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Dynamically generated hadronic states in the $\bar{K}N$ and ηN coupled-channels interactions

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The modern approach to meson-baryon interactions at low energies is based on coupled-channels techniques with inter-channels couplings derived from an effective chiral Lagrangian. These interactions lead to emergence of dynamically generated resonances that are assigned to experimentally observed hadronic states with the $\Lambda(1405)$ and $N^*(1535)$ being the most prominent ones in the strangeness sectors S=-1 and S=0, respectivelly. The resonances are related to the poles of the transition matrix with the pole positions identified as solutions of the equation that sets to zero the determinant of the inverse of the T-matrix. In our study we use models presented in Refs. [1] and [2] to analyze the conditions for an emergence of such poles in the $\bar{K}N$ and ηN s-wave amplitudes.

Additional insights are obtained by investigating movement of the poles to the zero coupling limit in which the inter-channels couplings are switched off. In particular, different concepts of forming the $\Lambda(1405)$ resonance were revealed and constraints related to the appearance of such poles were discussed in [3] where a comparative analysis of various approaches to the $\bar{K}N$ interactions was presented as well. Our analysis also indicates a possible existence of a subthreshold isovector $\bar{K}N$ resonance.

[1] A. Cieply and J. Smejkal, Nucl. Phys. A881 (2012) 115.
[2] A. Cieply and J. Smejkal, Nucl. Phys. A919 (2013) 46.
[3] A. Cieply, M. Mai, U.-G. Meissner and J. Smejkal, Nucl. Phys. A954 (2016) 17.

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