Decay spectroscopy in the neutron-rich A∼140 region beyond the doubly-magic ^{132}Sn

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An isomer and β-decay experiment was performed in the framework of the EURICA project at RIBF[1,2] aiming at detailed decay spectroscopy and systematical study of the nuclear shape in one of the most interesting, and yet unexplored regions of the nuclear chart, the one beyond the doubly-magic ^{132}Sn. For these nuclei, we may expect gradual change from spherical shape with predominantly single-particle-like structures, to a more deformed, prolate shape with collective-type of excitations, while with the increase of the neutron-number also octupole collectivity may develop. Furthermore, the perturbed shell structure of these nuclei by e.g. sub-shell gaps or intruder high-j orbitals may also cause isomeric states, picturing in turn these exotic systems far off stability.

The experiment was performed using in-flight ^{238}U fission at 345 MeV/u on Be target with a thickness of 2.9 mm. The beam intensity was between 1-5 pnA. The nuclei of interest were transported and selected by BigRIPS and implanted in the active stopper, WAS3ABi, consisting of five Si DSSD detectors[1]. Twelve Ge Cluster detectors and eighteen $LaBr_3$(Ce) detectors[3], constituting the EURICA 4π array surrounding the stopper, detected the isomeric- or β-delayed γ-rays. The experimentally obtained particle identification is shown in Fig. 1, where a line indicates the nuclei beyond which no half-lives are known according to[4]. Our preliminary data analysis of known half-lives for e.g. ^{138,139}Sb nuclei show a very good agreement with the ISOLDE measurement [5], providing an important input to the nucleosynthesis data around the A = 130 solar-system r-process abundance peak.

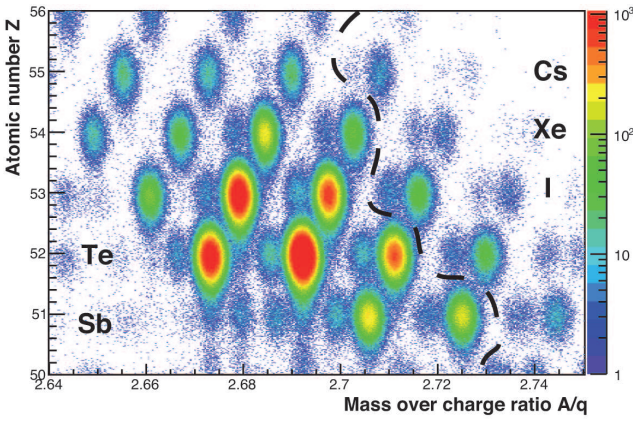

Fig. 1. Particle identification of the exotic nuclear cocktail.

Although the analysis is still in progress, our preliminary results show also several isomeric states before and after a β-decay in e.g. in Sb and I nuclei. Isomers are found also in the very neutron-rich Cs isotopes[6]. In addition, first excited states e.g. in the produced even-even nuclei with the neutron increase will provide new and vital information for the shell structure and the shape evolution in this region along with the detailed studies of the other exotic isotopes populated in the experiment.

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