1. Shape coexistence in radioactive ^{74,76}Kr studied by Coulomb excitation

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The neutron-deficient krypton isotopes near the $N=Z$ line are considered to be among the best examples of nuclear shape coexistence. States of prolate and oblate shape are thought to coexist within a narrow energy range of only a few hundred keV. This competition can be understood from the existence of large shell gaps in the single-particle spectrum at proton and neutron numbers 34, 36, and 38, both, for prolate and oblate deformation. Experimental indication for shape coexistence in the light krypton isotopes comes from the observation of low-lying excited 0^+ states. Based on their excitation energy, the electric monopole strength of their decay to the ground state, and the distortion of the otherwise regular rotational bands at low spin, a scenario has been proposed in which the ground states of the heavier isotopes ^{76,78}Kr have a prolate shape, prolate and oblate configurations strongly mix in ^{74}Kr, and the oblate configuration dominates the ground state of ^{72}Kr [1]. The Coulomb excitation experiments of radioactive isotopes ^{76}Kr and ^{74}Kr aimed at testing this scenario by measuring both transitional and static electromagnetic moments in these nuclei.

The radioactive ^{76}Kr and ^{74}Kr beams were produced by the SPIRAL facility at GANIL by fragmentation of a ^{78}Kr beam on ^{12}C primary target and post-accelerated in the CIME cyclotron to 4.4 A MeV for ^{76}Kr and 4.7 A MeV for ^{74}Kr. The beams were Coulomb excited on a ^{208}Pb target of 1 mg/cm^2 thickness. Scattered Kr projectiles and recoiling target nuclei were measured in a highly segmented annular Si detector mounted at forward angles. De-excitation γ-rays were detected with the EXOGAM spectrometer comprising 7 and 11 Ge clover detectors, respectively. In both isotopes the ground-state bands were populated up to the 8^+ state, and several non-yrast states were observed.

The Coulomb excitation analysis was performed using the least squares code GOSIA [2]. Both transitional and diagonal electromagnetic matrix elements were determined in a χ^2 minimization optimally reproducing the observed yields, as well as, previously known spectroscopic data (lifetimes, branching ratios, mixing ratios). During the preliminary analysis discrepancies with earlier lifetime measurements were found. A new lifetime measurement was performed. It confirmed the Coulomb excitation data [3]. The precise transition probabilities obtained in this complementary experiment enhanced significantly the sensitivity of the GOSIA fit to the diagonal matrix elements.

Positive values are found for the static quadrupole moments of the states in the ground-state band for both ^{74}Kr and ^{76}Kr, while the quadrupole moments of the second 2^+ state are negative. It should be stressed that the experiments exploited, for the first time, the reorientation effect with a radioactive beam. Furthermore, about 15 transitional matrix elements between low-lying states were determined for each isotope. The comparison of the experimentally determined matrix elements with configuration mixing calculations using the generator coordinate method shows an overall agreement, pointing out the importance of the triaxial degree of freedom in the theoretical description of light krypton isotopes [4].

References

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2. Recoil Filter Detector simulation for AGATA

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The European "Advanced GAmma Tracking Array" (AGATA) [1] project enters the Demonstrator phase, in which 15 to 18 HPGe detectors grouped in triple clusters will be employed to demonstrate the feasibility of the γ-ray tracking. Commissioning of the Demonstrator will take place in 2008 at the Laboratori Nazionali di Legnaro, Italy, and it will be followed by an experimental campaign. It is expected that the Demonstrator will provide γ-ray spectra of significantly better quality (P/T and FWHM) then any existing γ-ray detectors. The ancillary detectors used together with the Demonstrator should enhance the detection and resolving power of the array. On the other hand, their presence will disturb γ-ray radiation detected in the Ge crystals. The use of the Recoil Filter Detector (RFD, Fig.1) [2] as an ancillary detector in the Demonstrator phase is considered, thus reliable Monte Carlo simulation of the Demonstrator with RFD setup is necessary.

AGATA is expected to provide exact information on the position of the first interaction of each γ-ray in Ge crystals and this makes possible precise Doppler correction. In conventional detectors, the quality of the Doppler correction is limited by the uncertainty of the γ-ray detection angle, determined by the opening angle of the detector (or detector segment). In order to exploit fully this feature of AGATA, the velocity vector of the γ-ray source must be known. Such information can be provided by RFD.

Geant4 procedures defining the geometry of RFD were incorporated in the Geant4 [3] AGATA simulation code [4]. Eighteen Mylar foils which are the sensitive parts of RFD, as well as mechanical parts, like the target chamber, conical RFD chamber and beam tube were included. Work on the RFD simulation is in progress and it currently concentrates on providing realistic physics input (fusion-evaporation events) and on analyzing transport of residual nuclei in the