Abstract for an Invited Paper
for the HAW05 Meeting of
The American Physical Society

Perspective of nuclear physics and nuclear astrophysics studies

TOHRU MOTOBAYASHI, RIKEN

In recent decades, studies with beams of unstable nuclei have greatly developed in the fields of nuclear structure physics and nuclear astrophysics. At RIKEN, beams of unstable nuclei with a few tens MeV/nucleon energies have been produced by the projectile-fragmentation scheme. We call them "radioactive isotope (RI) beams", which have been provided since 1990. The separator RIPS can produces a beam with the world's highest intensity for many light unstable nuclei. Through investigations with such exotic beams provided by RIKEN facility together with similar ones in the world, NSCL, GANIL, GSI, and Lanzhou, for example, many new nuclear properties have been found, such as particle-stability in the vicinity of the neutron drip-line, properties of neutron halo and skin, appearance and disappearance of magic numbers, and decoupling of neutron and proton motion. Nuclear astrophysics studies have also been made with direct and indirect methods for nuclear burning processes involving unstable nuclei. Encouraged by the achievements of these RI-beam based researches, a new project called RI Beam Factory (RIBF) has been planned at RIKEN. Its basic part (accelerators and an RI beam separator called BigRIPS) is now under construction and will be commissioned during the year 2006. The RIBF is designed to provide much wider range of RI beams with higher intensities compared with the present facility. In-flight fission of a 350 MeV/nucleon primary beam of uranium will be used as well as projectile fragmentation of ions, such as those of Xe, Kr and Ca. We aimed at greatly extending the region of nuclei to be studied. Toghther with other new generation facilities like RIA, FAIR and Spiral2, we hope that a new ans comprehensive picture for the nuclear system is established and the mechanism of creating chemical elements in the universe is clarified.