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SELF-CONSISTENT STUDY OF NUCLEAR CHARGE RADII IN Ca REGION

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Fully self-consistent study of the charge radii in the long chains of the Ar to Sc isotopes is presented. The neutron-deficient and neutron-rich nuclei with pairing in both neutron and proton sectors, as well as the (semi-) magic nuclei around the closed neutron shells at N=20, 28, 32 are treated within the Energy Density Functional (EDF) approach with the Fayans functional DF3-a [1]. A comparison with its new options is done, namely Fy(stand) and more recent Fy(Δr,HFB) [2].
The performance of the DF3-a is analysed in describing both absolute radii and OES effects found in the CERN-ISOLDE experiments for 36-52Ca [3] and 36-52K [4] isotopes (Figs.1,2). In addition to a large-scale parametric fitting of the Fayans EDF suggested in [2], a new physics related to a higher power density gradient terms in its surface and pairing parts is of importance. A self-consistent account for the A-dependent fluctuating contribution due to the quasiparticle-phonon coupling explained strong increase of the radii at N>28 in Ca isotopes [5]. It is expected to be responsible for observed local anomalies in isotopic dependence of the absolute radii [3,4].
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Fig. 1. The charge radii of K, Ca, Sc isotopes calculated within the DF3-a functional compared to the data [3,4] and calculations[5]. For Ca isotopes, the DF3-a calculation with phonon corrections is shown.
Fig. 2. The charge radii of K isotopes calculated within the DF3-a functional with the gradient paring term compared to the data [3,4].

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