian University, Munich, Germany*
¶¶ *Instituut voor Kern- en Stralingsfysica, K.U. Leuven, Belgium*
□□ *Heavy Ion Laboratory, Warsaw University, Poland*
††† *Department of Physics, University of Manchester, United Kingdom*
‡‡‡ *AB Department, CERN 1211, Geneva 23, Switzerland*
§§§ *Max-Planck Institute of Nuclear Physics, Heidelberg, Germany*
¶¶¶ *Department of Physics, University of Oslo, Norway*

ABSTRACT

The experimental knowledge about the shell structure evolution towards the doubly-magic self-conjugate ^{100}Sn nucleus is now becoming available through radioactive ion beam (RIB) techniques. The investigation of exotic isotopes reveals novel effects of the underlying effective nucleon-nucleon interaction. Furthermore, the Sn isotopes span a region between the $N = Z = 50$ and $N = 82$, $Z = 50$ double shell closures, which make them the longest isotopic chain available for experiment. This enables a unique study of the shell structure variations as a function of the number of neutrons outside the closed Sn core. The constancy of the energy separation between the first excited 2^+ state and the 0^+ ground state in the even-mass Sn isotopes is well explained within the generalized seniority model. Furthermore, according to this theory, non-diagonal matrix elements of the even one-body E2 tensor operator will exhibit a parabolic behaviour as a function of mass number across the Sn isotope chain. Large scale shell-model calculations based using a microscopic description of the effective nucleon-nucleon interaction largely agree with the generalized seniority model. The adopted experimental $B(E2)$ values on the neutron-rich side of the Sn chain follow the theoretical predictions. The experimental RIB results on ^{106,108,110}Sn presented here display a clear discrepancy with theoretical models.