Dep. Física Atómica, Molecular y Nuclear
Universidad de Sevilla

SEMINAR ANNOUNCEMENT

“Symmetry energy and its components in finite nuclei”

by

Prof. Anton N. ANTONOV

Inst. For Nuclear Research and Nuclear Energy
Bulgarian Academy of Sciences (Sofia, Bulgaria)

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Abstract

The volume (a^V_A) and surface (a^S_A) contributions to the nuclear symmetry energy and their ratio are calculated within the Coherent Density Fluctuation Model (CDFM). Starting with global values of parameters for infinite nuclear matter, the approach makes it possible to derive the values of (a^V_A) and (a^S_A) in finite nuclei. Two energy-density functionals for nuclear matter, those of Brueckner and Skyrme are used. The weight function in the CDFM is obtained using the proton and neutron densities from the self-consistent HF+BCS method with Skyrme interactions. The obtained values of (a^V_A) and (a^S_A) and their ratio for the Ni, Sn and Pb isotopic chains and their isotopic sensitivity are presented and discussed. The results are compared with those of other theoretical methods, as well as with available experimental data obtained from analyses of nuclear properties, such as binding energies, neutron-skin thicknesses, excitation energies to isobaric analog states and others.

As a second task we investigated the temperature dependence of the symmetry energy for isotopic chains of even-even Ni, Sn, and Pb nuclei in the framework of the local density approximation. The Skyrme energy density functional with two Skyrme-class effective interactions, SkM* and SLy4, is used in the calculations. The temperature- dependent proton and neutron densities are calculated through the HFBTHO code that solves the nuclear Skyrme- Hartree-Fock-Bogoliubov problem by using the cylindrical transformed deformed harmonic-oscillator basis. In addition, two other density distributions of 208Pb, namely the Fermi-type density determined within the extended Thomas- Fermi (ETF) method and symmetrized-Fermi local density obtained within the rigorous density functional approach, are used. The kinetic energy densities are calculated either by the HFBTHO code or, for a comparison, by the ETF method. The temperature dependence of the neutron and proton root-mean-square radii and corresponding neutron skin thickness is also investigated, showing that the effect of temperature leads mainly to a substantial increase of the neutron radii and skins, especially in the more neutron-rich nuclei, a feature that may have consequences on astrophysical processes and neutron stars.