# 論文 / 著書情報
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# 論 文 要 旨

THESIS SUMMARY

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要旨（英文 800 語程度）
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The study on charmed baryons is one of the hot topics both theoretically and experimentally in hadron physics. In recent years, new charm hadrons have been found, as exotic states whose properties are very different from the normal hadrons. On the other hand, the charmed nuclei are also studied theoretically, though their properties are little known yet. In nuclear physics, we can discuss the impact of nuclear effects on the charmed baryons. In this thesis, we discuss the charmed dibaryon and charmed tribaryon and investigate the fundamental properties of the charmed nuclei. In particular, we consider the simple charm system, YcN and ΛcNN systems, where Yc means Λc, Σc, and Σc* baryons. It is important to obtain not only the binding energies but also the effects by changing nucleus flavor from strangeness sector to charm sector. There the channel coupling, symmetries, and mass effects are important issues. The charmed nuclei as the flavor extended system from strangeness are expected to give us the important information of many-body problem of hadrons and nuclei.

In the charmed dibaryon system, we first construct the YcN potential based on π and σ meson exchange from the hadron model and the direct exchange of quarks from the constituent quark model. Potential models are proposed, which are composed of the long-range one-boson exchange (OBE) force and the short-range quark exchange force based on the quark cluster model (QCM) in order to consider the short distance properties. The parameters in the model, the cutoffs and the coupling constants of π and σ mesons, are determined from the NN data, which is reproduced in the similar model. By reproducing the deuteron binding energy and the S-wave scattering lengths, four different parameter sets are obtained which are called YcN -CTNN potential. Using these potentials, we obtain shallow binding energies of the YcN two-body systems with several parameters in $J^{\pi}$= 0+ and 1+. We find shallow bound ΛcN states with both $J^{\pi}$= 0+ and 1+ in several parameter sets. The effect of the channel coupling to Σc*N is significant due to the strong tensor force coming from the one-pion exchange. According to the probabilities of the components in the coupled channels, the ΛcN channel is the dominant one but the ΣcN and Σc*N channels are necessary for YcN bound states to appear below the ΛcN threshold. We find that the effect of the channel coupling to ΣcN and Σc*N is significant due to the strong tensor force coming from the one-pion exchange. Furthermore, we compare scattering lengths to early studies with other potential models. This comparison shows that the YcN -CTNN potential is more attractive than other potentials. We also calculate the resonance states near the ΣcN and Σc*N thresholds with $J^{\pi}$= 0+, 1+ and 2+. We apply the complex scaling method to find the resonance energies and the decay widths. Those resonance energies are regarded as the binding energies when only the ΣcN and Σc*N channels are considered and the ΛcN channel is neglected. Analyzing numerical results of those resonance states, we find two groups of properties. One group includes the resonances near the ΣcN or Σc*N threshold with very small width, like quasi-stable states, and the other group has the resonances with rather large width. With the degenerate threshold averaged from the ΣcN and Σc*N thresholds, we obtain the approximately same energies and widths in the same group. This behavior comes from the heavy quark spin doublet states because of the heavy charm quark. For the charmed tribaryon system, we calculate the binding energies and the inter-particle distances by using the obtained potentials. In this calculation, we consider the ΛcNN three-body system, as the simplest system of charmed nuclei. Using the effective ΛcN potential which renormalizes the effects of ΣcN and Σc*N channels, we obtain 10 - 20 MeV binding energies and the compact structure of the ΛcNN system. In order to compare to not only theoretical data but also experimental information, we study the quark gluon plasma(QGP) production in relativistic heavy ion collision for the charmed dibaryon and charmed tribaryon and calculate the yield numbers of the ΛcN and ΛcNN states with the statistical model, the quark coalescence model, and the hadron coalescence model. In the ΛcN states, the result from hadron coalescence model is the strongest. According to the QGP expansion in section, ΛcN seems to be produced from individual hadrons most easily. This behavior is consistent with the YcN two-body system because YcN system is attracted by tensor force from hadron model mainly. By contrast, in the ΛcNN states, the yield number from the statistical model is larger than the result from the hadron coalescence model.


備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).