Evidence for a smooth onset of deformation in the neutron-rich Kr isotopes

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Nuclei in the neutron-rich A≈100 mass region are well suited for the understanding of evolution of nuclear deformation from spherical to strongly deformed ground-state shapes. By adding only a few neutrons to the N=50 shell closure, deformation and, thus, collective effects occur quickly. For the Z=40 (Zr) isotopes, the neutron number N=56 becomes an effective shell closure, so that ^{96}Zr has characteristics of a doubly-magic nucleus. Adding only a few neutrons more, the Zr-isotopes get strongly deformed. This behaviour indicates a shape phase transition around N=60. For the Z=38 (Sr) isotopes the systematics show a similar behaviour, whereas for the Z=42 (Mo) and Z=44 (Ru) isotopes, this rapid change of the shape seems to be attenuated.
The aim of this work was to investigate the behaviour of the even-even Z=36 (Kr) isotopes in this phase transition region by determining the energies of the 2_1^+ states and their E2 decay transition strengths to the ground state in ^{94}Kr (N=58) and ^{96}Kr (N=60). Information on the energies of the first excited 2^+ states exist only for the Kr isotopes up to N=58. For N=60, contradictory results on this observable were published recently.
To clarify this contradiction several experimental runs were performed at the REX-ISOLDE facility at CERN between 2009 and 2011, utilizing the high-efficiency MINIBALL gamma-ray spectrometer and analyzing the emitted gamma-rays and scattered particles after the Coulomb-excitation reactions. The results of these experiments will be presented and discussed in the framework of the proton-neutron interacting boson model based on the constrained Hartree-Fock-Bogoliubov approach using the microscopic Gogny-D1M energy density functional.