Investigation of ^{70,72,74}Ni from β decay of ^{70,72,74}Co

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One of the main unanswered questions of modern nuclear physics is whether the traditional magic numbers of protons and neutrons, such as they are known near stability, are maintained at extreme values of isospin, or whether new magic numbers emerge as a result of the unbalanced neutron-to-proton ratios. The nuclear region around ^{78}Ni, with 28 protons and 50 neutrons, has attracted great attraction for this purpose. This work aims at studying the even-even ^{70,72,74}Ni nuclei from β-delayed γ spectroscopy of the ^{70,72,74}Co progenitors to test the strength of state-of-the-art shell-model calculations in the vicinity of the doubly-magic ^{78}Ni core.

The data were collected in an experiment performed at RIKEN at the Radioactive-Isotope Beam Factory (RIBF) facility, as part of the EURICA campaign [1,2]. Nuclei in the isotopic chains of Cu, Ni, Co and Fe were produced in in-flight fission of a 345 AMeV ^{238}U stable beam impinging on a 3 mm Be target. The reaction residues were identified using the large-acceptance magnetic spectrometer BigRIPS [3], and were sent through the Zero-Degree spectrometer to a β-decay station, consisting of the WAS3ABi active stopper [1] and the EURICA γ spectrometer [2]. An array of 18 $LaBr_3$ scintillation detectors was also mounted to allow for fast-timing measurements.

The unprecedented high intensities of the primary beam, 10 pnA, enabled the collection of high statistics for the nuclei of interest. The β-delayed γ spectroscopic study is providing a large amount of new information in the populated isotopic chains, resulting in the establishment of new decay schemes in the Fe chain and great extension of existing level schemes for the Ni isotopes.

In this contribution an insight on the shape coexistence and seniority conservation in exotic nuclei of the Ni isotopic chain will be given.

References:

[1] S. Nishimura: Prog. Theor. Exp. Phys. 2012, 03C006 (2012)
[2] P.-A. Söderström et al., Nucl. Instr. and Meth. B 317, 649 (2013)
[3] T. Kubo: Nucl. Instr. Methods B 204, 97 (2003)