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Two-pion emission decays of negative parity singly heavy baryons

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We investigate two-pion emission decays of singly charmed and bottom baryons, focusing on $\Lambda_Q^*(1P)$ and $\Xi_Q^*(1P)$ states with $J^P = 1/2^-$ and $3/2^-$, which belong to the flavor triplet $\bar{3}_F$. Our study includes both sequential decays through intermediate states in the flavor sextet 6_F and direct three-body decay, with coupling constants estimated using the chiral-quark model and chiral-partner scheme. Examining recent Belle measurements for $\Lambda_c(2625)^+$, we confirm its assignment as a λ -mode excitation with $J^P = 3/2^-$. We then give predictions for other cases, including the Ξ_Q^* decays. The observed asymmetry in the $\pi\pi$ mass distribution highlights the role of the direct process, reflecting the chiral-partner structure. However, the direct process is less significant in three-body decays unless S-wave resonances are suppressed. Further experiments are needed to test our predictions and get more insights into the structure of heavy baryons.

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