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Kaonic nuclei studied via K- induced reactions at J-PARC

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The existence of kaonic nuclear states has not been established so far, despite the many efforts in both theoretical and experimental sides. Recent concerns are focusing on the simplest kaonic nuclear state, KbarNN, which is predicted to be bound by almost all theoretical studies. Experimentally, there are some reports on peak structure observations at ~100 MeV below KbarNN threshold, but they are too deep to be understood theoretically.

Our experimental approach in J-PARC E15 is to take advantage of K- induced reactions at 1 GeV/c on helium-3 target. In this reaction, a neutron knockout is dominant, where the momentum transfer is rather small (~200 MeV/c). Therefore, one can expect the KbarNN state could be efficiently formed.

In 2013, we took first physics data at J-PARC K1.8BR beamline. We investigated the formation reaction in the neutron missing-mass spectrum at very forward angle [PTEP(2015)061D01] and the KbaNN decay in the Lambda p invariant-mass spectrum [PTEP(2016)051D01]. While we did not observe significant structure in the deep binding region ~ 100 MeV, we found a peak-like structure around the threshold in the Lambda p invariant-mass spectrum. Therefore, in 2015, we performed the second experiment to further investigate the structure observed. The larger data sample allows us to perform detailed analysis such as the reaction angular dependence, which could lead to the first convincing evidence of the KbarNN bound state.

In this contribution, we will report the latest result of the Lambda p invariant-mass study. Analysis status of other channels and our future prospect will be also discussed.

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