



High Energy Physics - Phenomenology

# Deriving the existence of $B\bar{B}$ bound states from the X(3872) and Heavy Quark Symmetry

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(Submitted on 3 Jun 2011 (v1), last revised 31 Aug 2011 (this version, v2))

We discuss the possibility and the description of bound states between  $B$  and  $\bar{B}$  mesons. We argue that the existence of such a bound state can be deduced from (i) the weakly bound X(3872) state, (ii) certain assumptions about the short range dynamics of the  $D\bar{D}$  system and (iii) heavy quark symmetry. From these assumptions the binding energy of the possible  $B\bar{B}$  bound states is determined, first in a theory containing only contact interactions which serves as a straightforward illustration of the method, and then the effects of including the one pion exchange potential are discussed. In this latter case three isoscalar states are predicted: a positive and negative C-parity  $S_1$ - $D_1$  state with a binding energy of  $20$ ,  $\text{MeV}$  and  $6$ ,  $\text{MeV}$  below threshold respectively, and a positive C-parity  $P_0$  shallow state located almost at the  $B\bar{B}$  threshold. However, large uncertainties are generated as a consequence of the  $1/m_Q$  corrections from heavy quark symmetry. Finally, the newly discovered isovector  $Z_b(10610)$  state can be easily accommodated within the present framework by a minor modification of the short range dynamics.

Comments: 21 pages, 3 figures; a sign error in the potential has been corrected and new predictions have been computed

Subjects: **High Energy Physics - Phenomenology (hep-ph)**; Nuclear Theory (nucl-th)

Cite as: [arXiv:1106.0600 \[hep-ph\]](#)  
(or [arXiv:1106.0600v2 \[hep-ph\]](#) for this version)

## Submission history

From: Manuel Pavaon Valderrama [[view email](#)]  
[v1] Fri, 3 Jun 2011 10:01:12 GMT (130kb)  
[v2] Wed, 31 Aug 2011 15:28:59 GMT (165kb)

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