Ground State Properties of the β-Stable Nuclei in Various Mean Field Theories

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The separation energies of neutrons and protons, mean square charge radii, electric quadrupole moments and deformation parameters of the proton and neutron distributions are evaluated for all β stable even–even nuclei with $A \geq 12$. We compare the theoretical estimates obtained within the Hartree-Fock plus BCS model with a few sets of Skyrme forces, relativistic mean–field theory and frequently used Saxon-Woods and Nilsson potentials with experimental data.

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Masses and Radii of Spherical Nuclei Calculated in Various Microscopic Approaches

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The quality of the description of nuclear masses and charge radii, calculated in various microscopic approaches, is studied. The Hartree-Fock-Bogolubov (HFB), Extended, Thomas-Fermi model with Strutinski Integral (ETFSI), this Relativistic mean field (RMF) and macroscopic-microscopic (MM) approaches are considered. In HFB approximation, both finite-range (Gogny) and zero-range (Skyrme) effective forces are used. Spherical even-even nuclei (116 nuclides), from light (A=16) to heavy (A=220) ones, with known experimental mass are chosen for the study. A general result is that the best description of masses of considered nuclei is obtained in the MM and ETFSI approaches, while the best charge radii are obtained within the RMF and ETFSI approximation. The behaviour of nuclear masses and radii, when one moves far off the β-stability line, is also studied.

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A Microscopic Study of the Giant Dipole Resonance $\gamma-$Absorption Cross Section in Hot Rotating Nuclei

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An attempt has been made to study the γ-absorption cross section for the giant dipole resonances (GDR) in hot rotating nuclei in the framework of linear response theory along with a microscopic approach to incorporate corrections due to thermal fluctuations of the nuclear quadrupole shapes. The latter approach is based on the static path approximation to the grand canonical partition function. In the present illustrative application, we have employed a deformed harmonic oscillator Hamiltonian. The calculations have been done for a fictitious nucleus with the magic numbers of the oscillator $N = Z = 70$. We find that the width of the GDR cross section increases with increasing temperature and angular momentum. The results are compared with those obtained by the Landau prescription and it is found that the latter overestimates the effect of thermal fluctuations somewhat.

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