Ground-State Proton Emitters in the Relativistic Hartree-Bogoliubov Model

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The Relativistic Hartree Bogoliubov (RHB) model is applied in the description of ground-state properties of proton-rich odd-Z nuclei in the region $53 \leq Z \leq 69$. The NL3 effective interaction is used in the mean-field Lagrangian, and pairing correlations are described by the pairing part of the finite range Gogny interaction D1S. The model predicts the location of the proton drip-line, the ground-state quadrupole deformations and one-proton separation energies at and beyond the drip-line, the deformed single-particle orbitals occupied by the odd valence proton, and the corresponding spectroscopic factors. The results of fully self-consistent RHB calculations are compared with available experimental data, and with predictions of the macroscopic-microscopic mass model.

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Ground-State Properties of Even-Even Nuclei in the Relativistic Mean-Field Theory

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The ground-state properties of 1315 even-even nuclei with $10 \leq Z \leq 98$ have been calculated in the framework of the relativistic mean-field (RMF) theory. The Lagrangian parametrization NL3 was used in the calculations. Pairing correlations are accounted within the Bardeen-Cooper-Schrieffer (BCS) approach. The calculated values for the total binding energy, rms proton radius, rms neutron radius, rms charge radius, neutron quadrupole moment, proton quadrupole moment, charge (proton) hexadecapole moment, quadrupole deformation parameter, and hexadecapole deformation parameter are given in Table I. The RMF predictions for some rare-earth nuclei have been compared with the available experimental information.

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Magnetic Dipole Response in Rare Earth Nuclei

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Experimental observations in certain rare earth nuclei have established the presence of sizeable B(M1) strength of two peak structure lying in the 5-10 MeV region. The character of the states concerned, studied within a self-consistent Random Phase Approximation using Skyrme forces, are identified to be that of proton and neutron giant spin-flip resonances.

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Nonlinear Dynamics of Giant Resonances in Atomic Nuclei

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The dynamics of monopole giant resonances in nuclei is analyzed in the time-dependent relativistic mean-field model. The phase spaces of isoscalar and isovector collective oscillations are reconstructed from the time-series of dynamical variables that characterize the proton and neutron density distributions. The analysis of the resulting recurrence plots and correlation dimensions indicate regular motion for the isoscalar mode, and chaotic dynamics for the isovector oscillations. Information-theoretic functionals identify and quantify the nonlinear dynamics of giant resonances in quantum systems that have spatial as well as temporal structure.

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