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Lattice Study of $cc\bar{u}\bar{s}$ tetraquark channel in $D^{(*)}D_s^{(*)}$ scattering

We present a lattice QCD study of DD_s scattering in the $J^P = 0^+$ channel employing a newly proposed finite-volume Hamiltonian method using the Lippmann-Schwinger equation formulated in the plane-wave basis. This novel approach provides a direct way to analyze two-hadron interacting systems without relying on the traditional Lüscher formalism formulated in the partial-wave basis. From the extracted finite-volume spectra, we studied the scattering amplitude to look for any hadron pole in the near-threshold region. We observe small, non-zero shifts in the simulated finite-volume interacting energy levels compared to the non-interacting levels, which indicates a nontrivial interaction between D and D_s mesons in the channel of our interest. However, the extracted S-wave amplitude confirms no hadron pole in the near-threshold region. These findings provide new insight into heavy-meson dynamics. Also, they highlight the use of the plane-wave-based formalism as a complementary approach to study multi-hadron spectra in lattice QCD.

Author: Mr SHRIMAL, Tanishk (IMSc, Chennai)

Co-authors: Dr MADANAGOPALAN, Padmanath (IMSc, Chennai); Mr JANA, Priyajit (University of Cyprus)

Presenter: Mr JANA, Priyajit (University of Cyprus)