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Alpha-decay energies of superheavy nuclei for the Fayans functional

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A lpha-decay energies for several chains of superheavy nuclei are calculated within the self-consistent mean-field approach by using the Fayans energy density functional (EDF) FaNDF⁰. They are compared to the experimental data and predictions of two popular Skyrme EDFs, SLy4 and SkM* and of the macro-micro method as well. The corresponding lifetimes are calculated with the use of the semi-phenomenological formulas by Parkhomenko and Sobiczewski and by Royer and Zhang. There are two essential differences between the Fayans EDF and all Skyrme EDFs. The main, in-volume term of the Fayans EDF is different from the analogous one of the Skyrme EDF by the density dependent so-called 'Fayans denominator'. The use of the bare mass, m*=m, is another peculiarity of the Fayans EDF, whereas the use of the effective mass m*<m is typical for Skyrme EDFs. Both the features of the Fayans method are closely related to the self-consistent theory of finite Fermi systems and represent, in a hidden form, energy dependence effects inherent to this approach. Till 2015, the Fayans EDF was applied to spherical nuclei only, the results for different nuclear characteristics being, as a rule, better than known Skyrme analogous ones. Recently, the Fayans EDF method was developed for deformed nuclei. The first results turned out to be rather promising. In particular, well-known problem of Skyrme EDFs in describing the light Pb isotopes, A<190, was resolved. All popular Skyrme EDFs predict strong deformation of these nuclei, in contradiction with experimental data on their charge radii and magnetic moments of odd Pb isotopes. The Fayans EDF predicts the spherical ground state of all lead isotopes, in agreement with experiment.

Biography

Eduard E Saperstein has completed his PhD from National Research Nuclear University MEPhI, 115409 Moscow, Russia and Post-doctoral studies from the same University. He has completed his thesis of Docotor of Science. He is the Professor of MEPhI and the Chief Researcher in Kurchatov Institute. He is also the Assistant Editor of the *journal Physics of Atomic Nuclei*. He has published more than 150 papers in reputed journals.

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