Shape coexistence in neutron-deficient ^{190}Pb

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Shape coexistence is an broad phenomenon with manifestations all over the nuclear chart [1]. In the neutron-deficient lead region when approaching the neutron mid-shell N = 104, collective intruder configurations give rise to oblate and prolate shapes competing with the spherical ground-state, in particular in ^{190}Pb. Wealth of information on the nuclear structure is connected to these different potential well minima. Diagonal E2 matrix elements will be determined from the Coulomb excitation IS494 experiment [2] performed at ISOLDE. In this study, we have performed two other experiments to address this phenomenon via the best complementary fingerprints of it.

Simultaneous measurement of internal conversion electrons and γ rays was allowed thanks to the SAGE spectrometer [3] within the first campaign where is was used coupled to MARA (Mass Analysing Recoil Apparatus) [4,5], a vacuum mode recoil separator. The desired nucleus was produced via the fusion-evaporation reaction ^{159}Tb(^{35}Cl,4n), at beam energy of 165 MeV, in the Accelerator Laboratory at the University of Jyväskylä (JYFL) [6]. The accurate measurement of strong E0 inter-band transitions provides valuable information between states with different mean-square charge radii. These monopole transition strengths and shape mixing amplitudes can be calculated through the B(E2) values or lifetimes of the side-band transitions, if available. Besides, spectroscopic information has been gathered for the structures above the 11^- and 12^+ isomeric states.

Whereas previous experimental studies have assigned the yrast band with a spherical shape [7], theoretical calculations beyond mean-field and within the interacting boson model (IBM) have shed light on a possible oblate configuration dominance [8,9]. In order to clarify this and to investigate the shape mixing at low-spin and above the isomeric states, an experiment has been conducted in March 2023 at JYFL to provide more insight into the shape mixing in this region, via the Recoil Distance Doppler-Shift (RDDS) method.

References

[1] K. Heyde and J. L. Wood, *Rev. Mod. Phys.* **83** (2011) 1467.
[2] T. Grahn, J. Pakarinen *et al.*, IS494 (2009) 1-10.
[3] J. Pakarinen *et al.*, *Eur. Phys. J. A* **50** (2014) 1-11.
[4] J. Sarén *et al.*, *Nucl. Instrum. Methods Phys. Res. B* **266** (2008) 4196-42.
[5] J. Uusitalo, J. Sarén, J. Partanen and J. Hilton, *Acta Phys. Pol. B* **50** (2019) 319-327.
[6] A. M. Plaza *et al.*, *in preparation.*
[7] G. D. Dracoulis, A. P. Byrne and A. M. Baxter, *Phys. Lett. B* **432** (1998) 37-44.
[8] V. Hellemans, S. De Baerdemacker and K. Heyde, *Phys. Rev. C* **77** (2008) 064324.
[9] J. M. Yao, M. Bender and P.-H. Heenen, *Phys. Rev. C* **87** (2013) 034322.