Structure of ^{231}Ac

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Extensive studies on heavy actinides have given evidence for the occurrence of near-stable octupole deformation around A = 225 [1]. A survey of the available data for odd-A nuclei reveal that the largest amount of octupole correlations are present in the Ac and Pa nuclei. In particular for the Actinium isotopes the low-energy spectra of ^{223,225}Ac display the K=3/2 and K=5/2 parity doublets [2]. In ^{227}Ac only the K=5/2 parity doublet band, seen experimentally close to 300 keV excitation energy, can be described in terms of static octupole deformation. In the case of ^{229}Ac the four K=$1/2^{\pm}$ and K=$3/2^{\pm}$ bands are interpreted either as normal Nilsson levels or by assuming a weak octupole coupling. The study of the upper border of this octupole deformed region is of great relevance in order to understand the interplay of octupole and quadrupole collectivities and to reveal the exact mechanism by which the octupole deformation disappears in the presence of a well developed quadrupole field. Within the IS322 collaboration at CERN we carry out a systematic investigation of the heavy Fr – Th nuclei. Here we report on the structure of the heaviest odd-Ac isotope, ^{231}Ac, available for spectroscopic studies.

Previous knowledge on the excited states of ^{231}Ac was limited to the six strongest gamma lines observed in beta decay studies [3]. The proton pickup (t,α) reaction was used to investigate the structure of ^{233}Pa and its isotone ^{231}Ac [4]. In the case of ^{231}Ac the lack of information from beta decay caused that the band assignments from the experimental cross sections were only based on comparison to the ones assigned to the isotone ^{233}Pa.

In the present contribution the low-energy structure of ^{231}Ac following the β^- decay of ^{231}Ra has been investigated by γ-γ and γ-e$^-$ spectroscopy. Multipolarities of 22 transitions have been established by measuring conversion electrons. The decay scheme of ^{231}Ra $\rightarrow$ ^{231}Ac has been constructed for the first time. The Advanced Time Delayed $\beta\gamma\gamma(t)$ method [5] has been used to measure the half-lives of several levels. The deduced B(E1) rates are used to infer possible presence of octupole correlations.

References

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