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Search for $Z_c(3900)$ on the lattice with twisted mass fermions

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Recently a charged resonance-like structure $Z_c(3900)$ has been observed in several experiments. The invariant mass of this structure is close to the DD^* threshold, and one possible interpretation is a molecular bound state formed by the D and \bar{D}^* mesons. We study the low-energy scattering of $D\bar{D}^*$ using lattice QCD with $N_f = 2$ twisted mass fermion configurations with three pion mass values. The threshold scattering parameters, namely the scattering length a_0 and effective range r_0 , for the s-wave scattering in $J^P = 1^+$ channel are extracted. Our results indicate that the interaction of this channel is weakly repulsive. To further investigate the properties of $Z_c(3900)$, we redo the calculation with some improvements. We employ the stochastic LapH smearing method, which greatly improves the precision of our results. We also enlarge the operator basis and study the coupled channel effects.

Primary author: LIU, Liuming (University of Bonn)

Presenter: LIU, Liuming (University of Bonn)

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