Hyperon-nucleon interaction in chiral effective field theory

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We present results of an investigation of the hyperon-nucleon (YN) interaction performed at next-to-leading order in chiral effective field theory. The study builds upon and extends a previous investigation by the Bonn-Jülich group carried out at leading order [1].

We follow the scheme that has been applied successfully by Epelbaum et al. [2] to the NN interaction. Thus, in line with the original suggestion of Weinberg, the power counting is applied to the potential rather than to the reaction amplitude. The latter is obtained from solving a regularized Lippmann-Schwinger equation for the derived interaction potential.

At the order considered there are contributions from one- and two-pseudoscalar-meson exchange diagrams and from four-baryon contact terms without and with two derivatives. The latter represent the short-range part of the YN force and are parametrized by low-energy constants (LECs), that need to be fixed by a fit to data. SU(3) flavor symmetry is imposed for constructing the YN interaction in order to reduce the number of free parameters. In particular, all arising baryon-baryon-meson coupling constants are fixed from SU(3) symmetry and the symmetry is also exploited to derive relations between the various LECs. In the actual calculation the SU(3) symmetry is broken, however, by the mass differences between the Goldstone bosons (π, K, η) and between the baryons. For these masses we use the known physical values.

An excellent description of the hyperon-nucleon system can be achieved at next-to-leading order [3]. It is on the same level of quality as the one obtained by the most advanced phenomenological hyperon-nucleon interaction models [4,5].

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