SIDDHARTA impact on $\bar{K}N$ amplitudes used in in-medium applications

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The new data on kaonic hydrogen characteristics published by the SIDDHARTA collaboration [1] appear consistent with other experimental data on the K^-p threshold branching ratios and on the low energy K^-p cross sections. We have performed new fits [2] of our chirally motivated coupled-channels model for meson-baryon interactions [3] and discussed the impact of the SIDDHARTA measurement on the $\bar{K}N$ amplitudes in the free space and in nuclear medium. The kaon-nucleon amplitudes generated by the model are fully consistent with our earlier studies that used the older kaonic hydrogen data by the DEAR collaboration [4]. As expected, the next-to-leading order contributions included in our model improve the quality of the fit when compared with a model that employes only the leading order Tomozawa-Weinberg interaction.

The several versions of coupled-channels separable potential models considered in our work provide $\bar{K}N$ amplitudes that exhibit very similar energy dependence in the free space as well as in the nuclear medium. Specifically, the strong subthreshold energy and density dependence of the K^-p amplitudes, that reflects the dominant effect of the $\Lambda(1405)$ resonance, does not depend much on a particular version of the model. A prominent feature of the models is a sharp increase of K^-p in-medium attraction below the $\bar{K}N$ threshold. Since the K^--nuclear interaction probes subthreshold $\bar{K}N$ energies where the K^-p in-medium amplitude exhibits much stronger attraction the resulting K^--nuclear optical potential becomes much deeper than when it were constructed from the amplitudes taken at the $\bar{K}N$ threshold. The mechanism of constructing the optical potential from subthreshold $\bar{K}N$ energies [5] allows to link the shallow $\bar{K}$-nuclear potentials based on the chiral $\bar{K}N$ amplitude evaluated at threshold and the deep phenomenological optical potentials obtained in fits to kaonic atoms data. The relevance of this finding to an analysis of kaonic atoms and quasi-bound $\bar{K}$-nuclear states was already investigated in Refs. [5, 6].

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