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Study on Lambda(1405) in the flavor SU(3) limit in the HAL QCD method

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We perform a numerical study in lattice QCD on $\Lambda(1405)$, an excited Λ baryon whose existence is not well explained by the quark model. Since the previous studies using the chiral unitary model suggest that $\Lambda(1405)$ may be explained by two poles in the octet and the singlet channels of the flavor SU(3), we calculate the HAL QCD potentials for the meson-baryon systems in both channels using gauge configurations in the flavor SU(3) limit on 32^4 lattices with the meson mass $m_M \approx 670$ MeV.

We successfully extract a one-parameter family of potentials in the octet channel, all of which indicate an existence of one bound state. We find that the binding energy calculated from the meson-baryon potential in the octet channel is consistent with the one estimated from the octet baryon two-point function, though errors are much larger for the former. In the singlet channel, however, an existence of a zero point in the NBS wave function leads to a singular potential, which prevents a reliable extraction of the binding energy. We briefly discuss a possible solution to overcome this difficulty in a future study.

Topical area

Hadronic and Nuclear Spectrum and Interactions

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