Production of Neutron-Rich Λ Hypernuclei by Double-Charge-Exchange Reactions

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We calculate cross sections of the ${}^{A}\mathrm{Z}(\pi^-, K^+)^{A}_{\Lambda}(\mathrm{Z}{-}2)$ and ${}^{A}\mathrm{Z}(K^-, \pi^+)^{A}_{\Lambda}(\mathrm{Z}{-}2)$ reactions. Structure studies for a number of neutron-rich hypernuclei [1,2] attainable in these reactions have showed that their properties are sensitive to delicate features of hypernuclear interactions. Observation of neutron-rich Λ hypernuclei can provide new knowledge of the hyperon-nucleon force and widen the hypernuclear chart.

We consider two mechanisms of the reactions. The first one is the two-step process including Λ production at one step and preceding/subsequent meson charge exchange at the other step (e.g., $\pi^- \to K^0 \to K^+$ or $\pi^- \to \pi^0 \to K^+$). We treat the two-step reaction within the Glauber approach using empirical elementary amplitudes and taking into account differences between meson-neutron and meson-proton elastic amplitudes significant in neutron-rich systems.

Another mechanism considered is the one-step production via Σ^- doorway state (e.g., $\pi^- p \to K^+\Sigma^-$) appearing due to $\Lambda n \leftrightarrow p\Sigma^-$ coupling. The Σ^- admixture is calculated in the two-channel approach [3] with coupling potentials originated from meson-exchange models. Yields of the one-step mechanism are mainly determined by the Σ^- admixture probabilities and the cross sections can serve as a direct measure of the coupling.

We predict the differential cross sections for various light targets and study their energy and angular dependence. Particularly, in view of the proposed experiment [4] at KEK, we deal with reactions ${}^{12}\mathrm{C}(\pi^-, K^+)^{12}_{\Lambda}\mathrm{Be}$, ${}^{10}\mathrm{B}(\pi^-, K^+)^{10}_{\Lambda}\mathrm{Li}$, and ${}^{6}\mathrm{Li}(\pi^-, K^+)^{6}_{\Lambda}\mathrm{H}$.

References

[1] T.Yu. Tretyakova and D.E. Lanskoy, Eur. Phys. J. **A5** (1999) 391.
[2] K.S. Myint, T. Harada, S. Shinmura, and Y. Akaishi, Few-Body Syst. Suppl. **12** (2000) 383; K.S. Myint and Y. Akaishi, to be published.
[3] T.Yu. Tretyakova and D.E. Lanskoy, Nucl. Phys. **A691** (2001) 51c.
[4] P.K. Saha, KEK Symposium on Recent Progresses in Strangeness Nuclear Physics, KEK, Tsukuba, 2002.