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Studying the exotic decay of ^{70}Kr $\rightarrow$ ^{70}Br

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The β-decay of ^{70}Kr can be used to test the predictions of different theoretical models. First of all, the effects of $T = 0$ pn-pairing can be investigated through the study of the decay rates [1]. Furthermore the theoretical strength distributions of the β-decay of ^{70}Kr show clear differences depending on the shape of the ground state, hence assumptions on the shape of the ground state can be tested [2]. Finally ^{70}Kr might lay on the rp-process path and accordingly its half-life might play a role in rp-process network calculations [3]. Despite its importance, the knowledge on the β-decay of this isotope is rather limited. The half-life is known only with 15% accuracy, and only one γ-transition was identified to date [4,5].

To make the tests of these models possible, we've conducted an experiment at RIKEN-RIBF. The nucleus of interest was produced using a ^{78}Kr primary beam with a kinetic energy of 345 MeV/nucleon and intensity of about 300 pnA. The fragments were separated by BigRIPS using in-flight method, then were stopped in the WAS3ABi active silicon detector [6]. The β-delayed γ-rays were detected by the EURICA cluster array surrounding the implantation station [7].

The experiment significantly increased our knowledge on the structure of the daughter nucleus populated in the β-decay. A precise half-life value, with an uncertainty in the order of 2%, have been derived from time correlations of the β-particles and the decay-curves of the observed γ-transitions. Furthermore, after the identification of several new γ-transitions, a detailed level scheme – including about 20 transitions – have been derived [8]. The experimental approach, as well as the new half-life value and the level scheme, will be presented, along with an insight on the theoretical interpretations of the experimental results.

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Field of your work

Experiental nuclear physics

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