Contribution ID: **79** Type: **Semi-plenary talk (30 min + 5 min questions)**

Isotopic dependence of charge and matter radii.

Thursday, 14 July 2022 12:00 (30 minutes)

Isotopic dependence of charge and matter radii.
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Fully self-consistent study of the charge and matter radii in the chains of the Ar - Ti, Ni, Cu isotopes is presented. The nuclei with pairing in both neutron and proton sectors are treated within the Energy Density Functional (EDF) approach with the Fayans functional DF3-a [1]. Recently the new option of this functional named Fy(Δr,HFB) has become popular [2]. We compare their performance in describing both isotopic trend of the radii and odd-even staggering (OES) found in the CERN-ISOLDE experiments for 36-52Ca [2] and 36-52K [3] isotopes (Figs.1,2). For K, Ca, Sc isotopes, the calculated differential charge radii δ<r2> relative to N = 28 show universal increase independent on the mass number A in agreement with the data [2-3]. Strong increase of the radii at N>28 in K, Ca, Sc isotopes (Fig.1b) is explained by A-dependent contribution of the quasiparticle-phonon coupling [4,5]. The corresponding 3-point filters Δ(3) for the binding energies and radii are consistent with magicity of the N=20, 28, 32 shells in K isotopes [5] (Fig.2). Supported by the grant of Russian Scientific Foundation (RSF 21-12-00061).

Fig. 1. a) The differential charge radii of K, Ca, Sc isotopes calculated within the DF3-a functional compared to the data [2,3]. b) An impact of the quasiparticle-phonon coupling on the differential charge radii of Ca, isotopes[4].
Fig. 2. The 3-point filters Δ(3) for binding energies and charge radii of K isotopes calculated from the DF3-a functional with (red) and without (blue) gradient paring vs the data [3].

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2. A.J. Miller et.al. Nature Physics, 15, 432 (2019).
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The speaker is a student or young scientist

No

Section

1. Nuclear structure: theory and experiment

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Session Classification: Plenary session