HAW14-2014-000735

Abstract for an Invited Paper
for the HAW14 Meeting of
the American Physical Society

Using particle-gamma coincidences to study nuclear reactions and structure with fast radioactive ion beams

NOBUYUKI KOBAYASHI, University of Tokyo

Recently, spectroscopic studies on neutron rich nuclei have made considerable progress on the change of single particle levels, so-called shell evolution. On the studies, the method of particle-γ coincidences with fast radioactive ion beams has been a powerful spectroscopic tool. The nucleon knockout reaction with γ-coincedence on a light target has been used to determine the spin parities of final states by measuring the momentum distribution of the particles. In addition, combined analysis of nuclear- and Coulomb-dominated $1n$ removal reactions on light and heavy targets, respectively, can investigate the single particle orbitals of the incoming and outgoing nuclei. In this talk, I will overview the method of particle-γ coincidences, and then I will focus on our recent results. Our present work addresses the spectroscopy of neutron-rich nuclei around the island of inversion, specifically, the halo, shell and deformation properties of ^{31}Ne [1,2] and ^{37}Mg [3]. For this purpose, the nuclear- and Coulomb-dominated reaction probes are used at energies around 240 MeV/nucleon. The present analysis exploits the different sensitivities of these reaction mechanisms to obtain the ground state separation energy, spin parity and the spectroscopic factors of these projectiles. The observables obtained were the nuclear- and Coulomb-dominated $1n$-removal cross sections of ^{31}Ne and ^{37}Mg on C and Pb targets, and the parallel momentum distributions of the residues from the C target. We report also the recent analysis for the ^{20}C momentum distribution in two-neutron removal reactions from ^{22}C [4].

[1] T. Nakmaura, N. Kobayashi *et al.*, Phys. Rev. Lett. **103**, 262501 (2009).
[2] T. Nakmaura, N. Kobayashi *et al.*, Phys. Rev. Lett. **112**, 142501 (2014).
[3] N. Kobayashi *et al.*, Phys. Rev. Lett. **111**, 242501 (2014).
[4] N. Kobayashi *et al.*, Phys. Rev. C **86**, 054604 (2012).