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# Search for the Kaonic Bound State $\bar{K}NN$ at J-PARC

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## Collaboration

the J-PARC E15 collaboration

## Abstract content

The possible existence of strongly-bound $\bar{K}$ nuclear-states has been widely discussed as a consequence of the strongly attractive $\bar{K}N$ interaction in I = 0 channels. Experimentally, however, available information is not sufficient to discriminate between a variety of conflicting interpretations so far. To break through this situation, we have performed an experimental search for the simplest kaonic nuclear bound state, $\bar{K}NN$, by the in-flight $K^-$ + $^3$He reactions at 1 GeV/$c$ (J-PARC E15). The experiment investigates the $\bar{K}NN$ state both in the formation via $^3\mathrm{He}(K^-, n)X$ missing-mass spectroscopy and its decay via invariant-mass spectroscopy using $^3\mathrm{He}(K^-, \Lambda p)n$ channel.

The physics data-taking was performed at the K1.8BR beam-line in 2013 and 2015. With the data-set, we have observed a significant bump structure below the $K^-pp$ mass-threshold in the $\Lambda p$ invariant-mass spectrum. In addition, we have successfully observed $\Lambda(1405)pn$ final state in $K^-$ + $^3$He reactions by reconstructing $\pi^{\mp}\Sigma^{\pm}pn$ events, which is of special importance to understand the production mechanism of the $\bar{K}NN$ state such as theoretically predicted $\Lambda(1405)N \to \bar{K}NN$ doorway process.

We will discuss the possible existence of the $\bar{K}NN$ state from both aspects of production and decay: $\bar{K}NN$ and $\Lambda(1405)N$ production, and $\Lambda p$ non-mesonic and $(\pi\Sigma)^0 p$ mesonic decay, respectively.

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