Neutron skins in spherical and deformed nuclei from Skyrme Hartree-Fock calculations *

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The development of neutron skins as a function of the neutron number is investigated within a self-consistent framework based on deformed Hartree-Fock calculations with density dependent Skyrme forces and pairing correlations in BCS approximation. We study three isotopic chains, namely, Ni, Kr, Sn, and consider all the experimentally observed isotopes from neutron-deficient to neutron-rich.

The proton and neutron density distributions in these isotopic chains are calculated and analyzed in terms of several parameters that characterize the existence of a neutron skin as an excess of neutrons at distances larger than the radius of the proton distributions. We discuss various possibilities to define the neutron skin thickness based on the differences of neutron and proton radii defined in different ways, such as root mean square, diffraction, and geometrical radii. We also analyze definitions of neutron thickness based on comparison of the tails of the neutron and proton density distributions. It is shown that although the absolute sizes of the skin thickness obtained from different definitions could not have a very precise meaning, there is a convergence on the predicted development of the neutron skin, as the number of neutrons increase within a given isotopic chain.

We finally discuss the effects of deformation on the neutron skin based on the example of Kr isotopes. We study the skin formation in different directions for oblate and prolate shapes and discuss it in terms of the quadrupole components of the density distributions.

* This work is supported by MEC (Spain) under contracts No. FIS2005-00640, SAB2005-0012, and by the Bulgarian National Science Fund under contract No. Φ-1501.