

World new facilities for radioactive ion beams

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In developing our knowledge on the atomic nuclei, radioactive isotopes (RI) or unstable nuclei have been playing crucial roles. By finding various methods for artificial RI production, nuclear physics research has been extended accordingly. In the mid 80s, the idea to use unstable nuclei in the form of energetic beam was realized for the first time at LBL [1]. The projectile-fragmentation reaction with fast ion beams was used to produce RI's in-flight. The first application of these RI beams was to measure interaction cross sections of light unstable nuclei, and enhancement of matter radius known as neutron halo was observed for some light neutron-rich nuclei. Together with the "ISOL" technique, where RIs are produced by nuclear reactions and re-accelerated by an independent accelerator, and some other methods, radioactive ion beams and related technical developments have enlarged our capability for studying properties of the nuclei and nuclear reactions, and have casted new lights on various problems in nuclear physics .

According to the success and expected fruitfulness of RI beam based studies, "new generation" facilities with drastically enhanced performance in producing beams of nuclei much farther from the stability valley have been and are being planned in the world. In order to cover different energy domains and to meet various scientific demands, their designs are of a wide variety. For example, FAIR in Germany and FRIB in US are based on the fragmentation scheme for beams with a few hundred MeV/nucleon to GeV/nucleon energy, whereas Spiral2 in France and the future facility Eurisol in Europe are on the ISOL method providing lower-energy RI beams. There are a lot more projects including upgrades of existing facilities in the three continents, America, Asia and Europe. Among them, the fragmentation-based facility RIKEN RI Beam Factory in Japan is the accelerator complex in this category that is in operation [2].

The talk will give an overview of such new RIB facilities and their perspectives on nuclear physics research.

[1] I. Tanihata et al., Phys. Lett. B 160, 380 (1985).

[2] Special Issue "Research in RI Beam Factory", Ed. S. Shimoura, Prog. Theor. Exp. Phys. 2012-3 (2012), http://www.oxfordjournals.org/our-journals/ptep/special_issue_c.html