

論文 / 著書情報
Article / Book Information

題目(和文)	メソン-バリオン分子状態を含んだ構成子クォーク模型によるチャームバリオンのP波励起状態の解析
Title(English)	P-wave heavy baryons in a constituent quark model and their couplings to meson-baryon dynamical states
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
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論文要旨

THESIS SUMMARY

専攻 : Department of	基礎物理学	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 (理学) Doctor of
学生氏名 : Student's Name	吉田 哲也		指導教員 (主) : Academic Advisor(main)	岡 真
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Recently, experiments to observe new states of excited heavy baryons are being performed at several facilities such as J-PARC, KEKB-factory, J-Lab, GSI, CERN, BES-III. It is expected both theoretically and experimentally that heavy hadrons show the specific dynamics, which is not seen in light hadrons. Hence, the study of the spectra and the dynamics of heavy hadrons are interesting topics, and clarifying the masses of excited heavy baryons and their structures are urgent issues in the modern hadron physics.

In this thesis, we study the spectrum and the structure of heavy baryon excited states using a non-relativistic potential quark model.

The model Hamiltonian is chosen as the standard one with two exceptions: (1) the color-Coulomb term depends on quark masses and (2) an antisymmetric LS (spin-orbit) force is introduced. We fix model parameters in the strange baryon sector and the masses of the observed charmed and bottomed baryons are, then, fairly well reproduced with the parameters. One of our focuses is on the low-lying negative-parity states, in which the heavy baryons show specific excitation modes reflecting the mass differences of heavy and light quarks. By changing quark masses from the SU(3) limit to the strange quark mass, and, further, to the charm and bottom quark masses, we demonstrate that the spectra change from the SU(3) symmetry patterns to the heavy-quark-symmetry ones.

Heavy baryons are predicted in the constituent quark model. However, the conventional quark model neglects the meson-baryon coupling. Thus, the meson-baryon coupling effect should be considered to predict the hadron spectrum. Moreover, hadronic model suggests that the meson-baryon molecule states realize. Hence, two kinds of coupling effects on the three-quark state are considered, that is, the coupling of the three quark state with meson-baryon scattering states, and the coupling of the three-quark state with the meson-baryon molecule states. We investigate these two coupling effects by analyzing the poles in the two cases, namely in which the Weinberg-Tomozawa interaction is switched on and off.

The couplings of meson-baryon molecule state on the three-quark state are investigated by the hybrid model based on the quark model, the chiral effective theory and the Bete-Salpeter equation. We adopt the dimensional regularization scheme and we also use the 3D cut-off scheme in order to clarify the regularization scheme dependence. We determine the mass of excited heavy baryons from the constituent quark model and the effective coupling between the bare excited heavy baryon states and meson-baryon scattering state from 3P_0 model. We focus on $I = 0, J^P = 1/2, C = 1, B = 0, S = 0$ channels to study the coupling of the rho and lambda mode states with the meson-baryon scattering states.

Our study in this thesis have the following four purposes: (1) The prediction of the spectra of excited single- and double- heavy baryons, (2) Clarifying the structure of P-wave heavy baryons in the aspect of the specific two modes, rho and lambda modes, (3) investigating the heavy hadron states in the heavy quark limit and its relation to the SU(3) state and (4) investigating the P-wave excited states of charmed baryons in a constituent quark model with the meson-baryon coupling effect through the hybrid model based on the quark model, the chiral effective theory and Bete-Salpeter equation.

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。

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