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Symmetry energy, neutron star crust and neutron skin thickness

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We perform a systematic analysis of the density dependence of nuclear symmetry energy within the microscopic Brueckner-Hartree-Fock (BHF) approach using the realistic Argonne V18 nucleon-nucleon potential plus a phenomenological three-body force of Urbana type. Our results are compared thoroughly with those arising from several Skyrme and relativistic effective models. The values of the parameters characterizing the BHF equation of state of isospin asymmetric nuclear matter fall within the trends predicted by those models and are compatible with recent constraints coming from heavy ion collisions, giant monopole resonances, or isobaric analog states. In particular we find a value of the slope parameter L=66.5 MeV, compatible with recent experimental constraints from isospin diffusion, L=88±25 MeV. The correlation between the neutron skin thickness of neutron-rich isotopes and the slope L and curvature Ksym parameters of the symmetry energy is studied. Our BHF results are in very good agreement with the correlations already predicted by other authors using nonrelativistic and relativistic effective models. The correlations of these two parameters and the neutron skin thickness with the transition density from nonuniform to β-stable matter in neutron stars are also analyzed. Our results confirm that there is an inverse correlation between the neutron skin thickness and the transition density.

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