Symmetric and Asymmetric Nuclear Matter in the Relativistic Approach

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Symmetric and asymmetric nuclear matter is studied in the framework of the relativistic Brueckner-Hartree-Fock- and in the relativistic version of the so-called Λ^{00}–approximation [1]. The equations are solved self-consistently in the full Dirac space, so avoiding the ambiguities in the choice of the effective scattering amplitude in matter. The calculations were performed for some modern meson-exchange potentials constructed by Brockmann and Machleidt. In some cases we used also the Groningen potentials. First, we examine the outcome for symmetric matter with respect to other calculations, which restrict themselves to positive-energy-states only. The main part is devoted to the properties of asymmetric matter. In this case we obtain additionally to the good agreement with the parameters of symmetric matter, also a quite satisfactory agreement with the semi-empirical macroscopic coefficients of asymmetric matter. Furthermore we tested the assumption of a quadratic dependence of the asymmetry energy for a large range of asymmetries. Included is also the dependence of nucleon self-energies on density and neutron excess. For the purpose of comparison we discuss further the similarities and differences with relativistic Hartree– and Hartree–Fock calculations and non-relativistic Skyrme calculations.

References

[1] H. Huber, F. Weber, and M. K. Weigel, Phys. Rev. **C51** (1995) 1790