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Investigation of the nuclear structure at the proton stability line (PROLINE)

Abstract

The nuclear structure at the proton drip line is an important direction of experimental and theoretical research work with astrophysical implications. We will search for a deformed nuclear mean field, by using a self-consistent deformed Cluster-Hartree-Fock-Bogoliubov (dCHFB) approach in order to investigate how the alpha-clustering changes the equilibrium nuclear deformation for nuclei close to the proton drip line. We will analyze energy levels, electromagnetic alpha and beta decay rates in N~Z nuclei above the doubly magic nucleus ^{100}Sn in terms of a simplified version of the Multistep Shell Model (MSM), by also using the CHFB procedure. We will investigate beta delayed particle emission process close to the proton stability line, by extracting weak interaction with the help of proton-neutron deformed Quasiparticle Random Phase Approximation (pn-dQRPA) in laboratory system and a self-consistent nuclear mean field including alpha-clustering effects. A proton decay and two-proton systematics of these data will be given and astrophysical implications will be investigated. We will explain the linear correlation between the alpha reduced width and beta plus reduced matrix element. We will investigate the chiral symmetry breaking near the proton stability line in terms of a semiclassical description of nuclear dynamics related to triaxial shapes, giving an interpretation of chiral and wobbling bands.