Recent topics in Strangeness nuclear physics at J-PARC

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After the big earthquake in the East part of Japan in March, 2011, the beams from the J-PARC accelerators have been recovered in December, 2011. The beams in the Hadron experimental hall were also successfully delivered in the beginning of February, 2012. Some recent results obtained before and after the earthquake will be presented in this talk. A run schedule of strangeness nuclear physics program in the near future is also introduced.

1. Status of J-PARC Hadron Hall

The Japan Proton Accelerator Research Complex(J-PARC) started the beam commissioning in 2009 for three experimental facilities: the material and life sciences facility using neutrons and muons, the hadron experimental facility using kaons and pions, and the neutrino experimental facility using neutrino beams. In the hadron experimental hall [1], we have a medium-energy K^- beam line called K1.8 with the maximum beam momentum of 2 GeV/*c*. It has double-stage electro-static(ES) separator systems to achieve a good K^-/π^- ratio better than 1. This beam line has a branch option(K1.8BR) to extract the beam after the first ES separator with the maximum momentum of 1.1 GeV/*c*. At this moment, this is the only beam line available for strangeness nuclear physics program. Soon, another beam line K1.1 will be installed in the hadron hall.

2. Recent results in Strangeness nuclear physics

The first physics data taking(E19) in the hadron experimental hall was carried out in October and November of 2010. We took the data on $\pi^-p\rightarrow K^-\Theta^+$ at 1.92 GeV/*c* at the K1.8 beam line by using the SKS spectrometer, in high statistics and with a good energy resolution of 1.4 MeV/c^2(FWHM). The analysis showed no prominent peak structure for the penta-quark Θ^+ production [2]. After the big earthquake in the East part of Japan in March, 2011, the beams at the hadron experimental hall have been successfully recovered in February, 2012. The measurement of E19 has been continued at the incident momentum of 2 GeV/*c*, where the production cross section of the Θ^+ would be possibly enhanced. In the beam time in June, 2012, a new data taking to search for a K^-pp bound state in the $\pi^+d\rightarrow K^+(K^-pp)$ reaction at 1.7 GeV/*c* (E27) has been performed as a pilot run.

3. Run schedule in the near future

So far the beam power delivered for the hadron hall from the main proton synchrotron was about 5 kW, which is a few % of the designed beam power. In the next run scheduled in December, 2012, we expect to have the beam power of 10 kW or more. Then, we will be able to conduct some kaon beam experiments, soon.

The first experiment is still a pion beam experiment to look for a neutron-rich Λ hypernucleus of $^6_\Lambda$H via the double-charge-exchange (π^-,K^+) reaction(E10) which requires an high-intensity pion beam at 1.2 GeV/*c*. Recently, the evidence for the $^6_\Lambda$H was reported by the FINUDA collaboration [3] with only three candidate events. It would be important to confirm it in high statistics.

Before the summer shutdown in 2013, three kaon experiments are waiting for the beam. One experiment(E15) is a search for the K^-pp in K^- ^{3}He$\rightarrow$n(K^-pp), (K^-pp)$\rightarrow\Lambda$p reaction at 1 GeV/*c*. This experiment is ready for data taking at K1.8BR. The other experiments are a hypernuclear gamma-ray spectroscopy(E13) using the newly-constructed Hyperball-J detector system, and a search for Ξ hypernuclei in the (K^-, K^+) reaction (E05) using the SKS spectrometer at K1.8. The detail of these experiments will be presented.

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