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On the $\eta_1(1855)$ as a hadronic molecular state and its SU(3) partners

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In this work, we interpret the newly $\eta_1(1855)$ resonance with exotic $J^{PC} = 1^{-+}$ quantum numbers in the $I = 0$ sector, reported by BESIII collaboration, as a dynamically generated state from the interaction between the lightest pseudoscalar mesons and vector mesons. The interaction is derived from the lowest order chiral Lagrangian from which the Weinberg-Tomozawa term is obtained, describing the transition amplitude among the relevant channels, which are then unitarized using the Bethe-Salpeter equation, according to the chiral unitary approach. In addition, we evaluate the $\eta_1(1855)$ decays into the $\eta\eta'$ and $K\bar{K}^*\pi$ channels. Furthermore, we have also investigated its SU(3) partners, and according to our findings, the $\pi_1(1400)$ and $\pi_1(1600)$ structures may correspond to dynamically generated states, with the former one coupled mostly to the $b_1\pi$ component and the latter one coupled to the $f_1(1420)\pi$, $K_1(1270)\bar{K}$, and $K_1(1400)\bar{K}$ channels. In particular, our result for the ratio $\Gamma(\pi_1(1600) \to f_1(1285)\pi)/\Gamma(\pi_1(1600) \to \eta'\pi)$ is consistent with the one listed in the Review of Particle Physics, which supports our interpretation for the higher π_1 state. Finally, we also report poles in the $I = 1/2$ sector and discuss their influence on the line shape of the ϕK mass spectra, around 1770 MeV, in the $B \to J/\psi\phi K$ decays reported by the LHCb collaboration.

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