Spectroscopy of unstable nuclei using proton inelastic scattering with in-beam γ-ray spectroscopy technique

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Proton inelastic scattering has long been used as a tool to study the structure of nuclei. This method has been recently applied successfully to the study of unstable nuclei by the inverse kinematics configuration. In particular, by combining with the in-beam γ-ray spectroscopy technique, one can use a thick liquid hydrogen target, which provides the very high sensitivity to the structure of the low-lying states. For example, the excitation to the first 2^+ and 4^+ states in even-even nuclei provides the information on the collective feature of the nucleus, such as the excitation energies of these states or the quadrupole deformation parameter β_2. The proton inelastic scattering is also useful because it can probe the structure of neutron motion in the nucleus. By combining with the Coulomb excitation, which can probe only the proton motion, structure of neutrons and protons in the nucleus can be separately determined.

In the present paper, recent work at the RIPS facility[1] in RIKEN will be presented focusing on the studies to investigate the evolution of collectivity in the nuclei around N=20 or N=40.

[1] T. Kubo et al., Nucl. Instr. Meth. B 70 (1992) 309.