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Proton Drip Line for Hypernuclei

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Studies of hypernuclei with proton or neutron excess are of particular relevance now in strangeness physics. Such systems scarcely studied experimentally can currently be produced in heavy ion collisions at NICA complex developed in DUBNA. Research in exotic hypernuclei can provide insight into various aspects of hyperonic interactions including density dependence of the ΛN interaction, core polarization and charge symmetry breaking (CSB). Some of these features may have a profound influence on the structure of systems with an extreme excess of neutrons or protons, such as halo nuclei and neutron stars. Furthermore, considering the attractive nature of ΛN interaction, there is a chance to stabilize loosely bound nuclear systems and even get bound hypernuclei with unstable cores. Our goal was to study such occurrences for proton-rich hypernuclei up to $Z = 20$.

We address the structure of Λ-hypernuclei in the framework of Hartree-Fock approach with effective potentials in the Skyrme form. This phenomenological approach allows us to analyze the hypernuclear properties in relation to both nucleon-nucleon and hyperon-nucleon components of the general baryonic interaction. The model is shown to reproduce the experimental hyperon binding energies B in light hypernuclei, as well as predict the slower growth of B in heavier hyperisotopes. In essence, this signifies that the glue-like role of the Λ-hyperon decreases with increasing A, and it is more likely to bind lighter unbound nuclei with Λ. We study the proton-rich isotopes up to calcium and draw conclusions on the possibility of the proton drip line shift due to Λ-hyperon on the hypernuclear chart in this region. We show hypernuclei ^{9}C, ^{17}F, ^{20}Na and ^{20}Mg to be the most promising candidates for hyperisotopes with unbound nucleon cores.

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