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New results on the structure of exotic nuclei

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'Exotic nuclei' far from the stability line are unique objects of many-body quantum system, where ratios of neutron number to proton number are much larger or much smaller than those of nuclei found in nature. Their exotic properties and phenomena emerge from their large isospin asymmetry, and even affect scenarios of nucleosynthesis in universe. One of the exotic emergences is shell evolution. The magic numbers of stable nuclei are known; 2, 8, 20, 28, 50, 82 and 126. However the numbers 8, 20 and 28 have been found no more magic in a neutron-rich region, and new magic numbers such as 6, 16, 32 and 34 have been discovered. To access nuclei far from the stability line, especially neutron-rich nuclei, a large heavy-ion accelerator facility 'Radioactive Isotope Beam Factory (RIBF)' was constructed at RIKEN, Japan in 2007. The facility is highly optimized for inflight production of fission fragments via a U beam. The accelerator complex delivers an intense 345 MeV/u U beam. The U nuclide is converted at a target to fission fragments. The fragments of interest are collected and separated at an inflight separator, and are delivered to several experimental devices. The shell evolution programs at RIBF have been conducted with two methods; in-beam gamma spectroscopy and decay spectroscopy. A standard setup of in-beam gamma spectroscopy is combination of a NaI gamma detector array 'DALI2' and a beam line spectrometer 'ZeroDegree Spectrometer (ZDS)'. Coincidence measurements of de-excitation gamma rays at DALI2 and of reaction products at ZDS make it possible to select reaction channels event-by-event and to observe excited states of exotic nuclei in a specific reaction channel. Recently, a French-made thick liquid hydrogen target system 'MINOS' has been introduced to access more neutron-rich nuclei. Isomer and beta-delayed gamma spectroscopy is organized with a Euroball germanium cluster array system 'EURICA' and an active silicon stopper In this talk, I would like to present recent contributions and activities of RIKEN for the shell evolution study. Special emphasis would be given to selected recent highlights. Several coming programs on the structure would be shown, too.