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Dbar-N interaction from Lattice QCD at the physical point

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The Dbar-N two-body system is one of the most fundamental systems involving open-charmed mesons and nucleons. Owing to the absence of quark-antiquark annihilation, the Dbar-N channel is an entirely exotic channel, such that a bound state would correspond to a pentaquark state. While some EFT models predict a strong attraction that could form a pentaquark state, other models suggest only weak attraction or even repulsion, implying no such state [1-5]. Realistic lattice QCD simulations can thus play a crucial role in clarifying the existence (or absence) of a pentaquark state in the Dbar-N channel.

In this talk, we present results for the Dbar-N potential and its s-wave scattering parameters obtained using the HAL QCD method [6,7]. (2+1)-flavor lattice QCD simulations were performed at the physical point with gauge configurations generated by the HAL QCD Collaboration ("HAL-conf-2023"[8]) on a $96^3 \times 96$ lattice with a pion mass $m_\pi \simeq 137$ MeV and lattice spacing $a \simeq 0.0844$ fm. We observe an attractive phase shift in the low-energy region of the I=0 channel and a repulsive phase shift in the I=1 channel. Our results indicate the absence of pentaquark states in both I=0 and I=1 channels.

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Parallel Session (for talks only)

Hadronic and nuclear spectrum and interactions

Authors: YAMADA, Rento (RIKEN); LYU, Yan (RIKEN); MURAKAMI, Kotaro (Institute of Science Tokyo, RIKEN); DOI, Takumi (RIKEN)

Presenter: YAMADA, Rento (RIKEN)

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