Baryon-baryon interactions from chiral effective field theory

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Recent results from the ongoing study of baryon-baryon systems within chiral effective field theory by the Bonn-Jülich-Munich Group are reported. The focus will be on baryon-baryon systems with strangeness $S = -1$ and -2.

First, a calculation of the in-medium properties of a hyperon-nucleon (YN) interaction derived within chiral effective field theory (EFT) and fitted to ΛN and ΣN scattering data is presented. The single-particle potentials for the Λ and Σ hyperons in nuclear matter are evaluated in a conventional G-matrix calculation, and the Scheerbaum factor associated with the hyperon-nucleus spin-orbit interaction is computed [1]. A leading-order (LO) YN interaction published in 2006 which accounts well for the bulk properties of the ΛN and ΣN system [2] is considered, and a recent YN potential derived up to next-to-leading order (NLO) in chiral EFT which provides an excellent description of the available low-energy ΛN and ΣN cross sections and the inelastic capture ratio at rest [3].

Furthermore, the relevance of three-body forces for hypernuclei is discussed. Specifically, potentials for the leading order three-baryon interactions are presented, which involve contact terms and irreducible one- and two-meson exchange diagrams. It is argued that the low-energy constants that arise in the three-body forces of few-baryon systems with strangeness could be estimated by including decuplet baryons as explicit degrees of freedom.

Finally, first results for baryon-baryon systems with strangeness $S = -2$, obtained in chiral EFT up to NLO, are presented and discussed.

References

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