Structure of the $\Lambda^*(1405)$ and the Λ^*-Meson-Baryon couplings

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The nature of the $\Lambda^*(1405)$-resonance, investigated since half a century, bears still puzzling features. Its well established couplings to $\bar{K}N$ and $\pi\Sigma$ states have offered guidance to various theoretical approaches in improving our understanding of that resonance.

Recent achievements [1] in describing non-strange baryons such as the nucleon, Δ-, $P_{11}(1440)$ and $S_{11}(1535)$-resonances as a superposition of three- and five-quark states bring in new insights to the structure of baryons.

In a recent work [2] a chiral constituent quark model approach was extended to the strangeness sector, studying the $\Lambda^*(1405)$ in a truncated Fock space, which includes three- and five-quark components, as well as configuration mixings among them, namely, $qqq \leftrightarrow qqqq\bar{q}$ transitions. That formalism allowed us to calculate the helicity amplitudes for the electromagnetic decays ($\Lambda(1405) \to \Lambda(1116)\gamma$, $\Sigma(1194)\gamma$), and transition amplitudes for strong decays ($\Lambda(1405) \to \Sigma(1194)\pi$, K^-p), as well as the relevant decay widths, namely, $\Gamma_{\Lambda(1405)\to\Lambda(1116)\gamma}$, $\Gamma_{\Lambda(1405)\to\Sigma(1193)\gamma}$, and $\Gamma_{\Lambda(1405)\to\Sigma(1194)\pi}$. The only available experimental value [3], for the strong decay width $\Gamma_{\Lambda(1405)\to(\Sigma\pi)^\circ} = 50 \pm 2$ MeV, was well reproduced with about 50% of five-quark admixture in the $\Lambda(1405)$.

In this contribution we concentrate on other entities allowing to put further constraints on the percentage of the five-quark component within the Λ^*. Actually, the coupling constants $g_{\Lambda^*\bar{K}N}$ and $g_{\Lambda^*\pi\Sigma}$, as well as the ratio $R = g_{\Lambda^*\bar{K}N}/g_{\Lambda^*\pi\Sigma}$ have been investigated both experimentally [4] and within various theoretical approaches [5]. We will report on the dependence of those entities on the percentage of the five-quark admixture and show that a $\approx$50% probability allows reproducing the experimental value for $R = -2.6 \pm 0.2$.

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