Contribution ID: **100** Type: **Oral Presentation**

Lattice study on a tetra-quark state T_{bb} in the HALQCD method

Tuesday, August 9, 2022 2:40 PM (20 minutes)

We study a doubly-bottomed tetra-quark state $(bb\bar{u}\bar{d})$ with quantum number $I(J^P) = 0(1^+)$, denoted by T_{bb}, in lattice QCD with the NRQCD quark action for b quarks.
Employing $(2+1)$-flavor gauge configurations at $a \approx 0.09$ {fm} on $32^3 \times 64$ lattices, we have extracted the coupled channel HAL QCD potential between $\bar{B}\bar{B}^*$ and $\bar{B}^*\bar{B}^*$, which predicts an existence of a bound T_{bb} below the $\bar{B}\bar{B}^*$ threshold.
By extrapolating results at $m_\pi \approx 410,\ 570,\ 700$ {MeV} to the physical pion mass $m_\pi \approx 140$ {MeV}, we obtain a biding energy with its statistical error as $E_{\rm binding}^{\rm (single)} = 155(17)$ MeV and $E_{\rm binding}^{\rm (coupled)} = 83(10)$ MeV, where "coupled" means that effects due to virtual $\bar{B}^*\bar{B}^*$ states are included through the coupled channel potential, while only a potential for a single $\bar{B}\bar{B}^*$ channel is used in the analysis for "single".
A comparison shows that the effect from virtual $\bar{B}^*\bar{B}^*$ states is quite sizable to the binding energy of T_{bb}. We estimate systematic errors to be ± 20 MeV at most, which are mainly caused by the NRQCD approximation for b quarks.

Primary authors: AOKI, Sinya (Yukawa Institute for Theoretical Physics, Kyoto University); Mr AOKI, Takafumi (Yukawa Institute for Theoretical Physics, Kyoto University)

Presenter: AOKI, Sinya (Yukawa Institute for Theoretical Physics, Kyoto University)

Session Classification: Hadron Spectroscopy and Interactions

Track Classification: Hadron Spectroscopy and Interactions