Superheavy and Hyperheavy Nuclei in the Form of Bubbles or Semi-bubbles

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Self-consistent Hartree-Bogoliubov calculations have been performed with the effective interaction of Gogny for a large array of proton and nucleon numbers ($120 \leq Z \leq 340$; $300 \leq A \leq 1000$). Solutions in the form of a bubble and of "unsaturated" nuclei ("semi-bubbles") with a reduced central density are found, which may be ground states or excited metastable configurations. Fission barriers and estimates of α-decay lifetimes are given for typical nuclei.

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Compressed Nuclei in Relativistic Thomas-Fermi Approximation

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We approach the gross structure of compressed nuclei by scaling ground-state relativistic Thomas-Fermi (RTF) densities as well as by performing RTF calculations with a density-dependent constraint as the equivalent for an external pressure. For the NL1 parametrization of the nuclear effective Lagrangian the line of β stability as well as the proton drip lines are found to be bended to neutron-richer nuclei with increasing compression. In addition we conclude from calculated critical $(Z^2/A)_{\mathrm{crit}}$ values that fission barriers are appreciably reduced by the presence of an external pressure.

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Nuclear Surface Properties and Spin-orbit Potential in a Modified Derivative Coupling Model

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Based on the Zimanyi-Moszkowski derivative coupling Lagrangian plus tensor-coupling term, calculations of symmetric semi-infinite nuclear matter and finite nuclei have been performed. Our results show that with increasing tensor coupling the spin-orbit potential is considerably improved, but the surface tension and the surface thickness decrease to values too low compared with experiment. In addition, the effects of the σ-meson mass on nuclear surface properties, on the spin-orbit potential as well as on nuclear binding energies are discussed. No parameter set could be found that leads to good surface properties even if energies and spin-orbit splittings are realistic.

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