Describing non-$q\bar{q}$ candidates: the $D^*_{sJ}(2317)$ and the $X(1600)$

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The existence of low-energy multiquark states cannot be discarded from the quark model point of view. Gauging a free quark theory through the $SU(3)_c$ group all $(q\bar{q})^n$ $(qqq)^m$ states, being n and m integers, are allowed. Although theoretically suggested long time ago [1], only recently experimental evidence of the existence of these states has been obtained. Apart from the widely discuss pentaquark ($n = m = 1$) during the last years several tetraquark candidates ($n = 2, m = 0$) have been suggested. Among them, there are states compatible with meson quantum numbers, as it is the case of the D^*_{sJ}'s and the $X(3872)$ [2]. However other structures have to be clearly ascribed to multiquark state as for example the $X(1600)$, being isospin two [3].

The study of four quark systems has been done in two different directions. There have been some theoretical works specifically devoted to a particular set of states [4] while some others did a more general study but in any case making a detailed comparison with $q\bar{q}$ predictions within the same model [5]. The exciting scenario created by the new data obtained at BaBar, CLEO, FOCUS and Belle claims for a comprehensive study where two- and four-quark states ar e simultaneously addressed in a trial to disentangle the quark structure of the new experimental data.

In this work we have performed a throughoutfully study of tetraquark structures made of $qq\bar{q}\bar{q}$, $Qq\bar{q}\bar{q}$ and $qq\bar{Q}\bar{Q}$, where q stands for a light or strange quark and Q for charm or bottom. The quark-quark interaction used is the one that has been derived from a complete study of the meson spectra from the light pseudoscalars to bottomonium [6], compatible with the description of NN data and the baryon spectra.

We present results for all the systems studied. We make emphasis on the results obtained for the $D^*_{sJ}(2317)$ and the $X(1600)$. While the description of the $D^*_{sJ}(2317)$ as a four-quark state requires of aditional interactions, as it could be a three-body force, the simple $I = 2$ $X(1600)$ is obtained with the same mass reported by the PDG, but with a large component of the wave function not factorizable in two-meson states.

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