SHAPE COEXISTENCE IN NEUTRON-RICH STRONTIUM ISOTOPES AT N=60

E. Clément[1,2], M. Zielińska[3,4] A. Görgen[5], W. Korten[3], S. Péru[6], J. Libert[6], H. Goutte[3], S. Hilaire[6] for the IS451 collaboration
[1]GANIL, CEA/DSM-CNRS/IN2P3, F-14076 Caen Cedex 05, France
[2]PH Department, CERN 1211, Geneva 23, Switzerland
[3]CEA Saclay, IRFU, SPhN, 91191 Gif-sur-Yvette, France
[4]Heavy Ion Laboratory, University of Warsaw, PL-02-093 Warsaw, Poland
[5]Department of Physics, University of Oslo, 0316 Oslo, Norway
[6]CEA, DAM, DIF, F-91297 Arpajon, France

Neutron-rich A~100 nuclei are among the best examples of interplay of microscopic and macroscopic effects in nuclear matter. A dramatic onset of quadrupole deformation is observed in the neutron-rich Zr and Sr isotopes at N=60, making this region an active area of experimental and theoretical studies. This rapid shape transition is accompanied by the appearance of low-lying 0+2 states that, for N<60, can be interpreted as a deformed configuration that becomes the ground state at N=60, while the spherical ground-state configuration of the isotopes with N<60 becomes non-yrast for those with N≥60.

Low-energy Coulomb excitation experiments were to study properties of coexisting structures in ^{96,98}Sr (N=58,60) using post-accelerated exotic Sr beams from REX-ISOLDE. The experiments were carried out in the particle-gamma coincidence mode using the MINIBALL HPGe array coupled to an annular Double Sided Silicon Detector. Several different targets were used in order to make use of the dependence of the Coulomb excitation cross section on the atomic numbers of collision partners: ^{109}Ag and ^{120}Sn in the case of ^{96}Sr, ^{60}Ni and ^{208}Pb for ^{98}Sr. For ^{96}Sr, the $2^+_1 \rightarrow 0^+_1$ transition was observed together with excitation of target nuclei and a weak transition corresponding to the 0^+_2 deexcitation. For ^{98}Sr, the rotational ground-state band was populated up to spin 8^+, and the decay of the 2^+_2 state was also observed. Reduced transition probabilities and spectroscopic quadrupole moments were extracted from the measured differential Coulomb excitation cross sections.

The results support the scenario of shape transition at N=60 giving rise to coexistence of two very different configurations in ^{96,98}Sr. In ^{96}Sr, the spectroscopic quadrupole moment of the first 2^+ state was found to be small and negative, corresponding to a weak prolate deformation. In ^{98}Sr, the large and negative spectroscopic quadrupole moments in the ground state band prove its well-deformed prolate character, while the value close to zero obtained for the 2^+_2 state confirms that a spherical configuration coexists with the deformed configuration of the ground state. The comparison of the B(E2) values and the spectroscopic quadrupole moments between the 2^+_1 state in ^{96}Sr and the 2^+_2 state in ^{98}Sr underlines their similarity and further supports the shape inversion when crossing the N=60 line. Furthermore, a very small mixing between the coexisting structures was determined from measured intra-band transition probabilities in ^{98}Sr. This effect has been attributed to the rapidity of the shape change at N=60: a larger mixing would give rise to a more gradual transition from spherical to deformed ground state in Sr isotopes, like what is observed in other areas of shape coexistence, for example neutron-deficient Kr and Hg isotopes.

The experimental results, together with a detailed comparison with new beyond-mean-field calculations, will be presented. The present work will be also highlighted in a larger framework of the shape change in the mass region.