



Contribution ID: 89

Type: 1st and 2nd weeks (Hadron structure and interactions)

## Mass and Interaction of $1^+$ Diquark and Charm Quark in $\Sigma_c$

Thursday, October 17, 2024 2:30 PM (30 minutes)

In this study, we present a lattice QCD analysis of the  $J^P = 1^+$  diquark within the charmed baryon  $\Sigma_c^{++}(uuc)$ .

Treating  $\Sigma_c$  as a bound state of a charm quark and a  $uu$   $1^+$  diquark, we utilize an extended HAL QCD potential method to determine both the mass of the  $1^+$  diquark and the potential between the charm quark and the  $1^+$  diquark.

Unlike the standard HAL QCD approach, the mass of the  $1^+$  diquark is a non-trivial quantity that cannot be straightforwardly obtained from the two-point correlator due to the color confinement.

To address this, we employ the Kawanai-Sasaki extension of the HAL QCD method, originally developed to self-consistently determine the charm quark mass alongside the  $c\bar{c}$  potential within the HAL QCD framework.

Our lattice QCD Monte Carlo calculations are performed using 2+1 flavor QCD gauge configurations on a  $L^3 \times T = 32^3 \times 64$  lattice, generated by the PACS-CS collaboration, corresponding to a pion mass of approximately 700 MeV.

We find a spin-independent central potential of Cornell-type along with a short-ranged, spin-dependent central potential, which takes the form of a smeared delta-function.

The resulting mass of the  $1^+$  diquark is about 867 MeV, slightly lower than anticipated. This discrepancy is likely due to statistical noise in the Nambu-Bethe-Salpeter wave functions at long distances.

**Primary author:** NISHIOKA, Soya (RCNP, Osaka Univ)

**Co-author:** ISHII, Noriyoshi (RCNP, Osaka University)

**Presenter:** NISHIOKA, Soya (RCNP, Osaka Univ)

**Session Classification:** 1-day Workshop (1st week)