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Recent studies of shell evolution in the ^{78}Ni region

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Exploring nuclei far away from the valley of stability on the drip lines is one of the main topics at the forefront of current nuclear physics research. Fundamental properties and structure of these so-called neutron-rich, exotic nuclei provide the necessary ingredients to the physics of the unknown "terra incognita"region. Both theoretical and experimental discoveries near the drip lines exhibit that the shell structure in atomic nuclei is not as robust as we thought earlier but a more local concept. New magic numbers appear and some other conventional ones disappear mainly because of the different ordering of the single-particle orbitals. The evolution of nuclear shell structure experimentally, however, becomes rather challenging when more and more neutrons are added to the atomic nucleus. In this respect, the ^{78}Ni region, where Z=28 and N=50 shell gaps are formed, is significantly less known compared to the other doubly-magic regions. The evolution of the proton Z=28 gap at N=50 involves proton SPEs as a function of neutrons from N = 40 to N = 50. In this respect, neutron-rich Cu isotopes, having one proton outside the Z = 28 shell and lying between N=40 and 50 shell gaps, play an important role to inspect the shell structure in the ^{78}Ni region andhave been used as probes by large number of experimental studies so far.

In the present contribution, recent experimental studies performed at RIKEN using β-decay, direct reaction, and Columb excitation measurements will be presented. Neutron-rich nuclein near ^{78}Ni are populated through in-flight fission of ^{238}U on a several mm thick ^{9}Be target in all three experiments.

In the β-decay study, ^{75,77}Ni nuclei are implanted on the WAS3ABi silicon array while the EURICA spectrometer surrounds the active stopper to detect γ rays emitted after the β decay of the implanted ions.

In the (p,2p) knockout reaction, the ^{75,77}Cu nuclei are produced through one-proton knockout of ^{76,78}Zn beam particles at 250 MeV/nucleon impinging on a 10 cm thick active target time projection chamber filled with liquid hydrogen (LH2), called MINOS. The DALI2 NaI array is used to detect de-excitation γ rays measured in coincidence with ^{75,77}Cu nuclei identified in the Zero Degree Spectrometer.

In the third experiment, Coulomb excitation of the ^{77}Cu nucleus is performed on a 900-mg/cm^2 thick ^{197}Au target, mounted in front of the Zero Degree Spectrometer. The DALI2 NaI array is used to detect de-excitation γ ray measured in coincidence with the ^{77}Cu nucleus identified in the Zero Degree Spectrometer. Results will be discussed during the talk.

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