Report of the RCNP Collaboration Research Network (RCNP-COREnet)			
COREnet059			PI: Akinobu Dote
1	Title of research		"Revealing the charge-symmetry-breaking problem in A=4 hypernuclei by the refined Antisymmetrized Molecular Dynamics (AMD) method"
2	List of Participants (Name and affiliation)		Akinobu Dote (KEK theory center)
			Hisashi Horiuchi (RCNP)
			Masahiro Isaka (Hosei University)
			Takayuki Myo (Osaka Institute of Technology/RCNP)
			Hiroki Takemoto (Osaka Medical Pharmaceutical University)
			Hiroshi Toki (RCNP)
			Mengjiao Lyu (Nanjing University of Aeronautics and Astronautics)
			Niu Wan (South China University of Technology)
			Qing Zhao (Huzhou University)
3	Period of research		2 years (FY2025, 2026)
4	Main location of collaboration implementation		* Japan: RCNP, KEK (Tsukuba campus and Tokai campus) * China: Nanjing University of Aeronautics and Astronautics
5	Publication list (Please include DOI if available)	Articles	None
		Talks	None
6	Description of the results and outputs		In FY2025, we held a collaboration meeting on March 9 at Osaka Institute of Technology (Umeda campus). Four members (Dote, Myo, Takemoto and Toki) attended in person and a member (Isaka) attended online due to his personal reason. In the meeting, we discussed mainly 1. Strategy to accomplish our goal and 2. Current status of the development of High-Momentum AMD improved for hypernuclei (reported by Isaka). Additionally, we discussed related issues such as 3. Mirror nuclei of 10C and 10Be investigated with Multi-cool AMD (reported by Myo) and 4. Application of HM-AMD to kaonic nuclei (reported by Dote). We describe on the discussions 1 and 2, which are directly related to this project, in detail below. 1. Strategy to accomplish our goal: Though the discussion, a new idea came to our mind that we should investigate A=3 Lambda hypernucleus (hypertriron, 3ΛH) before proceeding to A=4 Lambda hypernuclei (4ΛH and 4ΛHe). Naturally, when we treat the four-body system with our approach, it should be checked whether the approach can treat correctly the three-body system. In addition, it should be remarked that 3ΛH has attracted much interests in hypernuclear physics field recently, due to new experimental results from Mainz MAMI and J-PARC. The binding energies of 3ΛH reported from both experiments deviate from the standard value (~130 keV), and additionally both results are largely different from each other: ~63 keV by J-PARC and ~523 keV by Mainz MAMI [2]. Therefore, we will investigate 3ΛH as well, in the process of our project. [1] T. Akaihsi et al (J-PARC E73 collaboration), PLB 873, 140163 (2026) [2] R. Kino et al., https://arxiv.org/abs/2601.08694 2. Current status of the development of High-Momentum AMD improved for hypernuclei: Isaka in our members is the most familiar with HM-AMD, since he carried out actual calculations in the previous study of triton with this method [3]. Therefore, he is supposed to play a main role in this project. Indeed, he is now developing the formalism of HM-AMD for hypernuclei. Differently from ordinary nuclei, the channel coupling is known to be important in hypernuclei, which means that a pair of a nucleon and Λ hyperon converts to a nucleon and Σ hyperon occasionally. He is formulating the extended HM-AMD, not only to include Λ hyperon simply but also to take into account ΛN-ΣN coupling. In the meeting, we discussed intensively how to treat such a channel coupling in the AMD framework. [3] M. Isaka et al., PRC 106, 044310 (2022) Additionally, we would like to introduce a useful side effect of this meeting. In the discussion 4, Dote introduced his study of kaonic nuclei (nuclei with anti-kaons, Kbar mesons) with the same approach. He consulted with other members on a problem that he encountered. As a first trial, he is examining the HM-AMD to the two-body system of Kbar-N. Due to the strong Kbar-N attraction, the Kbar-N distance becomes small, and as a result considerably high momentum is associated. Probably, because of such high momentum components, the numerical result of his calculation was unstable. It is considered to be attributed to the incorrectness of the angular momentum projection which is realized with a numerical integration. In the discussion, other members (Toki and Takemoto) suggested him to use Gauss-Legendre integration, instead of the simple integration (so-called TANZAKU integration). Following their suggestion, he examined GL integration, and then the numerical result has become stable. Owing to the discussion in this meeting, he can make his study go forward.
7	Amount of budget implemented (for internal use only)		43,505YEN