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Chiral three-body force and monopole properties of shell-model Hamiltonian

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We show an evolution to derive the shell-model effective Hamiltonian employing two- and three-body interactions based on the chiral effective field theory. A new way to calculate three-body matrix elements of the chiral interaction with the nonlocal regulator is given.

We apply our framework to the p-shell nuclei and perform benchmark calculations to compare our results with those by an ab initio no-core shell-model. We report that our results are satisfactory and the contribution of the three-body force is essential to explain experimental low-lying spectra of the p-shell nuclei. We discuss the contribution of the three-body force on the effective single-particle energy extracted from the monopole interaction.

Next, we investigate the shell evolution on the fp-shell nuclei. We show that the monopole component of the shell-model effective Hamiltonian induced by the three-body force plays an essential role to account for the experimental shell evolution.

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