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Structure of few-body hypernuclei

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Recently, in hypernuclear physics, we had three neutron-rich Λ hypernuclei, $nn\Lambda$, ${}^{6}_{\Lambda}$H and ${}^{7}_{\Lambda}$He. These observation are very important by following reason: One of the research goal in hypernuclear physics is to study new dynamical features by injecting a Λ particle into a nucleus. Since there is no Pauli principle between nucleons and a Λ particle, the Λ participation gives rise to more bound states and significant contraction of nuclear cores, especially in light systems. If a Λ particle is added to neutron-rich nuclei to have a weakly bound state or resonant one, a resultant hypernucleus will become more stable against neutron decay. Three observed hypernuclei are such systems. Currently, it is important to investigate structure of these Λ hypernuclei theoretically. For this purpose, I will report these hypernuclei within the framework of $nn\Lambda$, $tnn\Lambda$ and $\alpha\Lambda NN$ three- and four-body model. The following will be reported: (1) To study $nn\Lambda$ system, the coupled channel calculation of $NN\Lambda$ and $NN\Sigma$ is performed. We do not find any $nn\Lambda$ bound state, which is inconsistent with the interpretation of the data. (2) Interactions among the constituent subunits in ${}^{6}_{\Lambda}$H are determined so as to reproduce reasonably well the observed low energy properties of the tn, $t\Lambda$ and tnn. As long as we reproduce the energy and width of ^{5}H within the error bar, the ground state of ${}^{6}_{\Lambda}$H is obtained as a resonant state. (3) In our previous work, we predicted the ground state, $1/2^+$ and the excited states, $3/2^+_1$ and $5/2^+$. And the recent observed data at Jlab are in good agreement with our prediction. Here, I will report another new states, $3/2_2$ and $5/2^+_2$ in ${}^{7}_{\Lambda}$He which is second 2^+ state of ^{6}He coupled to $0s$-orbit of Λ particle. And I will report the structure of these spectra.