Temperature dependence of the symmetry energy components for finite nuclei

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Abstract. We investigate the temperature dependence of the volume and surface components of the nuclear symmetry energy (NSE) and their ratio [1] in the framework of the local density approximation. The results of these quantities for finite nuclei are obtained within the coherent density fluctuation model (CDFM) [2, 3]. The CDFM weight function is obtained using the temperature-dependent proton and neutron densities calculated through the HFBTHO code that solves the nuclear Skyrme-Hartree-Fock-Bogoliubov problem by using the cylindrical transformed deformed harmonic-oscillator basis [4]. We present and discuss the values of the volume and surface contributions to the NSE and their ratio obtained for the Ni, Sn, and Pb isotopic chains around double-magic ^{78}Ni, ^{132}Sn, and ^{208}Pb nuclei. The results for the T-dependence of the considered quantities are compared with estimations made previously for zero temperature [5] showing the behavior of the NSE components and their ratio, as well as with the available experimental data. The sensitivity of the results on various forms of the density dependence of the symmetry energy is studied. We confirm the existence of "kinks" of these quantities as functions of the mass number at $T = 0$ MeV for the double closed-shell nuclei ^{78}Ni and ^{132}Sn and the lack of "kinks" for the Pb isotopes, as well as the disappearance of these kinks as the temperature increases.

References

[1] A. N. Antonov, D. N. Kadrev, M. K. Gaidarov, P. Sarriguren, and E. Moya de Guerra, Phys. Rev. C **98**, 054315 (2018).
[2] A.N. Antonov, V.A. Nikolaev, and I.Zh. Petkov, *Bulg. J. Phys.* **6** (1979) 151; *Z. Phys. A* **297** (1980) 257; *ibid* **304** (1982) 239; *Nuovo Cimento A* **86** (1985) 23; A.N. Antonov *et al.*, *ibid* **102** (1989) 1701; A.N. Antonov, D.N. Kadrev, and P.E. Hodgson, *Phys. Rev. C* **50** (1994) 164.
[3] A.N. Antonov, P.E. Hodgson, and I.Zh. Petkov, *Nucleon Momentum and Density Distributions in Nuclei*, Clarendon Press, Oxford (1988); *Nucleon Correlations in Nuclei*, Springer-Verlag, Berlin-Heidelberg-New York (1993).
[4] M. V. Stoitsov *et al.*, Comput. Phys. Comm. **184**, 1592 (2013); M. V. Stoitsov *et al.*, Comput. Phys. Comm. **167**, 43 (2005).
[5] A. N. Antonov, M. K. Gaidarov, P. Sarriguren, and E. Moya de Guerra, Phys. Rev. C **94**, 014319 (2016).