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From low-energy QCD to nuclear physics and energy density functionals

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The interface of QCD at low energies with the physics of hadrons and nuclei is provided by an effective field theory of pions and nucleons based on the spontaneously broken chiral symmetry of QCD with (almost) massless u- and d-quarks. This presentation gives an overview of approaches to the nuclear many-body problem guided by these principles, using both perturbative methods and non-perturbative (functional renormalization group) strategies. Applications to nuclear and neutron matter will be reported, with emphasis on stringent constraints at high densities implied by the existence of massive (two-solar-mass) neutron stars. The construction of an energy density functional will be described in this context and comparisons will be made with nuclear phenomenology.

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