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ABOUT THE DEPENDENCE OF NUCLEAR SURFACE DIFFUSENESS ON NEUTRON-PROTON ASYMMETRY AND ITS INFLUENCE ON THE EVOLUTION OF SINGLE-PARTICLE SPECTRA

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The evolution of single-particle energies E_{nlj} of near to spherical medium and medium- heavy nuclei as they approached neutron drip line was studied within the dispersive optical model (DOM) [1]. The main attention was paid on the dependence of the diffuseness parameter a_{HF} of the Hartree-Fock component of the potential on neutron-proton asymmetry and its influence on the evolution. It was shown that the agreement with the available experimental data was improved if a_{HF} depended on neutron-proton asymmetry:
$a_{HF} = a^0_{HF} \pm a^1_{HF}(N-Z)/A$, + for n, –for p . (1)
In other words, the diffuseness a_{HF} increased when the Fermi energy goes up. The dependence (1) differs from that of the global diffuseness parameter a_V^{KD} of the traditional optical model potential [2]. The parameter a_V^{KD} decreases with increasing mass number A of the nucleus for both neutrons and protons. The dependence (1) leads, in particular, to the following: more pronounced inversion of the $2s_{1/2}$–$1d_{3/2}$ proton levels in stable Ca isotopes and the $1g_{7/2}$–$2d_{5/2}$ proton levels in stable Sn isotopes; more pronounced evolution of the energy gap between the neutron states $1f_{5/2}$ and $2p$ in the stable $1f-2p$–shell nuclei; better agreement with the experimental energies E_{nlj} of the $1d_{3/2}$ neutron state in neutron-rich Si isotopes [3] comparing to the parameter $a_{HF} = a_V^{KD}$ (see fig). Thus, dependence (1) improves the predictive power of DOM with respect to the nuclei far from the β-stability valley.

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