

Categorizing representations of scalar $SU(3)_f$ mesons by decays

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The scalar mesons are established for a long time, but their nature is still an open question. In this paper, we investigate the potential of categorizing their $SU(3)_f$ representations via $J/\psi \rightarrow SV$ and γS , offering a criterion that may illuminate this issue. Here, $S(V)$ denotes scalar (vector) mesons. Using the $SU(3)_f$ symmetry with the current data, we find that $f_0(500)$ and $f_0(980)$ are mostly made of singlet and octet $SU(3)_f$ representations, respectively, with the singlet-octet mixing angle of $\theta = (82.9 \pm 4.4)^\circ$. This conclusion is consistent with the calculations of the quark-antiquark ($q\bar{q}$) hypothesis. For the scalar mesons in the range of 1-2 GeV, we discuss the mixings between $q\bar{q}$ and glueballs. Our numerical results suggest that $f_0(1710)$ is likely composed of the scalar glueball. We urge our experimental colleagues to measure $J/\psi \rightarrow \rho a_0(980, 1450, 1710)$, $K^*(892)^\pm K^*(700, 1430, 1950)^\mp$ and $\omega f_0(500)$, which provide useful information in the $SU(3)_f$ analysis.

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