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An alternative approach within the CDFM for studies of nuclear symmetry energy components and their ratio

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A different alternative approach to calculate the ratio of the surface to volume components of the nuclear symmetry energy is proposed in the framework of the coherent density fluctuation model (CDFM). An alternate expression (scheme II) for the ratio is derived consistently within the model. This expression appears in a form more direct and physically motivated than the expression (scheme I) that was used in our previous works within the CDFM and avoids preliminary assumptions and mathematical ambiguities in scheme I. The calculations are based on the Skyrme and Brueckner energy-density functionals for nuclear matter and on the nonrelativistic Brueckner-Hartree-Fock method with realistic Bonn B and Bonn CD nucleon-nucleon potentials. The approach is applied to isotopic chains of Ni, Sn, and Pb nuclei using nuclear densities obtained in self-consistent Hartree-Fock+BCS calculations with the SLy4 Skyrme effective interaction. The applicability of both schemes within the CDFM is demonstrated by a comparison of the results with the available empirical data and with results of other theoretical studies of the considered quantities. Although in some instances the results obtained for the studied ratio and the symmetry energy components are rather close in both schemes, the proposed scheme II leads to more realistic values that agree better with the empirical data and exhibits conceptual and operational advantages.

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