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Theoretical status of antikaon-nucleon interactions

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In this talk, we discuss the recent theoretical studies of the strong interaction between an antikaon ($\bar{K}$) and a nucleon (N) [1,2]. The isospin $I = 0$ channel is of particular interest, as it exhibits an attractive interaction that can generate a quasi-bound state known as the $\Lambda(1405)$ resonance, located below the $\bar{K}N$ threshold. This suggests that the $\bar{K}N$ interaction may also produce quasi-bound states of kaonic nuclei [1]. Furthermore, the quasi-bound picture of the $\Lambda(1405)$ is related to the discussion of hadronic molecules in hadron spectroscopy.

Theoretical description of the $\Lambda(1405)$ in the coupled-channel meson-baryon scattering is developed with chiral SU(3) dynamics [2]. Based on the next-to-leading order (NLO) chiral SU(3) dynamics combined with the precise measurement of kaonic hydrogen by SIDDHARTA, it is shown that there are two resonances between the $\pi\Sigma$ and $\bar{K}N$ thresholds, $\Lambda(1405)$ and $\Lambda(1380)$. We review the current status of the theoretical studies of chiral SU(3) dynamics, including the recently performed NNLO analysis [3].

Femtoscopic study of the two-particle momentum correlation functions in high-energy collisions has become a new method to extract the hadron-hadron interactions. We present the study on the two-particle correlation function of a K^-p pair in high-energy collisions within the $\bar{K}N$-$\pi\Sigma$-$\pi\Lambda$ coupled-channels framework, which accurately account for all relevant effects, including the Coulomb potential and the threshold energy difference between K^-p and $\bar{K}^0n$ [4]. Realistic $\bar{K}N$-$\pi\Sigma$-$\pi\Lambda$ potential based on NLO chiral SU(3) dynamics is used. We discuss the resulting K^-p correlation functions in comparison with the recent measurements by the ALICE collaboration under various collision conditions [4].

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Collaboration

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