Contribution ID: **31** Type: **not specified**

Decay studies of exotic A ~ 70 nuclei: Test of nuclear properties at both extremes of the nuclear chart

The characterization of nuclei toward the drip-lines has attracted much attention in recent decades due to their importance in nuclear structure, astrophysics, and fundamental physics. In this framework we discuss two decay experiments that span the two extremes of the isobaric mass chain A ~ 70, performed in RIKEN as part of the EURICA collaboration.
Exotic nuclei of 70 Mn, 70 Fe, 70 Co, 70 Br, and 70 Kr were produced using relativistic in-flight fission of 238 U and fragmentation of 78 Kr. The nuclei were identified with the magnetic spectrometer BIGRIPS. Both the WAS3ABi active stopper and the EURICA γ-ray spectrometer were used for the study of their β-decay properties.
In this contribution, the progressive development of collectivity in the isobaric mass chain A = 70 will be discussed. This is at variance with previous studies of shell evolution where long isotopic or isotonic chains were systematically studied. On the neutron-rich side, the recently published results on the decays of 70 Mn [1], 70 Fe, and 70 Co [2] will be shown. Furthermore, evidence for shape coexistence in 70 Co will be discussed, showing that this is one of the first experimental cases which can be explained in terms of the newly reported type II of shell evolution [3]. On the proton-rich side, we will discuss the shape coexistence in the rp-process nucleus 70 Br. Of particular importance is the study of its half-life and superallowed branching ratio, as it is one of the heaviest TZ = 0, N = Z nuclei that can be used to test the conserved vector current hypothesis and the unitarity of the CKM matrix in the search for new physics beyond the Standard Model [4].

References

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