5. COLLABORATION WORKS IN THE LABORATORY FOR COMPLEX ENERGY PROCESSES

Collaboration Works in The Laboratory for Complex Energy Processes

1. Introduction

The laboratory was established for research on advanced energy by the collaborative projects among the researchers in the Institute of Advanced Energy to promote joint activity of our knowledge and wisdom to find solutions to these interdisciplinary energy/environmental problems. From such a viewpoint, the research targets of the laboratory are focused on two specific fields, (i) "advanced studies of science and technology on plasma energy and quantum energy" and (ii) "innovative studies of nano-bio functional materials for power generation". For this purpose, two sections (A2 and A3 mentioned below) are founded. In addition, A1 section promotes international or domestic collaborative research and assists activities such as academic meetings and seminars. In the fiscal year of 2023, strong advancement of the collaboration was achieved.

Close connection between related research fields in the institute have yielded unique and interesting outcomes from the collaboration. The laboratory takes charge of organizing and promoting the cooperative research project as a center of research activity in the Institute. The research teams were formed by mostly young generation staffs and students in the institute lead by associate professor or assistant professor, and participated in specific projects to carry out their subjects. The cooperative research activities will be published in a publication edited in the laboratory at the end of the fiscal year. Management of the technical staffs for large scale equipment are also under the responsibility of the laboratory.

A1 Division of International and Industrial Partnership

This division promotes international collaborative research on advanced energy to lead the field of energy science and technology as a worldwide pioneer. For this purpose, the symposium and the workshop organized by institution member are supported. Following the reduction of the threat of COVID-19, meetings or exchanges were begun to restart.

A2 Division of Plasma and Quantum Energy Research

This section promotes studies on advanced plasmas and quantum energy for realizing future energy systems, integrating plasma energy science and advanced energy material research. In particular, based on the results obtained in our related groups, we aim at extending the research fields and contributing to human society by utilizing the existing key devices such as Heliotron J, DuET, MUSTER and inertial electrostatic confinement (IEC) device, which have been developed in the institute.

A3 Division of Soft Energy Science Research

This division promotes studies on emergent materials and systems for realizing next generation soft energy system. In particular, functional nano- and bio-materials to efficiently utilize solar energy and bio-energy are studied by integrating laser science, nanotechnology, and bio-technology. We aim at extending our research fields by utilizing the existing devices such as System for Creation and Functional Analysis of Catalytic Materials, SEMs, SPM, NMRs including 800 MHz LC-MS/NMR, Solar Simulator, KU-FEL and various laser systems.

2. The cooperative research program

In the fiscal year of 2023, two categories were set up: (1) "Cooperative Research" for cross sectional research and (2) "Sprouting Research" for challenging research proposal by Assistant Professor. The submitted proposals were evaluated by the selection committee organized by a center director, a program chair and three division chairs. One "Cooperative Research" proposal and four "Sprouting Research" proposals were approved. The number of research subjects is listed in Table 1 according to the division. A brief summary of the cooperative research subjects carried out in FY2023 is shown in the next page.

	Table 1	Number (of the accepted	d research subiec	ts according to	the division
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	T. (. 1			
A1	A2	A3	Total	
4	2	2	8	

The individual research subjects are as follows.

<u>Supporting Activities on International and Indus-</u> <u>trial Collaborative Research</u>

<u>A1</u>

"Organization of the sixth research seminar on RNA research, and presentation and exchange of information in the seminar"

- · M. Katahira, T. Nagata (IAE, Kyoto University)
- R. Kurokawa, R. Yoneda (Saitama Medical University)
- T. Yamashita (University of Tokyo)
- · N. Ueno (NIBB)
- N. Shiina, S. Hirano (NIBB)
- N. Fukuda (Niigata University)
- S. Ishigaki (Nagoya University)
- K. Hitachi (Fujita Health University)
- T. Oyoshi (Shizuoka University)
- T. Manen (Ritsumeikan University)
- · R. Yoneda (Saitama Med. University)
- A. Takeuchi (Ehime University)
- · Y. Oishi (Nippon Medical School)
- · H. Tani (Yokohama University of Pharmacy)
- T. Nobeyama (Tsukuba University)

"Support for collaborative research with Laos on biological control of coffee plant diseases and promotion of its technology popularization."

- T. Hara, H. Ohgaki, Y. Takatsuka (IAE, Kyoto University)
- · A. Nonaka (Pentalink Inc.)
- · M. Yoneda (Farmer)

"7th International Symposium of the Kyoto Biomolecular Mass Spectrometry Society"

- T. Nagata (IAE, Kyoto University)
- H. Nishimura, T. Imai, S. Kuwashima,
- A. Sugiyama, K. Takahashi, S. Tazuru,Y. Tobimatsu (Research Institute for Sustainable Humanosphere, Kyoto University)
- M. Uesugi, M. Nakamura, S. Futaki, K. Masuguchi, S, Yamaguchi, S. Yamago, A. Fujihashi (Institute for Chemical Research, Kyoto University)
- J. Matsuo, K. Nishimura (Faculty of Engineering, Kyoto University)
- T. Ara (National Institute of Genetics)
- N. Kakuda (Doshisha University)
- T. Nirasawa (Bruker Japan)
- · J. Watanabe (Shimadzu Corporation)

"India, Thailand, Korea, Japan ISFT network activity and attendant, presentation, and exchange of information in STBP 2024."

- E. Nakata, H. Ohgaki, T. Morii (IAE, Kyoto University.)
- · N. Kumar (Delhi Technological University, India)
- M.S. Kim (Seoul National University, South Korea)
- Y.T. Kang (Korea University, South Korea)
- N. Watjanatepin (Rajamangala University of Technology Suvarnabhumi, Thailand)
- R.C. Singh, R. Chaudhary, R.M. Singari (Delhi Technological University, India)
- R. Dubey (University of South Florida, USA)
- S. Jonnalagadda (University of Kwazulu-Natal, South Africa)
- S. Chakraborty (University of Calabria, Italy)

Cooperative Research

<u>A2</u>

"Nitride/Oxide double coating using dielectric barrier discharge"

- J. Yagi, S. Inagaki, S. Kobayashi (IAE, Kyoto University)
- D. Fujii (Graduate School of Energy Science, Kyoto University)

"Reproducing Aurora Green Emission in Laboratory Plasma"

· S. Kado (IAE, Kyoto University.)

Sprouting Research

<u>A3</u>

"Construction of artificial carboxysomes for the efficient carbon fixation"

- L. Peng, T. Morii, E. Nakata (IAE, Kyoto University.)
- F. Komatsubara, Y. Hui (Graduate School of Energy Science, Kyoto University)

"Development of the in-cell NMR methods to investigate the dynamics and structure of biomacromolecules at various time-scales"

 T. Nagata, Y. Yamaoki, T. Sakamoto, Eladl Mohamed Mahmoud Omar Sobhi, M. Katahira (IAE, Kyoto University)

The Laboratory Seminars

Laboratory Seminars

The Laboratory promotes topical academic seminars in order to strengthen the research activities in each research section and to enhance the mutual cooperation among a lot of academic fields. In the fiscal year of 2023 the aims and progress reports of five cooperative researches were presented and discussed, as summarized below. The Laboratory also planned a symposium on April 5, 2024 for presentation of the cooperative research results in FY2023.

(1) August 2, 2023	(3) October 4, 2023
J. Yagi	S. Kado
"Usage of liquid lithium for fusion blanket"	"Can the aurora green spectrum be repro-
IAE, Kyoto University	duced in laboratory plasma?"
	IAE, Kyoto University
(2) September 13, 2023	
P. Lin	
"Design of artificial carboxysomes for efficient	(4) November 29, 2023
carbon dioxide fixation"	T. Nagata
IAE, Kyoto University	"Development of the in-cell NMR methods to
	investigate the dynamics and structure of bi-
	omacromolecules at various time-scales"
	IAE, Kyoto University

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