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Shape coexistence of neutron-rich ^{69,71,73}Co isotopes

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Observation of high 2^+ excitation energy in ^{68}Ni (Z = 28, N = 40) had drawn a clear signature of double magic character in this nucleus [1]. And while ^{68}Ni can be described as spherical isotope, 2^+ excitation energy of ^{66}Fe drops significantly [2], indicating deformed shape of ^{66}Fe. ^{67}Co isotope is in between ^{68}Ni and ^{66}Fe nuclei and found to share coexistence of both spherical and deformed structures in low-lying excited states [3]. This effect can be described as superposition of a proton $f_{7/2}$ hole coupled to neighbouring spherical even-even nickel isotope and a prolate proton-intruder state coupled to the ^{66}Fe isotope [4]. Discovery of shape coexistence in ^{67}Co rose an interesting question about further shape evolution in Co nuclei, namely ^{69,71,73}Co and shell transformation from N = 40 to N = 50.

In-beam gamma experiment was performed at Radioactive Isotope Beam Factory, RIKEN Nishina centre, Japan. Secondary beam of ^{70,72,74}Ni and ^{72}Co isotopes at energy of 260 MeV/μ bombarded liquid hydrogen target (MINOS) to produce ^{69,71,73}Co nuclei via (p, 2p) and (p, pn) reactions. DALI2 NaI(Tl) detector array was used to measure γ-rays. Energy levels were studied using γ-γ coincidence technique. Systematics of excited states of cobalt isotopes was compared with Lenzi-Nowacki-Poves-Sieja (LNPS) model [5] of nuclear interaction using fpgd model space. Experimental results of ^{69,71}Co spectrums show that isotopes share shape coexistence, as spherical structure coexists with deformed band. In case of ^{73}Co nucleus, due to the lack of statistics only spherical band is confirmed.

In this talk the evolution of shell structure in ^{69,71,73}Co isotopes will be discussed together with physics behind the shape coexistence in neutron-rich Co nuclei.

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