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$\Lambda_c N$ interaction in leading order covariant chiral effective field theory

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We study the $\Lambda_c N$ interaction in the covariant chiral effective field theory (ChEFT) at leading order. All the relevant low-energy constants are determined by fitting to the lattice QCD simulations from the HAL QCD Collaboration. Extrapolating the results to the physical point, we show that the $\Lambda_c N$ interaction is weakly attractive in the ${}^1S_0$ channel, but in the ${}^3S_1$ channel, it is only attractive at extremely low energies and soon turns repulsive for larger laboratory energy. Furthermore, we show that the neglect of the ${}^3S_1 - {}^3D_1$ coupling provided by the leading order covariant ChEFT would result in an attractive interaction in the ${}^3S_1$ channel at the physical point, which coincides with the previous non-relatistic ChEFT study. As a byproduct, we predict the ${}^3D_1$ phase shifts and the mixing angel ε_1, which can be checked by future lattice QCD simulations. In addition, we compare the $\Lambda_c N$ interaction with the ΛN and NN interactions to study how the baryon-nucleon (BN) interactions evolve as a function of the baryon mass with the replacement of a light quark by a strange or charm quark in the baryon (B).

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