Isospin-dependent properties of asymmetric nuclear matter in relativistic mean-field models

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Using various relativistic mean-field models, including the nonlinear ones with meson field self-interactions, those with density-dependent meson-nucleon couplings, and the point-coupling models without meson fields, we have studied the isospin-dependent bulk and single-particle properties of asymmetric nuclear matter [1]. In particular, we have determined the density dependence of nuclear symmetry energy from these different relativistic mean-field models and compared the results with the constraints recently extracted from analyses of experimental data on isospin diffusion and isotopic scaling in intermediate-energy heavy ion collisions as well as from measured isotopic dependence of the giant monopole resonances in even-A Sn isotopes. Among the 23 parameter sets in the relativistic mean-filed model that are commonly used for nuclear structure studies, only a few are found to give symmetry energies that are consistent with empirical constraints as shown in Fig. 1. We have also studied the nuclear symmetry potential and the isospin-splitting of the nucleon effective mass in isospin asymmetric nuclear matter. We find that both the momentum dependence of the nuclear symmetry potential at fixed baryon density and the isospin-splitting of the nucleon effective mass in neutron-rich nuclear matter

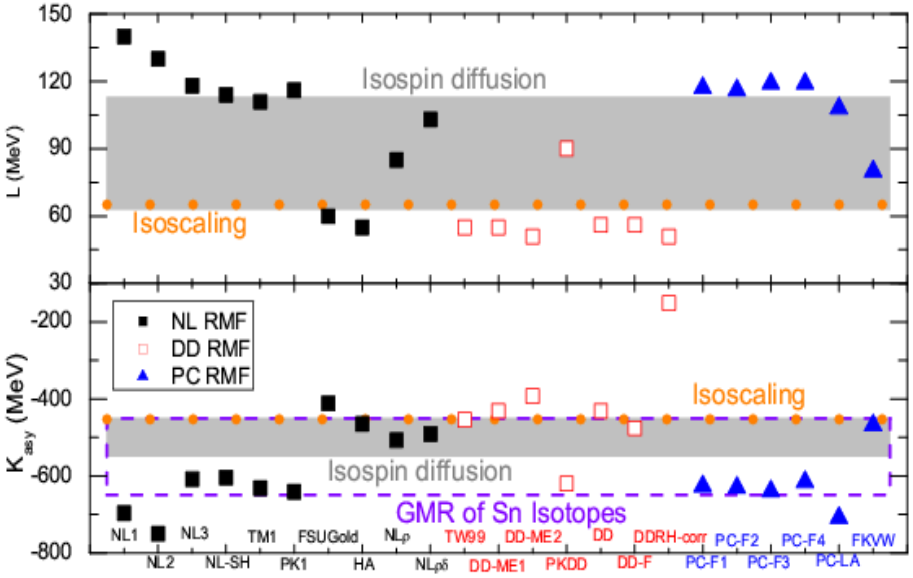

Figure 1. Values of the slope L and and curvature K_{asy} of nuclear symmetry energy for the 23 parameter sets in the nonlinear (solid squares), density-dependent (open squares), and point-coupling (triangles) RMF models. The constraints from the isospin diffusion data (shaded band), the isoscaling data (solid circles), and the isotopic dependence of the GMR in even-A Sn isotopes (dashed rectangle) are also included.

depend not only on the nuclear interactions but also on the definition used for the nucleon optical potential.

[1] L. W.Chen, C. M. Ko, and B. A. Li, Phys. Rev. C **76**, 054316 (2007).