

Extreme neutron rich sector of the nuclear chart: new horizons!

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Locating the proton and neutron drip lines and investigation of the nuclear structure far from the stability valley is one of the major problems in nuclear physics having also interdisciplinary importance, for example, in nuclear astrophysics. In studying the drip lines for neutron rich nuclei one usually takes a stable nucleus and increments the number of neutrons. At some point the nucleus becomes overloaded with neutrons and adding one more neutron makes the system unstable and one speaks of the neutron drip line. However, it might happen that adding more neutrons to an already unstable nucleus may restore the stability and this unusual fact is often omitted in the research. This phenomenon of stability restoration through adding more nucleons results in formation of stability islands and stability peninsulas on the nuclear chart. We use the HF+BCS approach (Hartree-Fock with Skyrme forces) to analyze neutron rich He, O, Fe, Ni, Ar, Kr, Zr, Rn, Pb in the ground state accounting for deformations. The calculations are performed using the oscillator basis. The results are compared with existing HFB and RMF calculations. Our analysis shows that stable areas on the nuclear chart may extend far beyond the so far predicted ones.