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Search for the K^-pp bound state via the in-flight $^3\mathrm{He}(\mathrm{K}^-, \mathrm{n})$ reaction

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Abstract content

Over the last decade, kaonic nuclear states have been studied extensively. In particular, the simplest state, K^-pp, is widely discussed in terms of its binding energy and width, since such simplest state is quite sensitive to the $\bar{K}N$ interaction. There are various theoretical predictions of the K^-pp state at present, thus it is quite important to compare the theoretical calculations with experimental studies. However, the experimental situation is also controversial; the DISTO and FINUDA collaborations have claimed observations of the deeply-bound K^-pp state, while the HADES and LEPS groups recently reported null results of the K^-pp searches. Therefore, we need to investigate the K^-pp state in different reactions and to understand background process, such as multi-nucleon absorption processes of K^-. In the J-PARC E15 experiment, the K^-pp search is performed via the $^3\mathrm{He}(K^-, n)$ reaction at 1.0 GeV/c. A forward-going neutron is detected by a neutron counter with 15 m flight length, and decay particles from K^-pp are simultaneously measured by a cylindrical detector system that surrounds a liquid ^{3}He target system. In March and May, 2013, we carried out the first physics data-taking with 5x10^9 incident kaons on the ^{3}He target, and we have obtained the missing-mass spectrum of $^3\mathrm{He}(K^-, n)$ and the exclusive analysis result of $^3\mathrm{He}(K^-, \Lambda p)n$ reaction. We have also examined not only the expected $K^-pp \to \Lambda p$ decay but also multi-nucleon absorption processes of in-flight K^- by reconstructing the exclusive $^3\mathrm{He}(K^-, \Lambda p)n$ channel. In this talk, we present the latest analysis results of the first physics data of J-PARC E15.

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