Probing the shapes of ^{186}Pb *

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The discovery of three co-existing shapes of the ^{186}Pb nucleus at very low excitation energies has been one of the recent highlights in studies of exotic nuclei [1]. The ground state of ^{186}Pb is obviously spherical and has a spin-parity of 0^+. Surprisingly, two first excited states of ^{186}Pb at 532 keV and 650 keV, identified in α-decay studies, have also been found to be 0^+ states and have been associated with oblate and prolate deformations, respectively. The existence of the low-lying prolate potential energy minimum was confirmed already earlier by the observation of an yrast prolate rotational band in in-beam experiments [2]. A rotational band associated with the oblate 0^+ state should also exist and, if discovered, would confirm the case of unique triple shape co-existence.

Detailed coincidence γ-ray studies of ^{186}Pb have been rather difficult as the production cross-section is only of the order of 100μb in fusion evaporation reactions. Recoil-Decay-Tagging (RDT) method has not been easily applicable since the half-life of ^{186}Pb is 4.8s. The highly granular GREAT focal-plane spectrometer at the RITU gas-filled separator operated in conjunction with the JUROGAM γ-ray array was used at JYFL to perform a RDT γ-ray experiment for ^{186}Pb using the ^{106}Pd(^{83}Kr,3n)^{186}Pb reaction. High statistics $\gamma\gamma$-coincidence data tagged with the α-decay of ^{186}Pb were collected, enabling the identification of the yrast prolate band and new non-yrast bands. Results have been compared with IBM calculations. Properties of the bands and their relations to nuclear shapes will be discussed.

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