Hypernuclear production with antisymmetrized molecular dynamics

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Content

Recently we have estimated hypernuclear production cross sections by using a new type of wave functions solved in the antisymmetrized molecular dynamics (AMD). The AMD framework has been often applied to hypernuclear structure analyses [1,2], because the model is advantageous enough to include not only shell-like states but also cluster states and even largely deformed structures as well. However, the AMD wave functions have not been employed so far in the hypernuclear production reactions. In the present work, we have applied the AMD wave functions, for the first time, to the estimates of hypernuclear production rates.

In studies on hypernuclear structure, not only the ground but excited states have attracted considerable interest. Particularly, since the p orbit has a spatial anisotropy, the excited states with the Λ particle in p orbits, namely p states, can reflect dynamical structures of the core nucleus. For example, in Ref. [3], the $\alpha+\alpha+\Lambda$ cluster model calculation predicted that the symmetric 2α cluster structure of ^{8}Be lifts the degeneracy of p states into two different directions. Furthermore, in $^{25}_{\Lambda}$Mg [4], it was predicted by the AMD calculation that three different p states appear by the splitting of the p orbits due to the triaxial deformation of ^{24}Mg. To investigate the structure of excited states such as the p states, it is essential to compare the production cross sections with experimental data.

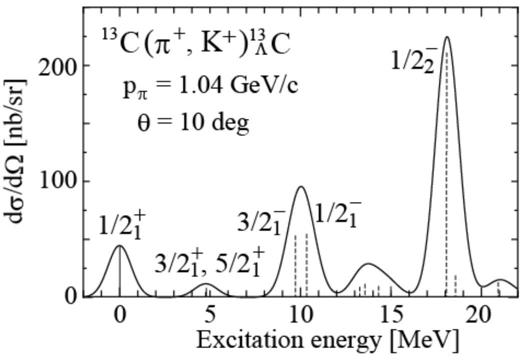

Figure: Reaction spectrum for $^{13}\mathrm{C}(\pi^+,K^+)^{13}_{\Lambda}\mathrm{C}$ with AMD+DWIA.

To evaluate the production cross sections of hypernuclei, we have constructed the framework of the distorted wave impulse approximation (DWIA) calculation based on the AMD wave functions (AMD+DWIA). As the first step, we have applied it to the production of the known p-shell hypernuclei, namely $^{12}\mathrm{C}(\pi^+,K^+)^{12}_{\Lambda}\mathrm{C}$, $^{12}\mathrm{C}(K^-,\pi^-)^{12}_{\Lambda}\mathrm{C}$, $^{12}\mathrm{C}(\gamma,K^+)^{12}_{\Lambda}\mathrm{B}$, $^{13}\mathrm{C}(\pi^+,K^+)^{13}_{\Lambda}\mathrm{C}$, and $^{13}\mathrm{C}(K^-,\pi^-)^{13}_{\Lambda}\mathrm{C}$. In this talk, we will compare the results with shell-model calculations and experimental data and discuss the validity of AMD+DWIA.

Reference

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Experiment / Theory: Theory
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