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Lattice QCD study on Λ_c -N central and tensor potentials with physical masses

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 Λ_c-N central and tensor potentials in the spin singlet channel (1S_0) and the spin triplet coupled channel ($^3S_1-^3D_1$) from lattice QCD by using HAL QCD method. We perform the first physical point simulation by employing gauge configurations generated by the HAL Collaboration at $m_\pi\simeq 137$ MeV, $m_K\simeq 502$ MeV, and $a\simeq 0.0844$ fm on 96^4 lattices (HAL-Conf-2023) in which a high statistical precision was achieved by 8000 Monte Carlo trajectories.

Our calculations of the Λ_c-N show a weak mid-range attractive and short-range repulsive central potential, along with a weak tensor force. This is qualitatively similar to the previous results obtained by HAL QCD Collaboration at heavier pion masses, $m_\pi \simeq 410,~570,~700$ MeV, while the current results at the physical point indicate a shallower mid-range attraction compared to the previous results. With the ALICE upgraded for LHC Run-3, the increased statistics of charm baryons may enhance the feasibility to analyzing the Λ_c-N interaction using both lattice QCD and experimental data. The present results at the physical point with the coupled-channel effect would also make a significant impact on the studies of Λ_c-N interactions based on chiral effective field theory.

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