DNP13-2013-000141

Abstract for an Invited Paper
for the DNP13 Meeting of
the American Physical Society

Shapes of Exotic Nuclei[1]

TAKAHARU OTSUKA, Department of Physics, University of Tokyo

I will discuss how shapes may appear in exotic nuclei. Low-lying states of most of stable nuclei can be characterized by "one shape." For instance, the ground state can be spherical with lowest states being phonon excitations, or the ground state forms an ellipsoid with lowest states being its rotation or gamma vibration. Such "one shape for one nucleus" picture leads us to the shape phase transition as functions of N and Z, with exceptions called shape coexistence. The situation of exotic nuclei may be different. The shell evolution changes their shell structure from that of stable nuclei so that nucleons can be excited from lower to higher orbits more easily, and states of different patterns of orbital configurations can coexist within a narrow energy region. Consequently, shape coexistence seems to occur in many exotic nuclei, not being too exceptional. I will show some examples by using recent results of Monte Carlo Shell Model. For exotic Ni isotopes, one sees a spherical ground state with superdeformed rotational band only 1-2 MeV lying higher. It is also of interest how the double magicity is preserved/broken in ^{56,68,78}Ni. Thus, the shape of exotic nuclei may open a new window for theoretical and experimental studies. For the latter, new types of experiments clarifying band structures with wide variation may be relevant. Theoretical survey of such nuclei is of extreme and urgent interest, and in fact being carried out by combining simple shell-evolution scenario and large-scale calculations on supercomputers.

[1]This work is supported by HPCI Strategic Program field 5. The results were obtained in part using the K computer at the Riken Advanced Institute for Computation Science under Proposal hp120284.