

Study of Light Single Hypernuclei with Nuclear Emulsion

Myint Kyaw Soe, Yoko ENDO, Kaoru HOSHINO, Hiroki ITO, Kazunori ITONAGA, Shinji KHINBARA, Hidetaka KOBAYASHI, Kazuma NAKAZAWA, Daisuki NAKASHIMA, Aye Moh Moh Theint, Junya YOSHIDA

Department of Physics, Gifu University, Japan

E-mail: [npkyawl@gmail.com](mailto:npyawl@gmail.com)

(Received December 15, 2015)

Searching for light hypernuclei in nuclear emulsion is ongoing. We target to measure binding energies of ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$, which are mirror hypernuclei to provide effective information on charge symmetry breaking in ΛN interaction.

KEYWORDS: Charge symmetry breaking (CSB), $A=4$ mirror Λ hypernuclei, nuclear emulsion

1. Introduction

In hypernuclear physics, both theoretical and experimental groups are approaching the charge symmetry breaking (CSB) effect in ΛN interaction by studying mirror Λ hypernuclei. Binding energy differences of mirror Λ hypernuclei lead to the existence of CSB in ΛN interaction. Motivation of our current work is to study CSB with $A=4$ mirror Λ hypernuclei. Since 1960s, emulsion experiments reported B_{Λ} of ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$ in ground state (0^+) [1- 3]. The combined results for $B_{\Lambda}(0^+)$ of ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$ were reported by M. Juric et al. [4] to be 2.04 ± 0.04 MeV and 2.39 ± 0.03 MeV, respectively. This combined data gave a large binding energy difference between ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$, $\Delta B_{\Lambda}(0^+) = 0.35 \pm 0.05$ MeV and thus CSB effect appears significantly.

CSB effect in excited states (1^+) was studied in γ -ray spectroscopy experiments by measuring the γ -rays from ($1^+ \rightarrow 0^+$) transition. To draw the level schemes of mirror hypernuclei (${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$), it completely depends on ground state (0^+) energy [5]. Recently, MAMI-C reported $B_{\Lambda}({}^4_{\Lambda}\text{H}(0^+)) = 2.12 \pm 0.01(\text{sta.}) \pm 0.09(\text{sys.})$ MeV and ΔB_{Λ} in $A=4$ mirror hypernuclei becomes small. We will measure B_{Λ} for both ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$ under the same experimental and analysis procedures in the emulsion. This may be very effective to study CSB effect in ΛN interaction of ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$.

To collect events of ${}^4_{\Lambda}\text{H}$ and ${}^4_{\Lambda}\text{He}$ hypernuclei, we use one emulsion stack of E176 experiment exposed by 1.66 GeV/c K^- beam [6]. Dimension of emulsion plate is 23cm \times 23cm \times 0.11cm and a stack consists of 43 emulsion plates. Searching for single hypernuclear events is ongoing.

2. Detection system of light single- Λ hypernuclear events