Thermal properties of nuclear surface

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Abstract

The thermal evolution of some thermodynamic properties of the nuclear surface like its thermodynamic potential energy, entropy and the symmetry free energy are examined for both semi-infinite nuclear matter and finite nuclei. Three Skyrme interactions, namely, SkM, SLy4 and SK255 are used for the calculations to gauge the dependence of the nuclear surface properties on the energy density functionals. For finite nuclei, the surface observables are computed from a global liquid-drop inspired fit of the energies and free energies of a host of nuclei covering the entire periodic table. The hot nuclear system is modelled in a subtracted Thomas-Fermi framework. Compared to semi-infinite nuclear matter, substantial changes in the surface symmetry energy of finite nuclei are indicated; surface thermodynamic potential energies for the two systems are, however, not too different. Analytic expressions to fit the temperature and asymmetry dependence of the surface thermodynamic potential of semi-infinite nuclear matter and the temperature dependence of the surface free energy of finite nuclei are given. Finally, our findings are compared with those of Ravenhall, Pethick and Lattimer (NPA407, 1983).

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