

Influence of $f_0(500)$ and scalar glueball on pion-pion and pion-nucleon scattering within the extended linear sigma model

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We investigate the two-flavor version of the extended linear sigma model (eLSM), which contains, besides the standard scalar and pseudoscalar quark-antiquark degrees of freedom, also vector and axial-vector mesons, as well as the nucleon and its chiral partner. We extend this model by an additional light scalar meson, a potential four-quark state, and the scalar glueball. We investigate several possible interaction terms of these states with the other particles, some of which preserve and some of which explicitly break the $U(1)_A$ symmetry. We test our model by performing a global fit to masses and decay widths of the scalar resonances and pion-pion scattering lengths, obtaining quite reasonable results. We also discuss the influence of the additional scalar resonances on the baryon sector by evaluating pion-nucleon scattering parameters. Finally, we elaborate on some problems and extensions to improve our approach.

Primary authors: Mr LAKASCHUS, Phillip (University Frankfurt); MAULDIN, Justin (Goethe University); GIACOSA, Francesco (Kielce University); RISCHKE, Dirk (University Frankfurt)

Presenters: Mr LAKASCHUS, Phillip (University Frankfurt); MAULDIN, Justin (Goethe University); GIACOSA, Francesco (Kielce University)

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