

Applications of in-medium chiral dynamics to nuclear structure

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ABSTRACT

A relativistic nuclear energy density functional is developed, guided by two important features that establish connections with chiral dynamics and the symmetry breaking pattern of low-energy QCD: a) strong scalar and vector fields related to in-medium changes of QCD vacuum condensates; b) the long- and intermediate-range interactions generated by one- and two-pion exchange, derived from in-medium chiral perturbation theory, with explicit inclusion of $\Delta(1232)$ excitations. Applications are presented for the description of ground-state properties and collective excitations of medium and heavy nuclei. The extension to hypernuclei will also be presented, showing a new interpretation of the Λ -nucleus potential.

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REFERENCES

- [1] P. Finelli, N. Kaiser, D. Vretenar and W. Weise, *Nuclear many body dynamics constrained by QCD and chiral symmetry*, Eur. Phys. J. A **17** (2003) 573.
- [2] P. Finelli, N. Kaiser, D. Vretenar and W. Weise, *Relativistic nuclear model with point couplings constrained by QCD and chiral symmetry*, Nucl. Phys. A **735** (2004) 449.
- [3] P. Finelli, N. Kaiser, D. Vretenar and W. Weise, *Relativistic nuclear energy density functional constrained by low-energy QCD*, Nucl. Phys. A **770** (2006) 1.
- [4] P. Finelli, N. Kaiser, D. Vretenar and W. Weise, *Chiral pion-nucleon dynamics in finite nuclei: Spin-isospin excitations*, Nucl. Phys. A **791** (2007) 57.
- [5] P. Finelli, N. Kaiser, D. Vretenar and W. Weise, *In-medium chiral dynamics and hypernuclear structure*, Phys. Lett. B **658** (2007) 90.