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Baryon states with open and hidden charm in the extended local hidden gauge approach

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We examine the interaction of DN and D^*N states, together with their coupled channels, by using an extension of the local hidden gauge formalism from the light meson sector, which is based on heavy quark spin symmetry. The scheme is based on the use of the impulse approximation at the quark level, with the heavy quarks acting as spectators, which occurs for the dominant terms where there is the exchange of a light meson. The pion exchange and the Weinberg-Tomozawa interactions are generalized and with this dynamics we look for states generated from the interaction, with a unitary coupled channels approach that mixes the pseudoscalar-baryon and vector-baryon states. We find two states with nearly zero width which are associated to the $\Lambda_c(2595)$ and $\Lambda_c(2625)$. The lower state, with $J^P = 1/2^-$, couples to DN and D^*N, and the second one, with $J^P = 3/2^-$, to D^*N. In addition to these two Λ_c states, we find four more states with $I = 0$, one of them nearly degenerate in two states of $J = 1/2,\ 3/2$. Furthermore we find three states in $I = 1$, two of them degenerate in $J = 1/2, 3/2$.

The s-wave interaction of $\bar{D}\Lambda_c$, $\bar{D}\Sigma_c$, $\bar{D}^*\Lambda_c$, $\bar{D}^*\Sigma_c$ and $\bar{D}\Sigma_c^*$, $\bar{D}^*\Sigma_c^*$, is studied within a unitary coupled channels scheme with the extended local hidden gauge approach. In addition to the Weinberg-Tomozawa term, several additional diagrams via the pion-exchange are also taken into account as box potentials. Furthermore, in order to implement the full coupled channels calculation, some of the box potentials which mix the vector-baryon and pseudoscalar-baryon sectors are extended to construct the effective transition potentials. As a result, we have observed six possible states in several angular momenta. Four of them correspond to two pairs of admixture states, two of $\bar{D}\Sigma_c - \bar{D}^*\Sigma_c$ with $J = 1/2$, and two of $\bar{D}\Sigma_c^* - \bar{D}^*\Sigma_c^*$ with $J = 3/2$. Moreover, we find a $\bar{D}^*\Sigma_c$ resonance which couples to the $\bar{D}\Lambda_c$ channel and one spin degenerated bound state of $\bar{D}^*\Sigma_c^*$ with $J = 1/2, 5/2$.

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