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Nuclear matter and surface clustering

Abstract

We demonstrate that the binding energy per nucleon of symmetric nuclear matter (SNM) (with Coulomb interaction switched off and N Z) in the limit of zero density approaches to its value, uv, at the saturation density, where uv is the volume term of the Weizsäcker mass formula. This phenomenon is a direct result of the clustering of nuclei in the low density region of nuclear matter. We study the implications of this result on the properties of nuclei. We also study the properties of asymmetric nuclear matter. Because of clustering a provocative interpretation of the equation of state of asymmetric nuclear matter emerges which is at considerable variance at low densities with hitherto all the previous calculations. For nuclei, as a framework, an extended version of Thomas-Fermi theory is invoked. Calculations are performed for 2149 nuclei with N, Z ≥ 8. The present scheme leads to a forceful interpretation of the low density asymmetry energy data of Natowitz et al.

Keywords

Asymmetric nuclear matter; Density approaches; Energy data; Equation of state