

Theoretical approaches to low energy $\bar{K}N$ interactions

Monday, 6 June 2016 17:15 (0:20)

Collaboration

Abstract content

Several theoretical groups [1-4] describe the antikaon-nucleon interaction at low energies within approaches based on the chiral SU(3) dynamics and including next-to-leading order (NLO) contributions. We present a comparative analysis of the pertinent models and discuss in detail their pole contents. We note that the Kyoto-Munich [1] and Prague [2] models have relatively small NLO contributions (representing only moderate corrections to the LO chiral interactions) while the Murcia [3] and Bonn [4] models introduce sizable NLO terms that generate inter-channel couplings very different from those obtained by only the Weinberg-Tomozawa interaction.

The models reproduce the experimental data on a qualitatively very similar level and in mutual agreement especially concerning the data available at the $\bar{K}N$ threshold. They also tend to agree on a position of the higher energy of the two poles generated for the $\Lambda(1405)$ resonance. However, in our recent work [5] we demonstrated that the approaches lead to very different predictions for the K^-p amplitude extrapolated to subthreshold energies as well as for the K^-n amplitude. The theoretical ambiguities observed below the $\bar{K}N$ threshold are much larger than those indicated by uncertainty bounds derived from variations of the K^-p scattering length within constraints enforced by a recent SIDDHARTA measurement of the kaonic hydrogen characteristics [6].

We have also analysed the origin of the poles of the scattering T -matrix generated by the various theoretical models by following the pole movements to the so-called zero coupling limit, in which the inter-channel couplings are switched off. This procedure enabled us to reveal different concepts of forming the $\Lambda(1405)$ resonance and provided us with new insights related to the appearance of poles in a given approach. In particular, we discuss a possible isovector $\bar{K}N$ pole located below the $\bar{K}N$ threshold and demonstrate that an appearance of a pole in a given approach can be related to conditions imposed on the subtraction constants or inverse interaction ranges, the parameters fitted to reproduce the experimental data.

[1] Y.Ikeda, T.Hyodo and W.Weise, Nucl. Phys. A 881 (2012) 98

[2] A.Cieply and J.Smejkal, Nucl. Phys. A 881 (2012) 115

[3] Z.H.Guo and J.A.Oller, Phys. Rev. C 87 (2013) 035202

[4] M.Mai and U.-G.Meissner, Eur. Phys. J. A 51 (2015) 30

[5] A.Cieply, M.Mai, U.-G.Meissner and J.Smejkal, submitted to Nucl. Phys. A, arXiv:1603.02531 [hep-ph]

[6] M.Bazzi et al. [SIDDHARTA Collaboration], Phys. Lett. B 704 (2011) 113

Primary author(s) : CIEPLY, Ales (Nuclear Physics Institute)

Presenter(s) : CIEPLY, Ales (Nuclear Physics Institute)

Session Classification : Parallel Session C6