

WEAK DECAY OF Λ -HYPERNUCLEI: FUTURE PERSPECTIVES OF A POWERFUL DISCOVERY TOOL

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The systematic study of weak decay processes of Λ -hypernuclei, in particular of the p -shell ones, is a challenging research subject. It offers the unique opportunity to test our knowledge of the weak interaction with strangeness and to gain a new insight into several topics, sometimes even beyond the scope of strangeness nuclear physics.

In the last decade, several new results were achieved and it was possible to start to draw a coherent picture of the observed phenomena.

However, many tiles of the puzzle are still missing.

For this reason, new ideas for further studies of p -shell Λ -hypernuclei weak decay have been recently put forward. The most straightforward approach is to take advantage of the existing facilities at J-PARC to perform a precise measurement ($\leq 5\%$) of all the partial decay widths (Γ_{π^-} , Γ_{π^0} , Γ_p , Γ_n , Γ_{2N} , Γ_{tot}) of weak decay of Λ -hypernuclei, produced through the well known (π^+ , K^+) reaction on different nuclear targets (${}^7\text{Li}$, ${}^9\text{Be}$, ${}^{10}\text{B}$, ${}^{12}\text{C}$, ${}^{13}\text{C}$, ${}^{16}\text{O}$).

A more challenging proposal is to exploit for the first time the (π^- , K^0) reaction on the same set of targets in order to produce and to observe several neutron-rich Λ -hypernuclei.

The aim of this measurement is actually the precise determination of the two mesonic, Γ_{π^-} and Γ_{π^0} , and of the one-proton induced, Γ_p , partial decay widths. Moreover, the measured value of the total decay width Γ_{tot} , i.e. of the Λ -hypernucleus lifetime τ , will give an important contribution to the ongoing debate about the lifetime of the Λ hyperon when embedded into a nucleus.

With such a robust data sample a definitive insight into the so far elusive $\Lambda\mathcal{N} - \mathcal{N}\mathcal{N}$ weak interaction could be achieved.