Symmetry energy and symmetry free energy of asymmetric nuclear matter in the Thomas-Fermi approximation

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Received: 17.04.2018 Final revised: 12.10.2018 Accepted: 28.11.2019

Abstract

Within the semi-classical Thomas-Fermi approximation, which is based on a statistical approach, the phase-space occupation number of nuclear matter is obtained by employing the Landau Fermi-Liquid theory. First, the equation of state (EOS) of asymmetric nuclear matter is derived using the NN-interactions of Myers and Swiatecki, known as TF(96) and TF(90). Then, a special attention is devoted to studying the behavior of symmetry energy and symmetry free energy quantities which have a substantial effect on the equation of state. Hence, the stiffer behavior of the EOS in the TF(90) interaction compared with the TF(96) interaction refers to the important effects of these quantities. The extensibility feature of the present model is shown by determining the saturation density and the nuclear matter incompressibility coefficient. In addition, the values for symmetry energy, symmetry free energy, saturation density, and nuclear matter incompressibility coefficient are compared with the results of the other models, and the temperature effects on these quantities are studied.

Keywords: Thomas-Fermi approximation, nuclear matter, equation of state, symmetry energy and symmetry free energy, Incompressibility

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