The 567th Nuclear Science Seminar

Dr. Yudai ICHIKAWA
(Advanced Science Research Center, JAEA)

Experimental study of the kaonic nuclei by using the pion induced reaction

April 8th, 2016 (Fri) 16:00-17:00

Room 309, Faculty of Science Build 1,
Hongo campus, the University of Tokyo

Whether there exist kaonic nuclei, which is the bound state of Kbar and nucleus, or not is a key issue to make our understandings on the KbarN interaction in vacuum and in nuclear medium. We have searched for a “K-pp” bound state, which is considered as the simplest kaonic nuclei, by using the π + d → K + X reaction at 1.69 GeV/c. This experiment was carried out at the K1.8 beam line of the J-PARC hadron experimental facility.

In this reaction, Λ(1405) hyperon resonance is expected to be produced as a door-way to form the K-pp through the Λ(1405)p → K-pp process. However, most of the produced Λ(1405)'s would escape from deuterons without secondary reactions. Therefore, coincidence of high-momentum (> 250 MeV/c) proton(s) in large emission angles (39◦ < _lab: < 122◦) is requested to enhance the signal-to-background ratio. It is because such proton(s) can be produced from the K-pp but not from the quasi-free hyperon production (background).

We have measured the inclusive missing-mass spectrum at this beam energy in high statistics and high energy resolution for the first time. While a gross structure is well understood with a simple quasi-free picture based on the known elementary processes, we have observed two distinct deviations; one peculiar enhancement at 2.13 GeV/c^2 is due to the ΣN cusp, and the other notable feature is a “shift” of a broad bump structure, mainly originating from hyperon resonance productions of Λ(1405) and Σ(1385).

We have measured a mass distribution of a “K-pp”-like structure in the π+ d →K+ “K-pp”, “K-pp”→Σ0 p mode in a two-proton coincidence analysis, for the first time. By fitting the mass distribution with a relativistic Breit Wigner function, the mass and width have been evaluated to be 2275^{+17}_{-18} (stat.) $^{+21}_{-30}$ (syst.) MeV/c^2 and 162^{+87}_{-45} (stat.)$^{+66}_{-78}$ (syst.) MeV, respectively. It corresponds to the K-pp binding energy of 95^{+18}_{-17} (stat.) $^{+30}_{-21}$ (syst.) MeV.

Nuclear Science Seminar (NSS)
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