

$B_s\pi - B\bar{K}$ interaction in finite volume and the nature of $X(5568)$

Recently, the observation of the $X(5568)$ by the D0 Collaboration has attracted a lot of interest both theoretically and experimentally. In a previous study (arXiv:1309.4743[hep-ph]), based on a fit to the lattice QCD scattering lengths of DK and its coupled channels, unitary chiral perturbation theory (UChPT) can dynamically generate the $D_{s0}(2317)$. Inspired by that work and the recent work of Albaladejo and Eulogio where one could tune the interaction such that the $X(5568)$ can be generated within UChPT (arXiv:1603.09230 [hep-ph]), we performed a coupled channel calculation on $X(5568)$ in UChPT considering the $B_s\pi$ and $B\bar{K}$ coupled channels. Further more, we computed the discrete energy levels of the $B_s\pi$ and $B\bar{K}$ system in finite volume. Our results show that the $B_s\pi$ and $B\bar{K}$ interaction is weak and the $X(5568)$ cannot be a $B_s\pi$ and $B\bar{K}$ molecular state. Therefore, the $X(5568)$ and the $D_{s0}(2317)$ cannot simultaneously be of molecular nature, from the perspective of heavy quark symmetry and chiral symmetry. The comparison with the latest lattice QCD simulations, which disfavors the existence of the $X(5568)$, supports our picture. In addition, we show that the (generalized) Weinberg compositeness condition also indicates that the $X(5568)$ cannot be a molecular state made from $B_s\pi$ and $B\bar{K}$ interactions.

Summary

We report on a recent study of the $B_s\pi$ and $B\bar{K}$ interactions in finite volume and the nature of the $X(5568)$ (arXiv:1607.06327[hep-ph])

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