Recent Progresses in the Study of Nonmesonic Weak Decay of Λ Hypernuclei

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The nonmesonic weak decay (NMWD) process of the Λ hypernuclei, $\Lambda p \rightarrow np$ (Γ_p) and $\Lambda n \rightarrow nn$ (Γ_n), is very unique in that it occurs only in the nucleus. Since this process can not be easily realized in the free space, the NMWD provides practically the only means to study this important strangeness changing baryonic weak interaction process. There has been a long standing discrepancy between the experimental and theoretical relative strengths of the two channels, namely Γ_n/Γ_p ratio [1]. Thanks to the recent developments in experimental and theoretical studies, the ratios now converged to ~0.5 and the discrepancy problem finally has been solved [2]. However, evenif the progresses, the decay interaction of NMWD is not well established yet and there remain the important issues such as the discrepancy of asymmetry parameter between experimental and theoretical values, confirmation of 3-body NMWD process, and whether the $\Delta I=1/2$ rule for $\Delta S=1$ decay would hold or not in NMWD.

Especially the recent experimental indication of the 3-body decay process $\Lambda NN \rightarrow NNN$ whose contribution was predicted to be significant in the theoretical calculations seems to be found in the quenching of singles and coincidence nucleon yields in NMWD. It turned out that the quenching of nucleons has been the real reason behind the long standing Γ_n/Γ_p puzzle. Furthermore, the quenching strongly indicates a surprisingly large contribution of the 3-nucleon or even many-nucleon processes [3]. In addition to the quenching of nucleons, the momentum sum correlation of the two emitted nucleons shows a high momentum group in addition to the dominant low momentum group, which is well separated from the latter and points clearly to the contribution of three- (or many-) nucleon induced NMWD processes. At the moment, the statistics for this high momentum group is quite limited. It now becomes one of the urgent issues in NMWD study to determine its contribution experimentally, which is one of the main purposes of J-PARC 50 GeV PS experiment, E18.

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2. B. Kang *et al*., Phys. Rev. Lett. **96** (2006) 062301, M. J. Kim *et al*., Phys. Lett. B **641** (2006) 28.
3. H. Bhang *et al*., Eur. Phys. Jour. A **33** (2007) 259.