Gamma-ray spectroscopy at the extremes; in-beam study of ^{180}Pb

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A considerable body of both theoretical and experimental evidence has been gathered for coexisting configurations possessing different shapes in the very neutron-deficient lead isotopes [1,2]. This phenomenon becomes particularly apparent in lead isotopes in the vicinity of the N=104 neutron midshell, where the competing deformed structures intrude down to energies close to the spherical ground state. The intruder states have been associated with proton multiparticle-multihole excitations across the closed Z=82 shell. This picture is supported by hindrance factors obtained in α-decay fine-structure studies [3]. Mean-field calculations suggest that each intruder configuration can be associated with a different shape [4]. Together with the spherical ground state, they result in a unique triplet of shape-coexisting 0^+ states in ^{186}Pb [3].

Various spectroscopic techniques have been employed in order to understand the driving force and behaviour of the intruder states. This presentation focuses on in-beam γ-ray spectroscopy employing recoil-decay tagging. Although these studies possess a vast experimental challenge, as nuclei of interest are produced in the level of few particles per hour, it is the only feasible technique to access very neutron-deficient nuclei in the lead region.

Very recently, we have observed excited states in the extremely neutron-deficient nucleus ^{180}Pb [5]. This study lies at the limit of what is presently achievable with in-beam spectroscopy, with an estimated cross section of only 10 nb. Results shed light on the evolution of different shapes when moving further beyond the N=104 neutron midshell. The systematic behaviour of levels in the lead isotopic chain shows a continuation of the trend of what is observed in heavier ^{182}Pb and ^{184}Pb isotopes. A comparison with beyond meanfield calculations has been made. The interpretation of results will be discussed in more details.

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