

Report of the RCNP Collaboration Research Network (RCNP-COREnet)			
COREnet048		PI: TANIDA Kiyoshi	
1	Title of research	Revealing the nature of exotic hadrons in Belle (II) by collaboration of experimentalists and theorists	
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3	Period of research	July 2023 – March 2025	
4	Main location of collaboration implementation	Online with annual in-person meeting at RCNP, Osaka University	
5	Publication list (Please include DOI if available)	Daiki Suenaga, Makoto Oka: Axial anomaly effect to the chiral-partner structure of diquarks at high temperature, Physical Review D 108 (2023) 014030, doi:10.1103/PhysRevD.108.014030, (arXiv:2305.09730). * Guang-Juan Wang, Makoto Oka, Daisuke Jido: Quark Confinement for Multi-Quark Systems – application to fully-charmed tetraquarks –, Physical Review D (Letter) 108 (2023) L071501, doi:10.1103/PhysRevD.108.L071501 (arXiv:2307.04310). * Ibuki Terashima and Tetsuo Hyodo: Hadron-hadron potentials coupled to quark degrees of freedom for exotic hadrons, Phys. Rev. C 108, 035204, doi.org/10.1103/PhysRevC.108.035204 * S. Yasui, D. Suenaga, K. Suzuki: QCD Kondo effect for single heavy quark in chiral symmetry broken * W. A. Yamada, O. Morimatsu, T. Sato and K. Yazaki: Survival probability of unstable states in coupled-channels: Nonexponential decay of threshold cusp, Phys. Rev. D108 (2023) L071502, doi:10.1103/PhysRevD.108.L071502. * Hong-Zhou Xi, Yi-Wei Jiang, Hua-Xing Chen, Atsushi Hosaka, Niu Su: Fully-strange tetraquark states with the exotic quantum numbers, Phys.Rev.D 108 (2023) 094019, doi:10.1103/PhysRevD.108.094019 * Takuma Nishibuchi and Tetsuo Hyodo: Analysis of the Xi(1620) resonance and Kbar Lambda scattering length with a chiral unitary approach, Phys. Rev. C 109, 015203, doi.org/10.1103/PhysRevC.109.015203 * YongXin Song, DuoJie Jia, WenXuan Zhang, Atsushi Hosaka: Low-lying doubly heavy baryons: Regge relation and mass scaling, Eur. Phys. J. C83 (2023) 1, doi:10.1140/epjc/s10052-022-11136-9. * S.B. Yang et. al. (Belle Collaboration): Observation of a Threshold Cusp at the $\Lambda\eta$ Threshold in the $p\bar{K}$-Mass Spectrum with $\Lambda c \rightarrow p\bar{K}-\pi^+$ Decays, Phys. Rev. D 108, (2023) L031104, doi:10.1103/PhysRevD.108.L031104 * Tomona Kinugawa and Tetsuo Hyodo: Compositeness of Tcc and X(3872) by considering decay and coupled-channels effects, Phys. Rev. C 109, 045205, doi.org/10.1103/PhysRevC.109.045205 * H. Hirata et. al. (Belle Collaboration): Study of the lineshape of X(3872) using B decays to $D^0 \bar{D}^0 K$, Phys. Rev. D 107 (2023) 112011, doi:10.1103/PhysRevD.107.112011. * Alessandro Giachino, Atsushi Hosaka, Elena Santopinto, Sachiko Takeuchi, Makoto Takizawa: Rich structure of the hidden-charm pentaquarks near threshold regions, Phys.Rev.D 108 (2023) 074012, doi:10.1103/PhysRevD.108.074012. * Hiroto Takada, Daiki Suenaga, Masayasu Harada, Atsushi Hosaka, Makoto Oka: Axial anomaly effects to three-quark and five-quark singly heavy baryons, Physical Review D 108 (2023) 054033, doi:10.1103/PhysRevD.108.054033 (arXiv:2307.15304). * Qi Meng, Emiko Hiyaama, Makoto Oka, Atsushi Hosaka, Chang Xu: Doubly heavy tetraquarks including one-pion exchange potential, Physics Letters B 846 (2023) 138221, doi:10.1016/j.physletb.2023.138221 (arXiv:2308.05466).	
		* Yasuhiro Yamaguchi: Exotic hadrons as a hadronic molecule, Nagoya Workshop on Exotic Hadrons 2023, Nagoya University, Nagoya 11/14-17 (2023). * Yasuhiro Yamaguchi: Heavy exotic hadrons as a molecular state near thresholds, 第9回クラスター階層領域研究会, 理化学研究所 9/22-23 (2023). * Tetsuo Hyodo: Compositeness, Lambda(1405), and kaonic nuclei, 第9回クラスター階層領域研究会, 理研 9/23 (2023).	

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		Talks	* 山口康宏: チャームエキゾチックなハドロン分子状態, 研究会「多彩なハドロンの存在形態を探る理論と実験の最近の発展」, 理化学研究所, 9/12 (2023). * Yasuhiro Yamaguchi: Exotic hadrons: Rich structure of multiparticle state near thresholds, The 41st SPP Physics Conference and Annual Meeting, Siargao Island, Philippines 7/19-21 (2023). * Katsuyoshi Sone: Near-threshold hadron scattering using new parametrization of amplitude, International School for Strangeness Nuclear Physics 2023 (SNP school 2023), 12/13 (2023) * Katsuyoshi Sone: Near-threshold hadron scattering using new parametrization of amplitude, Fourth International Workshop on the Extension Project for the J-PARC Hadron Experimental Facility (HEF-ex 2024), 2/21 (2024).	
			* K. Tanida: Cusp spectroscopy: bound, virtual, or something else? Invited talk in 6th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan, Waikoloa 11/26-12/1 (2023). * Tetsuo Hyodo: Compositeness of hadrons and its application to baryon resonances, 6th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan, Waikoloa 11/26 (2023). * K. Tanida: Peak/cusp structures observed in Λ_c decays at Belle, Nagoya Workshop on Exotic Hadrons 2023, Nagoya, 11/14-17 (2023). * Katsuyoshi Sone: Near-threshold hadron scattering using new parametrization of amplitude, Nagoya Workshop on Exotic Hadrons, 名古屋大学 11/14 (2023).	
			* Osamu Morimatsu: Near-threshold resonances from uniformed Mittag-Leffler expansion talk given at International workshop on J-PARC hadron physics 2023 (J-PARC Hadron 2023), Tokai 9/12-25 (2023). * Katsuyoshi Sone: Near-threshold hadron scattering using new parametrization of amplitude, International workshop on J-PARC hadron physics 2023 (J-PARC Hadron 2023), J-PARC Tokai 9/14 (2023). * Katsuyoshi Sone: Near-threshold hadron scattering using new parametrization of amplitude, 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」, 東北大学電子光センター 11/8 (2023).	
6	Description of the results and outputs		We had meetings every month, mostly online, with one in-person meeting in November 18-24. We have discussed followings: * General behavior of the coupled-channel scattering amplitude near the two-body threshold. In particular, we have clarified the constraints imposed in the Flatte amplitude, which is frequently used in analysis of experimental data. * Data analysis method using Mittag-Leffler expansion to extract pole positions of resonances. * Difference in the definition of branching ratio in particle decays between theorists and experimentalists. * Several case studies on specific exotic hadron candidates, such as $\Xi(1620)$, $\Omega(2012)$, $X(3872)$ and so on.	
7	Amount of budget implemented (for internal use only)		JPY271665	
