

Report of the RCNP Collaboration Research Network (RCNP-COREnet)

COREnet056

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1	Title of research		Elucidation of charmed hadron potentials in Lattice QCD and effective models
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3	Period of research		From May 2024 to March 2026
4	Main location of collaboration implementation		Nagoya University, Institute of Science Tokyo, RIKEN, Remote
5	Publication list (Please include	Articles	Analysis of bound and resonant states of doubly heavy tetraquarks with spin $J \leq 2$, Manato Sakai, Yasuhiro Yamaguchi, arXiv:2503.11134 [hep-ph] pp.1-24, 2025, https://doi.org/10.48550/arXiv.2503.11134
			Heavy exotic hadrons near thresholds: T_{cc} and its partners, Tatsuya Asanuma, Yasuhiro Yamaguchi, Masayasu Harada, Journal of Subatomic Particles and Cosmology 1–2 (2024) 100002, https://doi.org/10.1016/j.jspc.2024.100002
			"Heavy exotic hadrons near thresholds", Yasuhiro Yamaguchi, The Reimei Workshop "Hadron interactions with strangeness and charm", Uni Hotel, Jeju Island, South Korea 6/26-28 2024
			"Exotic hadrons: Rich structure of multiparticle state near thresholds", Yasuhiro Yamaguchi, Frontiers in Physics and Material Science, Beihang University, Beijing, China July 1 - August 31 2024
			"Exotic mesons in the core-molecular hybrid model (Poster)", K. Miyake, Y. Yamaguchi, SNP CNS Summer School 2024, The University of Tokyo and RIKEN, August 2024
			"Mixture of Hadronic Molecules and Charmonium Core", K. Miyake, Y. Yamaguchi, International Workshop on Quark Structure of Hadrons 2024, RIKEN, August 2024
			"ハドロン分子としての束縛状態、共鳴状態のdoubly heavy tetraquarkの解析", 酒井 愛斗, 原子核三者若手夏の学校2024, 国際オリンピックセンター, August 2024
			"クォーコンウムとハドロン分子", 三宅浩太郎, 山口康宏, 第70 回原子核三者夏の学校, 国際オリンピック記念青少年センター, August 2024
			"Hadronic molecules near thresholds: T_{cc} and its partners", 山口康宏, 研究会「対称性と有効模型で切り拓くクォーク・ハドロン物理の最前線」名古屋大学, 愛知, 日本 9/5-7 2024
			" $\chi_{cJ}(2P)$ 質量スペクトルパズルにおけるハドロン分子の効果", 三宅浩太郎, 山口康宏, 対称性と有効模型で切り拓くクォーク・ハドロン物理の最前線 名古屋大学, September 2024
			"共鳴状態のdoubly heavy tetraquarkの解析", 酒井 愛斗, 日本物理学会2024年年次大会, 北海道大学, September 2024
			"Exotic hadrons as a hadron composite state near thresholds", Yasuhiro Yamaguchi, Universality of Strongly Correlated Few-body and Many-body Quantum Systems, Tohoku University, Sendai, Japan, August 26 - September 27 2024
			"Analysis of bound and resonant states of doubly heavy tetraquarks as hadronic molecules", Manato Sakai, Hadrons and Hadron Interactions in QCD 2024 (HHIQC2024), Kyoto University, October 2024

5	(Please include DOI if available)	Talks	"$\chi_{cJ}(2P)$ with hadronic molecules", K. Miyake, Y. Yamaguchi, Hadrons and Hadron Interactions in QCD 2024 (HHIQCD 2024), Yukawa Institute for Theoretical Physics, Kyoto University, October 2024. "$\bar{D}_s^* \chi_{cc}$ pentaquark as a partner of T_{cc}", 山口康宏, RARIS 研究会「実験、反応・構造計算、格子QCD で解き明かすハドロン分光 2024」, 東北大学先端量子ビーム科学研究センター, 仙台 November 20-21 2024 "Mixture of $\chi_{cJ}(2P)$ and Hadronic Molecules", 三宅浩太郎, 山口康宏, RARIS 研究会「実験、反応・構造計算、格子QCD で解き明かすハドロン分光2024」, 東北大学先端量子ビーム科学研究センター, November 2024 "A new method for calculating compositeness using lattice QCD data," Kotaro Murakami, RARIS 研究会「実験、反応・構造計算、格子QCD で解き明かすハドロン分光 2024」, Sendai, Japan, Nov. 20-21, 2024. "Hadronic molecules near thresholds: T_{cc} and its partners", Yasuhiro Yamaguchi, East Asian Workshop on Exotic Hadrons 2024, Nanjing, China November 8-11 2024 "Exotic hadrons as heavy hadronic molecules and their partners", Yasuhiro Yamaguchi, KMI2025 : The 6th KMI International Symposium, Nagoya University, Nagoya, March 5-7 2025 "Analysis of Exotic Hadrons by Superposition of Hadronic Molecules and Charmonium (Poster)", K. Miyake, Y. Yamaguchi, The 6th KMI International Symposium (KMI2025), Nagoya University, March 2025 "$\chi_{cJ}(2P)$とハドロン分子によるエキゾチックハドロンの解析", 三宅浩太郎, 山口康宏, 原子核と他分野研究の交差点2025 (MINOR2025), 理化学研究所, March 2025 "ヘビーマeson-核子からなるハドロン分子状態とそのスピン構造", 山口康宏, 日本物理学会 2025年春季大会, オンライン, March 18-21 2025 "ハドロン分子と$\chi_{cJ}(2P)$ 結合状態", 三宅浩太郎, 山口康宏, 日本物理学会2025 年春季大会, オンライン, March 2025 "Exotic hadrons as heavy hadronic molecules and their partners", Yasuhiro Yamaguchi, The 21st International Conference on Hadron Spectroscopy and Structure (HADRON2025), Osaka University, Japan, March 27-31 2025 "Analysis of bound and resonant states of T_{cc} and T_{bb} as hadronic molecules", Manato Sakai, The 21st International Conference on Hadron Spectroscopy and Structure (HADRON2025), Osaka University, March 2025 "Hadronic Molecules and $\chi_{cJ}(2P)$ Coupled States", K. Miyake, Y. Yamaguchi, The 21st International Conference on Hadron Spectroscopy and Structure (HADRON2025), Osaka University, March 2025
6	Description of the results and outputs		In the first fiscal year, we constructed the hadron-interaction models for $D^*({}^*)D^*({}^*)$ and $D^*({}^*)\bar{D}^*({}^*)$ systems. The models are described by the meson-exchange picture, including a pion, vector mesons and sigma, etc. For the $D^*({}^*)\bar{D}^*({}^*)$ case, we also introduce the coupling to the bare $c\bar{c}$ state, which has been considered to be important to explain the nature of X tetraquarks. As the first attempt, parameters of the model were determined to reproduce the experimental mass spectra of doubly-charm T_{cc} and hidden-charm X's, and we confirmed that the obtained models successfully explain these states. We also discussed the natures of T_{cc} and X's by using the models. We consider that the obtained models are useful to understand the Lattice QCD potentials, which will be discussed in the next fiscal year.
7	Amount of budget implemented (for internal use only)		139,632 YEN