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Scalar and Axial-Vector Mesons in a Three-Flavour Sigma Model

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Scalar mesons have been one of the most hotly debated issues of low-energy QCD for decades. Experimental data show the existence of six scalar isosinglet states in the region below 1 GeV – next to the famous sigma meson, there are five states with the same quantum numbers but higher energies than the energy of the sigma. If we consider u and d quarks as degenerate and work in a theoretical framework that also includes strange states, then we can construct two isoscalar $\bar{q} - q$ states. Thus constructed isoscalars can, of course, describe at most two out of the mentioned six experimentally known states - but the question is: Which two?

We present an $N_f=3$ linear sigma model with (pseudo)scalar and (axial-)vector mesons that allows us to pursue an answer to this question. We find the isoscalar states above 1 GeV – $f_0(1370)$ and $f_0(1710)$ – to be strongly favoured as quarkonia rather than $f_0(600)$ and $f_0(980)$.

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