Contribution ID: **83** Type: **talk**

Measurement of beta decay rates of Λ hypernuclei for studying the baryon modification in nuclear matter

Thursday 30 June 2022 11:55 (15 minutes)

We propose an experiment for measuring the beta decay of Λ hypernuclei to study possible modification of baryon structure in nuclear matter due to the interaction between the quarks in the baryon and the meson field in nuclear matter. The QMC (Quark Meson Coupling) model predicts that the axial charge g_A of a Λ decreases by 10% at maximum in nuclear matter, and the beta decay rate of a Λ decreases by 20% at maximum. We plan to use the ${}^{5}_{\Lambda}He$ hypernucleus, which will be produced via the ${}^{6}Li(\pi^+, K^+){}^{6}_{\Lambda}Li$, ${}^{6}_{\Lambda}Li \rightarrow {}^{5}_{\Lambda}He + p$ reaction at J-PARC K1.1 beamline. To clearly measure the effect of the baryon modification, we will determine the beta decay rate within a 4.5% accuracy by measuring the branching ratio and the lifetime with accuracies of 4% and 2%, respectively. Measuring the branching ratio, a huge background of π^0 and π^- from the $'s$ main decay modes should be reduced down to the order of 1% of the beta decay electron signal. For this purpose, we designed apparatus around the ${}^{6}Li$ target made of plastic and lucite Cerenkov counters together with a BGO 4π calorimeter and studied how to remove the background by simulation using the GEANT4 code. Via elaborated analysis methods for background suppression, the background rate from the Λ's main decay modes is found to be reduced down to 4% of the beta decay electron signal. Furthermore, nonmesonic weak decay ($\Lambda p \rightarrow np$ and $\Lambda n \rightarrow nn$) and quasi-free Λ production may also make background. We simulated these background processes, and these background rates are found to be reduced to ˜15.5% of the beta decay electron signal. In a rough estimate, the systematic error in the beta decay branching ratio can be ˜ 6% by subtracting the background events within 30% accuracy. Thus we found that this beta decay experiment is feasible.

Author: KAMADA, Kento (Tohoku University)

Co-authors: TAMURA, Hirokazu; FUJITA, Manami

Presenter: KAMADA, Kento (Tohoku University)

Session Classification: 4; Thu-IIa