Deformation and weak decay of Λ hypernuclei

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It has been well known that many open-shell nuclei are deformed in the ground state. The nuclear deformation generates the collective rotational motion, which is characterized by a pronounced rotational spectrum as well as strongly enhanced quadrupole transition probabilities. Theoretically, a standard way to discuss nuclear deformation is a self-consistent mean-field theory. By allowing the rotational symmetry to be broken in the mean-field potential, the mean-field theory provides an intuitive and transparent view of the nuclear deformation.

In this talk, we will first discuss the deformation property of Λ hypernuclei[1] using the relativistic mean field (RMF) method, which has been as successful as the Skyrme-Hartree-Fock method in describing stable nuclei as well as nuclei far from the stability line. We shall show that, while an addition of Λ particle does not influence much the shape of many nuclei, ^{12}C and ^{28}Si make important exceptions. That is, the Λ particle makes the shape of these nuclei change from oblate to spherical. This conclusion is achieved both with the NL3 and NLSH parameter sets of the RMF Lagrangian, and independent of the treatment of pairing correlation among the nucleons.

We will then briefly discuss the pionic decay of neutron-rich hypernuclei using the Skyme-Hartree-Fock method. We will show that, for a given isotope chain, the decay rate increases as a function of mass number, due to the strong neutron-proton interaction.

1. Myaing Thi Win and K. Hagino, Phys. Rev. C78 (2008) 054311.