Nuclear Theory

Relativistic Description of Finite Nuclei Based on Realistic NN Interactions

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A set of relativistic mean field models is constructed including the Hartree and Hartree-Fock approximation accounting for the exchange of isoscalar and isovector mesons as well as the pion. Density dependent coupling functions are determined to reproduce the components of the nucleon self-energy at the Fermi surface, obtained within the Dirac-Brueckner-Hartree-Fock (DBHF) approach using a realistic nucleon-nucleon interaction. It is investigated, to which extend the various mean field models can reproduce the DBHF results for the momentum dependence of the self-energies and the total energy of infinite matter. The mean field models are also used to evaluate the bulk properties of spherical closed-shell nuclei. We find that the Hartree-Fock model allowing for the exchange of $\sigma,\,\omega,\,\rho,\,\delta$ mesons and pions, yield the best reproduction of the DBHF results in infinite matter and also provides a good description of the properties of finite nuclei without any adjustment of parameters.

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