Summary of the K-pp bound-state observation in E15 and future prospects

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The possible existence of deeply-bound $\bar{K}$-nuclear bound states has been widely discussed as a consequence of the strongly attractive $\bar{K}N$ interaction in I = 0 channels. The investigation of those exotic states will provide unique information of the $\bar{K}N$ interaction below the threshold, which is still not fully understood up to date. Furthermore, the great interest of those exotic states is that they might form high-density nuclear matter where the chiral symmetry is expected to be restored. ewline For the simplest $\bar{K}$-nuclear bound state, $\bar{K}NN$, many theoretically works based on a few-body calculation using the $\bar{K}NN-\pi\Sigma N-\pi\Lambda N$ coupled-channel system have been performed and predicted the existence of the bound state. Experimentally, howeve, available information is not sufficient to discriminate between a variety of conflicting interpretations so far. To obtain further understanding of the $\bar{K}NN$ bound state, we performed an experimental search for the $\bar{K}NN$ bound state by the in-flight K^-+ ^{3}He reactions at 1 GeV/c (J-PARC E15). With the Λpn final state reconstructed, we observed a significant peak below the K^-pp mass-threshold in the Λp invariant-mass spectrum, which can be interpreted as the "K^-pp" bound state. ewline We will discuss the $\bar{K}NN$ bound state from both aspects of production and decay. In addition, we will discuss future prospects of kaonic nuclei studies at J-PARC: we have proposed a series of experimental programs for the systematic investigation of the light kaonic nuclei, from the $\bar{K}N$ (=Λ(1405)) to $\bar{K}NNNN$.