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Study of $B\bar{B}^*$ and $B^*B\bar{B}^*$ interactions in $I=1$ and relationship to the $Z_b(10610)$, $Z_b(10650)$ states

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We use the local hidden gauge approach in order to study the $B\bar{B}^*$ and $B^*B\bar{B}^*$ interactions for isospin $I=1$. We show that both interactions via one light meson exchange are not allowed by the Okubo-Zweig-Iizuka rule and, for that reason, we calculate the contributions due to the exchange of two pions, interacting and noninteracting among themselves, and also due to the heavy vector mesons. Then, to compare all these contributions, we use the potential related to the heavy vector exchange as an effective potential corrected by a factor which takes into account the contribution of the other light meson exchanges. In order to look for poles, this effective potential is used as the kernel of the Bethe-Salpeter equation. As a result, for the $B\bar{B}^*$ interaction we find a loosely bound state with mass in the range 10587–10601 MeV, very close to the experimental value of the $Z_b(10610)$ reported by the Belle Collaboration. For the $B^*B\bar{B}^*$ case, we find a cusp at 10650 MeV for all spin $J=0,1,2$ cases.

Summary

Author: ACETI, Francesca (IFIC - Universidad de Valencia)

Co-authors: OSET, Eulogio; DIAS, Jorgivan

Presenter: ACETI, Francesca (IFIC - Universidad de Valencia)

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