Experimental status of S=-2 hypernuclei

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Nuclei with double strangeness ($S = -2$) provide the key information to understand Baryon-Baryon interaction under the $SU(3)_f$ symmetry. Therefore we have carried out the experiments at KEK and BNL for quarter a century. Recently, the interaction in $S = -2$ sector is noted to derive the information of the EOS of neutron stars which should include hyperons due to higher density than that of ordinal nuclei.

However, experimental information is very limited, so far. Only the NAGARA event presented weakly attractive Λ-Λ interaction by E373@KEK. Other 5 events were analyzed so as not to be inconsistent with the result of NAGARA[1]. Regarding stable H dibaryon, its mass was limited by the NAGARA event and some resonance-like peak was shown over the ΛΛ threshold region[2]. Ξ^- nuclear potential was introduced to be $-18 \sim -14$ MeV although peak structure was not seen for Ξ hypernucleus[3] by E224@KEK and E885@BNL. From E176@KEK, bound systems of Ξ^- hyperon and nucleus were presented with possibilities of atomic 3D states by twin-hypernuclear events[4]. The KISO event showed weakly attractive Ξ-N interaction via a uniquely assigned Ξ^--^{14}N system, very recently[5].

At J-PARC hadron hall, very intense and highly pure K^- beam is ready to be provided for experiments to search for $S = -2$ systems. The E07 experiment is expected to provide $\sim 10^2$ and $\sim 10^3$ double-Λ hypernuclei with hybrid-emulsion and overall scanning method, respectively[6]. The H dibaryon resonance shall be measured in ΛΛ production with Time Projection Chamber to detect Λ hyperons by E42[7]. Ξ nucleus potential shall be measured by Ξ atom and Ξ nucleus. The E03 and the E07 experiment plan to measure X-rays from Ξ^- capture by Fe and (Ag, Br), respectively, with Ge-detector (Hyperball)[6,8]. Regarding Ξ hypernuclei, the E05 experiment will detect peak structure in K^+ momentum spectrum via $^{12}\mathrm{C}(K^-, K^+)\mathrm{X}$ interaction with high energy-resolution spectrometer[9]. In the E07 experiment, twin-hypernuclei can be detected as sources of deeply bound Ξ^--nucleus systems in a few hundreds events to be expected.

In the workshop, we will review the above knowledge obtained by the experiments at KEK and BNL, and discuss coming experiments with developing technologies to search for $S = -2$ systems.

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[8] http://www.j-parc.jp/researcher/Hadron/en/pac_0606/pdf/p03-Tanida.pdf

[9] http://www.j-parc.jp/researcher/Hadron/en/pac_0606/pdf/p05-Nagae.pdf