

Understanding the charged heavy quarkoniumlike states in chiral effective field theory

We generalize the framework of chiral effective field theory to study the interactions of the isovector $D^* \bar{D}^{(*)}$ and $B^* \bar{B}^{(*)}$ systems up to the next-to-leading order, in which the long-, mid-, and short-range force contributions as well as the S - D wave mixing are incorporated. Based on the Lippmann-Schwinger equation, we fit the invariant mass distributions of the elastic channels measured by the BESIII and Belle Collaborations. Our results indicate that the four charged charmoniumlike and bottomoniumlike states $Z_c(3900)$, $Z_c(4020)$ and $Z_b(10610)$, $Z_b(10650)$ can be well identified as the $D\bar{D}^*$, $D^*\bar{D}^*$ and $B\bar{B}^*$, $B^*\bar{B}^*$ molecular resonances. The bound state explanations are vetoed in our framework. Our study favors the Z_c and Z_b states are the twin partners under the heavy quark symmetry.

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Primary author: Dr WANG, Bo (Hebei University)

Presenter: Dr WANG, Bo (Hebei University)