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The Structure of Hadronic Matter from Nuclei to Neutron Stars

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In recent years it has become apparent that the intermediate scalar attraction in the NN system should lead to some modification of the internal structure of the nucleon. At the simplest level this effect corresponds to a non-zero scalar polarizability which, in most models investigated so far, tends to oppose the applied scalar field. Such a mechanism naturally leads to saturation of nuclear matter. We shall review the key results of the QMC model and later covariant versions, with a special emphasis on the possibility of testing such ideas experimentally - especially at Jefferson Laboratory. Key examples include modifications of the structure functions and form factors of bound “nucleons” as well as the predictions for hypernuclei. We also discuss the application of such models to dense nuclear matter, including possible phase transitions to quark matter or superconducting quark matter.